

LABORATORY DATA CONSULTANTS, INC.

7750 El Camino Real, Suite 2L Carlsbad, CA 92009 Phone: 760/634-0437 Fax: 760/634-0439

Northgate Environmental Management, Inc.

January 8, 2010

1100 Quail Street Ste. 102 Newport Beach, CA 92660 ATTN: Ms. Cindy Arnold

SUBJECT: Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada,

Data Validation

Dear Ms. Arnold,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on December 3, 2009, December 7, 2009, December 9, 2009 and December 14, 2009. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project # 22233:

SDG#	<u>Fraction</u>
238974, 239237 239753, 240560 240965	Radium-226 & Radium-228, Isotopic Uranium & Isotopic Thorium

The data validation was performed under Stage 2B & 4 guidelines. The analyses were validated using the following documents, as applicable to each method:

- Standard Operating Procedures (SOP) 40, Data Review/Validation, BRC 2009
- Quality Assurance Project Plan Tronox LLC Facility, Henderson Nevada, June 2009
- NDEP Guidance, May 2006
- Multi Agency Radiological Laboratory Analytical Protocols (MARLAP)
 Manual, July 2004
- USEPA, Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, October 2004

Please feel free to contact us if you have any questions.

Sincerely,

Erlinda T. Rauto

Operations Manager/Senior Chemist

Attachment 1

T	I	S	<u>-</u> T	ΨŢ	┪	T		丁	Т			ī	$\overline{}$			_		-		-		_	7	٦								П	7	204
İ	-	3	+	+	+	\dashv	\dashv	\dashv			\dashv	\dashv		-	-	-			-	_			-	\dashv	\dashv	\dashv	_						\dashv	0
ŀ		<u>></u> ဖ	╅	+	\dashv	┪	-	\dashv	\dashv	-	\dashv	\dashv								\exists			\dashv	\dashv	\dashv			-		-			_	
	}		\dashv	+	+	+	\dashv	-	-	\dashv		\dashv			-	\dashv	\dashv		\dashv			\dashv	\dashv	-		\dashv				_		\vdash	┪	
-		≥	-	+	+	\dashv	-	\dashv	-	\dashv	-					-								\dashv	\dashv	┥				_	_	\vdash	-	
	-	S	+	+	\dashv	\dashv	\dashv		\dashv	_						-	_		_	_	\vdash				\dashv	\dashv					_	\vdash	-	9
-		<u></u> ≥	_	4	4	_	4	\dashv	4		_										\dashv	_	_	_	\dashv	\dashv			\vdash	_		⊢		_
ŀ		S	4	4	4	4	4	4								_							_	\dashv	4	_			-	_		\vdash	_	릐
-		3	\dashv	4	4	4	_	_	_																							\sqcup	_	의
		S	\perp	_	_	_																			_				_			Ш		의
6		3							_																				L				_	의
2009)		S			_																		_						L			Ц		의
$\mathbf{\omega}$		≥		\perp																												Ш		
Ise		S																												L	<u> </u>	Ц		٥
ha		≥	T	[[]																												٥
×		S				$ \top $																												0
Northgate, Henderson NV / Tronox Phase		3																																0
Ī		S		1			Ì																											0
>		3	T																															0
Z		S	1																															0
SOI		3	T	T		┪	╗																											
der		S	\top																													П		0
en		3																																
T,		S																																0
Jate	ľ	3																																0
t		S																	Г										Γ					0
9		3																																0
	. 6	S	7	2	0	က	0																											30
	lso. U (300)	3	0	-	0 91,50	0	2																						Г					21
ŏ	6	S	7	R	Q	3	0																									П		30
0	lso. Th (300)	3	0	-	8	0	2													ļ														21
L	28		4	R	0	က	0						<u> </u>																┢					30
232	Ra-228 (904.0)	3	0	-	0	ᅴ	2											<u> </u>										┌┈						21
22		S	7	8	6	က	0										ļ						Г											30
LDC #22232 (Tronox LLC-	Ra-226 (903.1)	3	0	-	8		2								-												T							21
2		- 1		9	60	8								\vdash										-				ļ	<u> </u>		厂	\vdash		
	(3) DATE DUE		12/03/09 12/24/09	12/14/09 01/06/10	12/07/09 12/29/09 18 0 18	12/07/09 12/29/09	12/09/09 12/31/09								ļ											ĺ								
		ł	9	<u>)</u>	1,	9 12	9 12	-		-	<u> </u>	-	\vdash	-		┝	├	-		-	-	 	-	\vdash	_	-	┝	-	┢	╁	╁╌	├	_	
	DATE REC'D		03/0	14/0	0/20	0//0/	0/60/																											
	_ R		12	12	12	12	12							<u> </u>	_	_	<u> </u>	<u> </u>	ļ	-		L	_	ļ	<u> </u>	_	-	<u> </u>	╂	╀	-			
																										ŀ								
2B/4	*SDG	Soil	238974	239237	239753	240560	240965												l															씸
Stage 2B/4	SD	Water/Soil	238	239	239	240	240																											
🛭																																		T/LR
	DG.	Matrix:	4	В	၁	٥	Ш		\vdash		H	T	f^-	t	T	T	f^-	T	\vdash	T	T		<u> </u>	_	I^-	\vdash	\vdash	T	T	\dagger	T	T	\vdash	Total
		Σ		ш	V				L	<u> </u>	1			<u> </u>		1	<u> </u>		<u> </u>	L	<u>L</u>		L,	l	<u> </u>		L	<u> </u>	<u></u>			<u> </u>	<u></u>	اعرا

LDC #: <u>22232</u> SDG #: <u>238974, 233237, 239753, 240560, 240965</u> Page: 1 of 1 Reviewer: JE 2nd Reviewer: BC

Tronox Northgate Henderson Worksheet

EDD Area	Yes	No	NA	Findings/Comments
I. Completeness		li.		· 通信、例如: (1) 通行。(1)
Is there an EDD for the associated Tronox validation report?	X			
II. EDD Qualifier Ropulation				
Were all qualifiers from the validation report populated into the EDD?	X		S1014 47 540	
III. EDD Lab Anomalies			i i	
Were EDD anomalies identified?	X			
If yes, were they corrected or documented for the client?	X			See EDD_discrepancy_ form_LDC22232_010410.doc
IV-EDD Delivery	11-11		1144 1144	
Was the final EDD sent to the client?	X			

EDB TROMON 010410 PRILL BOO

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Data Validation Reports LDC #22232

Radium-226 & Radium-228



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: October 13 through October 29, 2009

LDC Report Date: December 31, 2009

Matrix: Soil

Parameters: Radium-226 & Radium-228

Validation Level: Stage 4

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 238974

Sample Identification

RSAN8-10BSPLP

SA52-15BSPLP

SA52-28BSPLP

RSAQ8-10BSPLP

RSAQ8-31BSPLP

SA34-10BSPLP

SA34-31BSPLP

RSAN8-10BSPLPMS

RSAN8-10BSPLPDUP

SA34-10BSPLPMS

SA34-10BSPLPDUP

Introduction

This data review covers 11 soil samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

No field blanks were identified in this SDG.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
SA52-15BSPLP	Radium-228	3.0	3.03	None	Р

The MDA was greater than the PQL as listed above.

V. Sample Result Verification and Project Quantitation Limit

All sample result verifications were acceptable.

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 238974	All isotopes reported below the PQL.	J (all detects)	A

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 238974

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
238974	RSAN8-10BSPLP	Radium-228	None	Р	Minimum detectable activity
238974	RSAN8-10BSPLP SA52-15BSPLP SA52-28BSPLP RSAQ8-10BSPLP RSAQ8-31BSPLP SA34-10BSPLP SA34-31BSPLP	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 238974

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 238974

No Sample Data Qualified in this SDG

SI)G #	:22232A29 t:238974 atory:_GEL_Laboratories_L			N COMP		Henderson ESS WORKSH - 니	EET	Date:12-21-0 Page:of Reviewer: <u>/</u> 2nd Reviewer:/
TI	ne sa	OD: Radium 226 and Ra amples listed below were tion findings worksheets.		·				alidation findi	ngs are noted in attached
		Validation	Area					Comments	
	1.	Technical holding times			A	Sampling of	lates: 10 - 13 - 09	through	10-29-09
	lla.	Initial calibration			A			0	
	IIb.	Calibration verification			Α				
	III.	Blanks	-		À				
	IVa.	Matrix Spike/(Matrix Spike)	Duplica	ates	Α	MS/I	PV P		
	IVb.	Laboratory control samples			A	LCS			
	IVc.	Chemical recovery			A				
	V.	Sample result verification			A Ar				
	VI.	Minimum dectectable activity	y (MD/	A)	SW				
	VII.	Overall assessment of data			Α				
$\ $	VIII.	Field duplicates			7				
	ΧIV	Field blanks			12	<u> </u>			
	ote: alidat	A = Acceptable N = Not provided/applicable SW = See worksheet ed Samples:		R = Rin FB = Fi	eld blank	ds detected	D = Duplicate TB = Trip blar EB = Equipm	nk	
[1	RSAN8-10BSPLP	11	SA34-10SPL	226 PDUP	21		31	
		SA52-15BSPLP	12	P85		22		32	
	3	SA52-28BSPLP	13	PBSPLP		23		33	
	4	RSAQ8-10BSPLP	14			24		34	
	5	RSAQ8-31BSPLP	15			25		35	
1	3	SA34-10SPLP	16			26_		36	
	7	SA34-31BSPLP	17			27		37	
	8	RSAN8-10BSPLPMS	18			28		38	
	9	RSAN8-10BSPLPDUP	19			29		39	
9[10	SA34-10SPLPMS	20			30		40	

Notes:	Fluid 3	(Keagent	Water)	 	
		U	,		

VALIDATION FINDINGS CHECKLIST

	Page:_	1 of 6
	Reviewer:	
2nd	Reviewer:	1~

Method:Radiochemistry(EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.				
II, Calibration				
Were all instruments and detectors calibration as required?	1			
Were NIST traceable standards used for all calibrations?	/			
Was the check source identified by activity and radionuclide?	/			1
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?				
III. Blanks				
Were blank analyses performed as required?	\checkmark			
Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see the Blanks validation completeness worksheet.		/		
IV. Matrix spikes and Duplicates				
Were a matrix spike (MS) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	/			
Were the MS percent recoveries (%R) within the QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.				
Was a duplicate sample anaylzed at the required frequency of 5% in this SDG?	/			
Were all duplicate sample duplicate error rations (DER) ≤1.42?.				
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	/			
VI: Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?				
Were tracer/carrier recoveries within the QC limits?	/			
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		/		
Were the performance evaluation (PE) samples within the acceptance limits?			/	
VIII. Sample Result Verification			,	
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
Were the Minimum Detectable Activities (MDA) < RL?		<u>/</u>		

LDC #: 3333A39 SDG #: 238974

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: MG
2nd Reviewer: V

Validation Area	Yes	No	NA	Findings/Comments
IX Overall assessment of data				
Overall assessment of data was found to be acceptable.				
X. Field:duplicates				
Field duplicate pairs were identified in this SDG.		/		1
Target analytes were detected in the field duplicates.			/	
XI. Field blanks				
Field blanks were identified in this SDG.				
Target analytes were detected in the field blanks.				

9333A39 738974 LDC #: SDG #: METHOD: Radiochemistry (Method: SCC Cover

The following sample MDAs are above the RDL:

VALIDATION FINDINGS WORKSHEET

Minimum Detectable Activities

Page: | of

#	Sample ID	Isotope	AAPP POL RDL (units)	Lab DL MBA (units)	Finding	Qualifications
_	7	Ra-238	3. (pc:/r)	3.03 (10:1/1)	Lab D	None / P
						10000
Comments:	ţs:					

LDC #: 3333A39 938974 SDG #:

VALIDATION FINDINGS WORKSHEET Level IV Recalculation Worksheet

Page:__ Reviewer:_ 2nd Reviewer:_

METHOD: Radiochemistry (Method:_

COVEN 9ec

Percent recoveries (%R) for a laboratory control sample, a matrix spike and a matrix spike duplicate sample were recaluculated using the following formula:

%R = Found x 100 True

Found = activity of each analyte measured in the analysis of the sample. True = activity of each analyte in the source. Where,

A matrix spike and matrix spike duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = $\frac{|S-D|}{(S+D)/2}$ × 100

S = Original sample activity
D = Duplicate sample activity Where,

					Recalculated	Reported	
Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	%R or RPD	%R or RPD	Acceptable (Y/N)
	Laboratory control sample						
527		Ra-238	43.046 (PCi/L) 39.2 (PCi/L)	39.2 (Ri/L)	011	011	>
	Matrix spike sample						_
01		Ra-336	243.39 (PC:1) 243. (PC:1)	243. (PCi/)	101	101	
	Duplicate RPD						
1-1		Ra-236	0.378 U (Pc:/L)	.3796 u (pc://)0.4366 u (pc://)	0.41	0.41	
	Chemical recovery	89-133		f			
7		40-	255.9 (com)	55.9 (cpm) 372.8 (cpm)	793	79.3	
		Ra-338				•	*>

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results

Vol = Volume

CF =%R. Self-absorbance, abundance, ect.

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	of_
Reviewer:	MG
2nd reviewer:	

METHOD: Radiochemistr	y (Method: See cover	
Please see qualifications N N/A Have result N N/A Are result	below for all questions answered "N". ults been reported and calculated co is within the calibrated range of the in	Not applicable questions are identified as "N/A". rectly?
Analyte results for # 2 and verified using the follo		reported with a positive detect were recalculate
Activity =	Recalculation:	
(cpm - bckgrd cpm) (2.22)(E)(Vol)(CF)	(0.633 - 0.167) (2.2590)(0.300 L) × 0.6	1 × 1 × 1.002 = 0.4816 pc:/
E = Efficiency	(· · · · · · · · · · · · · · · · · · ·	61 0.975

#	Sample ID	Analyte	Reported Concentration (PC:/L)	Calculated Concentration (p C i / L)	Acceptable (Y/N)
	2	Ra-278 Ra-276	3.35	3,34	Ý
		Ra-226	0.480	0.482	J.
					-

Note:					
	· · · · · · · · · · · · · · · · · · ·	****	· 	 	
				 ·	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: October 16 through October 20, 2009

LDC Report Date: December 31, 2009

Matrix: Soil/Water

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 239237

Sample Identification

SA108-20B SA33-33B SA108-30B SA108-20BMS SA108-45B SA108-20BDUP

SA157-10B

SA157-25B

SA157-44B

SA171-5B

SA171-15B

SA171-30B

SA171-41B

EB101909-SO1A3

SA156-0.5B

SA156-10B

SA156-30B

SA156-35B

SA156-45B

SA33-0.5B

SA33009-0.5B

SA33-10B

SA33-20B

Introduction

This data review covers 22 soil samples and one water sample listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample EB101909-SO1A3 was identified as an equipment blank. No radium-226 or radium-228 was found in this blank.

Samples FB080309-SO (from SDG 234414) and FB082809-SO (from SDG 236238) were identified as field blanks. No radium-226 or radium-228 was found in these blanks with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB082809-SO	8/28/09	Radium-228 Radium-226	3.83 pCi/L 1.75 pCi/L	SA108-20B SA108-30B SA108-45B SA157-10B SA157-25B SA157-44B SA171-15B SA171-15B SA171-30B SA171-41B SA33-0.5B SA33-0.5B SA33-10B SA33-20B SA33-33B

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs.

V. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 239237	All isotopes reported below the PQL.	J (all detects)	А

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA33-0.5B and SA33009-0.5B were identified as field duplicates. No isotopic radium-226 or radium-228 was detected in any of the samples with the following exceptions:

-	Concentral	tion (pCi/g)				
Analyte	SA33-0.5B	SA33009-0.5B	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	1.32	0.660	-	0.66 (≤0.50)	J (all detects)	А
Radium-226	1.05	0.490	-	0.56 (≤0.50)	J (all detects)	Α

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 239237

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
239237	SA108-20B SA108-30B SA108-45B SA157-10B SA157-25B SA157-44B SA171-5B SA171-15B SA171-15B SA171-14B EB101909-SO1A3 SA156-0.5B SA156-10B SA156-30B SA156-35B SA156-35B SA156-35B SA33-0.5B SA33-0.5B SA33-0.5B SA33-10B SA33-20B SA33-33B	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)
239237	SA33-0.5B SA33009-0.5B	Radium-228 Radium-226	J (all detects) J (all detects)	А	Field duplicates (Difference) (fd)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 239237

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Equipment Blank Data Qualification Summary - SDG 239237

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 239237

No Sample Data Qualified in this SDG

			i ronox Nortngate Henderson
LDC #: 22	2232B29		VALIDATION COMPLETENESS WORKSHEET
SDG #: 2	39237	٠.	Stage 2B

Date: 12-21-09
Page: _t_of_t_
Reviewer: MG
2nd Reviewer: \

Laboratory: GEL Laboratories LLC

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
1.	Technical holding times	A	Sampling dates: 10-16-09 through 10-20-09
IIa.	Initial calibration	A	đ
IIb.	Calibration verification	Α	
III.	Blanks	Α	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/DUP (SDG: 237885, 238830)
iVb.	Laboratory control samples	Α	LCS
IVc.	Chemical recovery	Α	
V.	Sample result verification	N	
VI.	Minimum dectectable activity (MDA)	A	
VII.	Overall assessment of data	A	
VIII.	Field duplicates	SW	D=17+18
ΧIV	Field blanks	SW	EB=*11 FB = FB082809-50 (506: 236238)

FB= * FB080309-50 (SDG: 234414)

Note:

A = Acceptable

¥ = ND = No compounds detected

N = Not provided/applicable SW = See worksheet

R = Rinsate FB = Field blank D = Duplicate TB = Trip blank

EB = Equipment blank

Validated Samples.

1	SA108-20B	ક	11	EB101909-SO1A3	w	21	SA33-33B S	31
2	SA108-30B		12	SA156-0.5B	S	22	376 778 SA108-20BMS	32
3	SA108-45B		13	SA156-10B		23	296 229 SA108-20BDUP	33
4	SA157-10B		14	SA156-30B		24	PBS	34
5	SA157-25B		15	SA156-35B		25 g	PBW	35
6	SA157-44B	Ш	16	SA156-45B		26		36
7	SA171-5B	Ш	17	SA33-0.5B		27		37
8	SA171-15B	Ш	18	SA33009-0.5B	\perp	28		38
9	SA171-30B	Ц	19	SA33-10B		29		39
10	SA171-41B	J	20	SA33-20B	J	30_		40

Notes:				
	 	······································	· · · · · · · · · · · · · · · · · · ·	

LDC #: 3333 B39 SDG #: 339337

VALIDATION FINDINGS WORKSHEET Field Blanks

Jo	7	<u>;</u>
Page:	Reviewer	2nd Reviewe

COVEr Sec METHOD: Radiochemistry (Method:_

Were target isotopes detected in the field blanks? Were field blanks identified in this SDG?

Blank units: Pci/L Associated sample units: PCi

Field blank type: (circle one) Field Blank)/ Rinsate / Other:

(> 10x) 1710, 17101 gua, Sample identification Associated Samples: Burples rode 200 0.0383 0.0175 Blank Action Limit FB DB 2 809 - 50 Blank ID 3.83 1.75 Ra-338 Ra-326 Analyte 7 RL <u>√</u>

Associated sample units: Blank units:

Sampling date:_

Field blank type: (circle one) Field Blank / Rinsate / Other:_

Associated Samples:_ Analyte

Γ		7		7	_	T	_	T	_	Т	_	Т		7	_
			_										,		
		_								1		-			_
			_					_							
Hication	IIIcariOil														
Sample Identification				-					_					-	
Ö			1		+		1						_		
							+		+		+		+		ľ
					_						1	-	-		
															Marin tive
Blank	Action	CIMIL													trations w
Blank ID		-					_						_	_	Samples with isotope concentrations within the time.
\dashv	,					_									n isotopi
Analyte															mples wil
									_		_			لـ	S B

with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected,

LDC#: 239237 SDG#: 239237

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page:_		of <u>1</u>	_
Reviewer:	٨	16	
2nd Reviewer:		<	_/

METHOD: Radio Chemistry (Method: see cover)

ON NA ON NA

Were field duplicate pairs identified in this SDG? Were target analytes detected in the field duplicate pairs?

	Concentration (pCi/g)		(≤50)	(pCi/g)	(pCi/g)	Qualifications	
Compound	17	18	RPD	Difference	Limits	(Parent Only)	
Ra-228	1.32	0.660		0.66	(<0.50)	J dets/ A fd	
Ra-226	1.05	0.490		0.56	(≤0.50)	J dets/ A fd	

V:\FIELD DUPLICATES\FD_inorganic\22232B29.wpd

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: October 23 through November 2, 2009

LDC Report Date: December 30, 2009

Matrix: Water

Parameters: Radium-226 & Radium-228

Validation Level: Stage 4

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 239753

Sample Identification

M-141B M-137BMS

M-141009B M-137BDUP

PB102309-A3

M-145B

M-139B

M-146B

M-144B

M-138B

M-138009B

M-138BDISS

M-138009BDISS

M-137B

M-137BDISS

M-148B

EB103009-GWA4

M-147B

M-147009B

EB110209-GWA3

M-141BMS

M-141BDUP

Introduction

This data review covers 22 water samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Samples EB103009-GWA4 and EB110209-GWA3 were identified as equipment blanks. No radium-226 or radium-228 was found in these blanks.

Sample FB080409-GW (from SDG 233776) was identified as a field blank. No radium-226 or radium-228 was found in this blank with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB080409-GW	8/4/09	Radium-228 Radium-226	2.33 pCi/L 0.396 pCi/L	M-146B

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

Sample	Isotope	Reported Activity	Modified Final Activity
M-146B	Radium-226	0.880 pCi/L	1.00U pCi/L

Samples PB100209-A2 (from SDG 237885) and PB102309-A3 were identified as pump blanks. No radium-226 or radium-228 was found in these blanks.

Sample FiltB092509-A2 (from SDG 237885) was identified as a filter blank. No radium-226 or radium-228 was found in this blank with the following exceptions:

Filter Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FiltB092509-A2	9/25/09	Radium-228	1.88 pCi/L	M-138BDISS M-138009BDISS M-137BDISS

Sample concentrations were compared to concentrations detected in the filter blanks as required by the QAPP. No sample data was qualified.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs.

V. Sample Result Verification and Project Quantitation Limit

All sample result verifications were acceptable.

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 239753	All isotopes reported below the PQL.	J (all detects)	А

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples M-141B and M-141009B, samples M-138B and M-138009B, samples M-138BDISS and M-138009BDISS, and samples M-147B and M-147009B were identified as field duplicates. No isotopic radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentrat	ion (pCi/L)	RPD	D'''		
Analyte	M-141B	M-141009B	(Limits)	Difference (Limits)	Flags	A or P
Radium-228	2.40U	2.39	-	0.01 (≤3.00)	•	-
Radium-226	0.228U	0.458	-	0.23 (≤1.00)	-	-

	Concentrat	ion (pCi/L)	RPD	D!#			
Analyte	M-138B	M-138009B	(Limits)	Difference (Limits)	Flags	A or P	
Radium-226	0.671	0.540	-	0.131 (≤1.00)	-	•	

	Concentra	tion (pCi/L)	222	D''			
Analyte	M-138BDISS M-138009BDISS		RPD (Limits)	Difference (Limits)	Flags	A or P	
Radium-226	0.252U	0.276	-	0.024 (≤1.00)	-	-	

	Concentra	tion (pCi/L)	200	D:#		
Analyte	M-147B M-147009B		RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-226	0.784	0.303	-	0.481 (≤1.00)	-	_

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 239753

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
239753	M-141B M-141009B PB102309-A3 M-145B M-139B M-146B M-144B M-138B M-138009B M-138BDISS M-138009BDISS M-137B M-137BDISS M-148B EB103009-GWA4 M-147B M-147009B EB110209-GWA3	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 239753

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Equipment Blank Data Qualification Summary - SDG 239753

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 239753

SDG	Sample	Isotope	Modified Final Activity	A or P	Code
239753	M-146B	Radium-226	1.00U pCi/L	А	bf

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Pump Blank Data Qualification Summary - SDG 239753

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Filter Blank Data Qualification Summary - SDG 239753

No Sample Data Qualified in this SDG

Tronox Northgate Henderson VALIDATION COMPLETENESS WORKSHEET

LDC:	#: <u>22232C29</u>	_ VA	LIDATIO	N COMPI	LETEN	NESS WOF	RKSHEE	ΕT	Date: 12 - 21 - 09			
	#: 239753			St	tage 2 l	B 4			Page:of			
Laboratory: GEL Laboratories LLC			9n H					Reviewer: MG 2nd Reviewer: 1				
					•	·			Zna Reviewer/(/			
METI	HOD: Radium 226 and R	adiur	n 228 (EPA	Method 90	3.1 & 90	04)						
The s	amples listed below were	e revi	ewed for ea	ch of the fo	llowing	validation are	as. Valida	ation fin	dings are noted in attached			
valida	ation findings worksheets	•							-			
	Validation	A						 				
F.	Validation Area			Α	Sampling dates: 19-33-09 + hrough 11-2-09							
	Technical holding times				Sampling	dates: / O -)	93-09	- Three	ough 11-2-09			
lla.	Initial calibration			A								
IIb.	Calibration verification	-		$\frac{A}{\lambda}$								
111.	Blanks			A	MC	10	-					
IVa.	Matrix Spike/(Matrix Spike)		ates	A		40Q						
IVb.	Laboratory control samples			A	LCS							
IVc.				A								
V.	Sample result verification			AN								
VI.	Minimum dectectable activi	Minimum dectectable activity (MDA)				-						
VII.	Overall assessment of data			Α								
VIII.	Field duplicates			SW	D= 1+2 D= 8+9 D= 10+11 D= 16+17 Pump Blank = * 3, * PB100209-A2 (SDG: 237885)							
LXIV	Field blanks			SW	Pump 1	3lank = * 3	, * PB10	00209	-A2 (SDG: 237885)			
Note:	A = Acceptable		# = ND = No		EB =	D = Di	uplicate	ilank =	Fil+B092509-A2 (506:23			
	N = Not provided/applicable SW = See worksheet	€	R = Rin: FB = Fie	sate eld blank		EB = 8	rip blank Equipment b	lank	,			
Valida	ted Samples:			`	FB=	FB0804	109-G1	J (SI	og: 233776)			
	all water	Т	<u> </u>			7	226					
1	M-141B	11	M-138009BDI	ISS	21	M-137BMS	296	31				
2	M-141009B	12	M-137B		22	M-137BDUP		32				
3	PB102309-A3	13	M-137BDISS		23	PBW		33				
4	M-145B	14	M-1 2 8B	9W 8	24			34				
5	M-139B	15	EB103009-G\	NA4	25			35				
6	M-146B	16	M-147B		26			36				
7	M-144B	17	M-147009B		27			37				
8	M-138B	18	EB110209-GWA3		28			38				
9	M-138009B	19	M-141BMS	M-141BMS				39				
10	M-138BDISS	20	M-141BDUP	22	30			40				
Notes												
	·								***************************************			

LDC #: 32232C29 SDG #: 239753 Page: 1 of 2 Reviewer: MG 2nd Reviewer: V

Method: Radiochemistry (EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	/			
II. Calibration				
Were all instruments and detectors calibration as required?	/			
Were NIST traceable standards used for all calibrations?	/			
Was the check source identified by activity and radionuclide?	/			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	/			
iff. Blanks				
Were blank analyses performed as required?	✓			
Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see the Blanks validation completeness worksheet.		/		
IV. Matrix spikes and Duplicates				
Were a matrix spike (MS) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	/			
Were the MS percent recoveries (%R) within the QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	· /			
Was a duplicate sample anaylzed at the required frequency of 5% in this SDG?	/			
Were all duplicate sample duplicate error rations (DER) ≤1.42?.	.V			
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	/		_	
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	/			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?	/			
Were tracer/carrier recoveries within the QC limits?	/		***********	
VII. Regional Guality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		/		
Were the performance evaluation (PE) samples within the acceptance limits?			\checkmark	
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
Were the Minimum Detectable Activities (MDA) < RL?	<u> </u>			

LDC #: 22232 C29 SDG #: 239753

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2 Reviewer: MG 2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
IX. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			
X. Field duplicates				
Field duplicate pairs were identified in this SDG.	/			ŀ
Target analytes were detected in the field duplicates.	/			
XI. Field:blanks				
Field blanks were identified in this SDG.				
Target analytes were detected in the field blanks.				

LDC #: 23232C39 SDG #: 239753

VALIDATION FINDINGS WORKSHEET Field Blanks

2nd Reviewer: Reviewer: MG

> see cover METHOD: Radiochemistry (Method:_

Were field blanks identified in this SDG? K N N N N N

WN N/A Were target isotopes detected in the field blanks?

Blank units: Pci/L Associated sample units: Pci/L

Sampling date: 9-35-09

Field blank type: (circle one) Field Blank / Rinsate Other Filter Blank Associated Samples:

	I Jein Diailk	ype: (circle	one) rield E	Find Main type: (circle one) Field Blank / Rinsate /Other) Filter Blank Associated Samples: 10 11 13 / 11 N N
	Analyte	Blank ID	Blank	
	200	2000		Sample Identification
	T 20 4-43	as 07-4a	\ Limit	No samples were and lifting
18 V	< RL Ra - 228	98		
•				
	Blank unite:	PCi /		pCi // 100
	Sampling date: 8 - 4 - 09	8: 8-4	4550ciated :	.1
	Field blank ty	'pe: (circle o	ine) (Field Bla	Field blank type: (circle one) Field Blank) Rinsate / Other:
	Analyte	Dient 15		modulared Sainples:
	- Andrews	5 F 1 5	Glank	

7

Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected.
"U". Sample Identification 0.880/1.00 ی Blank Action Umit F B 080 409 - GW 0.396 2.33 Ra-338 Ra-336 2

LDC#: 32232 < 29 SDG#: 339753_

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page: 1 of 1
Reviewer: HG
2nd Reviewer: _____

METHOD: Radio Chemistry (Method: see cover)

ÝN NA ÝN NA

Were field duplicate pairs identified in this SDG?
Were target analytes detected in the field duplicate pairs?

	Concentrati	on (pCi/L)	(≤30)	(pCi/L)	(pCi/L)	Qualifications
Compound	1	2	RPD	Difference	Limits	(Parent Only)
Ra-228	2.40U	2.39		0.01	(≤3.00)	
Ra-226	0.228U	0.458		0.23	(≤1.00)	

V:\FIELD DUPLICATES\FD_inorganic\22232C29.wpd

	Concentrati	on (pCi/L)	(≤30)	(pCi/L)	(pCi/L)	Qualifications
Compound	8	9	RPD	Difference	Limits	(Parent Only)
Ra-226	0.671	0.540		0.131	(≤1.00)	

V:\FIELD DUPLICATES\FD_inorganic\22232C29.wpd

	Concentrati	on (pCi/L)	(≤30)	(pCi/L)	(pCi/L)	Qualifications
Compound	10	11	RPD	Difference	Limits	(Parent Only)
Ra-226	0.252U	0.276		0.024	(≤1.00)	

V:\FIELD DUPLICATES\FD_inorganic\22232C29.wpd

	Concentrati	on (pCi/L)	(≤30)	(pCi/L)	(pCi/L)	Qualifications
Compound	16	17	RPD	Difference	Limits	(Parent Only)
Ra-226	0.784	0.303		0.481	(≤1.00)	

V:\FIELD DUPLICATES\FD_inorganic\22232C29.wpd

LDC #: 32332C39 239753 SDG #:

VALIDATION FINDINGS WORKSHEET **Level IV Recalculation Worksheet**

Page: / of Reviewer:

2nd Reviewer:

See cover METHOD: Radiochemistry (Method:_

Percent recoveries (%R) for a laboratory control sample, a matrix spike and a matrix spike duplicate sample were recaluculated using the following formula: Found = activity of each analyte measured in the analysis of the sample. Where, %R = Found x 100

A matrix spike and matrix spike duplicate relative percent difference (RPD) was recalculated using the following formula:

True = activity of each analyte in the source.

S = Original sample activity D = Duplicate sample activity Where, RPD = $\frac{1.8 \cdot D_1}{(S+D)/2} \times 100$

					Recalculated	Reported	
Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	%R or RPD	%R or RPD	Acceptable (Y/N)
	Laboratory control sample						
527		Ra-226	19.434 (pc:/L) 34.2 (pc:/L)	24.2 (pc:/L)	80.3	B0.4	>
	Matrix spike sample						_
6		Ra-338	43.435 (pci/) 79.1 (pci/)	79.1 (PC://)	811	81.1	
	Duplicate RPD						
25		Ra-336	0.1767 U (PC:/)	1767 u (PCil) 0.1867u (PCil)	5.50	5.53	
	Chemical recovery	134-133		ı			
6		for 2a-238	976.4 (CPM)	76.4 (cpm) 304.5 (cpm)	90.8	8.06	> >

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results

LDC	#:	222	3	7	C	29
SDG		239				

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	of1
Reviewer:	MG
2nd reviewer:	

METHOD: Radiochemistry	(Method:_	see	cover	
------------------------	-----------	-----	-------	--

P	eas	e see	qualifications below	for all question	s answered "N". i	Not applicable questions	are identified as "N/A".

YN N/A

Have results been reported and calculated correctly?

N N/A

Are results within the calibrated range of the instruments?

Analyte results for and verified using the	世 2, Ra- ∂∂8 he following equation:	reported with a positive detect were recalculated
Activity =	Recalculation:	
(cpm - bckgrd cpm) (2.22)(E)(Vol)(CF) E = Efficiency Vol = Volume CF = %R, Self-absorbar	,	$\frac{1}{0.990} \times \frac{1}{0.778} \times 1.057 = 2.3852 \text{ pCi/L}$

#	Sample ID	Analyte	Reported Concentration	Calculated Concentration	Acceptable (Y/N)
1	2	Ra- 228	2.39	2.39	Y
		Ra-226	0.458	0.460	1
2	11	Ra- 226	0.276	0.277	<u> </u>
	:				
	· · · · · · · · · · · · · · · · · · ·				

Note:	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: November 5, 2009

LDC Report Date: December 31, 2009

Matrix: Soil

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 240560

Sample Identification

SA77-0.5B SA77-10B SA77009-10B SA77-0.5BMS SA77-0.5BDUP

Introduction

This data review covers 5 soil samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample FB082809-SO (from SDG 236238) was identified as a field blank. No radium-226 or radium-228 was found in this blank with the following exceptions:

Field Blank ID	Sampling Date	· · ·		Associated Samples		
FB082809-SO	8/28/09	Radium-228 Radium-226	3.83 pCi/L 1.75 pCi/L	All samples in SDG 240560		

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs.

V. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 240560	All isotopes reported below the PQL.	J (all detects)	Α

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA77-10B and SA77009-10B were identified as field duplicates. No isotopic radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentra	ition (pCi/g)		D:#		
Analyte	SA77-10B SA77009-10B		RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	0.917	0.753	-	0.164 (≤0.50)	-	-
Radium-226	0.926	0.768	-	0.158 (≤0.50)	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 240560

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
240560	SA77-0.5B SA77-10B SA77009-10B	All isotopes reported below the PQL.	J (all detects)	А	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 240560

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 240560

No Sample Data Qualified in this SDG

Tronox Northgate Henderson

LDC #: 22232D29	VALIDATION COMPLETENESS WORKSHEET
SDG #: 240560	Stage 2B
Laboratory: GEL Laboratories L	<u>LC</u>

Page:__of__ Reviewer: MG 2nd Reviewer:

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments					
1.	Technical holding times	A	Sampling dates: 11-5-09					
lla.	Initial calibration	A						
IIb.	Calibration verification	A						
111.	Blanks	Α						
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/DUP					
IVb.	Laboratory control samples	Α	LCS					
IVc.	Chemical recovery	A						
V.	Sample result verification	N						
VI.	Minimum dectectable activity (MDA)	Α						
VII.	Overall assessment of data	A						
VIII.	Field duplicates	SW	D= 2+3					
XIV	Field blanks	SW	FB = FB082809-50 (SDG: 236238)					

Note:

A = Acceptable

N = Not provided/applicable

SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank D = Duplicate

TB = Trip blank EB = Equipment blank

Validated Samples:

	all soil			
1_	SA77-0.5B	11	21	31
2	SA77-10B	12	22	32
3	SA77009-10B	13	23	33
4	3% 228 SA77-0.5BMS	14	24	34
5	SA77-0.5BDUP 228	15	25	35
6	PBS	16	26	36
7		17	27	37
8		18	28	38
9		19	29	39
10		20	30	40

Notes:		

LDC #: 33232D39 SDG #: 340560

VALIDATION FINDINGS WORKSHEET Field Blanks

Page: 1 of 1 2nd Reviewer: Reviewer:

> Cover Sec

METHOD: Radiochemistry (Method:_

Were target isotopes detected in the field blanks? Were field blanks identified in this SDG?

Blank units: Pci/L Associated sample units: PCi/Sampling date: 8-38-09
Field blank type: (circle one) Field Blank/ Rinsate / Other:_

(> 10x) ied. 70 94al: 1 Sample Identification Associated Samples: samples were 0.0383 0.0175 Blank Action Limit FB 082 809 -50 Blank ID 3.83 1.75 Ra-238 Ra-226 Analyte ٦ ٧

Associated sample units: Blank units:

Sampling date:

Fleid blank type: (circle one) Field Blank / Rinsate / Other:

Sample Identification Associated Samples: Blank Action Blank 1D Analyte

		···				
						Samples with isotope concentrations within five times the associated field plank concentrations.
						1
						July Concords
						ated field his
						S the associ
				-		thin five time
						Il entrations wi
						otope conce
					+	Samples with is

LDC#: 22232 D29 SDG#: 240560_

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page: ___of __ Reviewer: _____ 2nd Reviewer: _____

METHOD: Radio Chemistry (Method: see cover)

₩ NA

Were field duplicate pairs identified in this SDG?
Were target analytes detected in the field duplicate pairs?

	Concentration (pCi/g) 2 3		Concentration (pCi/g)		(≤50)	(pCi/g)	(pCi/g)	Qualifications
Compound			RPD	Difference	Limits	(Parent Only)		
Ra-228	0.917	0.753		0.164	(≤0.50)			
Ra-226	0.926 0.768			0.158	(≤0.50)			

V:\FIELD DUPLICATES\FD_inorganic\22232D29.wpd

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: November 11, 2009

LDC Report Date: December 31, 2009

Matrix: Water

Parameters: Radium-226 & Radium-228

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 240965

Sample Identification

M-122B

M-122BDISS

M-122BMS

M-122BDUP

M-122BDISSMS

M-122BDISSDUP

Introduction

This data review covers 6 water samples listed on the cover sheet. The analyses were per EPA Methods 903.1 and 904.0 for Radium-226 and Radium-228.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined and a self-absorption curve was generated for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within laboratory control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample PB102309-A3 (from SDG 239753) was identified as a pump blank. No radium-226 or radium-228 was found in this blank.

Sample FiltB092509-A2 (from SDG 237885) was identified as a filter blank. No radium-226 or radium-228 was found in this blank with the following exceptions:

Filter Blank ID	Sampling Date	Isotope	Concentration	Associated Samples		
FiltB092509-A2	9/25/09	Radium-228	1.88 pCi/L	M-122BDISS		

Sample concentrations were compared to concentrations detected in the filter blanks as required by the QAPP. No sample data was qualified.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Chemical Recovery

All chemical recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs.

V. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 240965	All isotopes reported below the PQL.	J (all detects)	Α

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Data Qualification Summary - SDG 240965

SDG	Sample	Sample Isotope Flag		A or P	Reason (Code)	
240965	M-122B M-122BDISS	All isotopes reported below the PQL.	J (all detects)	А	Sample result verification (PQL) (sp)	

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 240965

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Pump Blank Data Qualification Summary - SDG 240965

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Radium-226 & Radium-228 - Filter Blank Data Qualification Summary - SDG 240965

No Sample Data Qualified in this SDG

Tronox Northgate Henderson

LDC #: 22232E29	VALIDATION COMPLETENESS WORKSHEET
SDG #: 240965	Stage 2B
Laboratory: GEL Laboratorie	s LLC

Date: 12-22-09 Page:___of__ Reviewer: MG 2nd Reviewer: ___ \(\sqrt{\chi} \)

METHOD: Radium 226 and Radium 228 (EPA Method 903.1 & 904)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l.	Technical holding times	Α	Sampling dates: 11-11-09
lla.	Initial calibration	Α	
IIb.	Calibration verification	A	
111.	Blanks	A	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/DUP
IVb.	Laboratory control samples	A	LCS
IVc.	Chemical recovery	A	
V.	Sample result verification	N	
VI.	Minimum dectectable activity (MDA)	Α	
VII.	Overall assessment of data	Α	
VIII.	Field duplicates	N	
XIV	Field blanks	SW	Pump Blank = * PB102309-A3 (SDG: 239753)

Filter Blank = FiltB092509-A2 (50G: 237885)

Note: A = Acceptable

N = Not provided/applicable SW = See worksheet

≭ = ND = No compounds detected

FB = Field blank

R = Rinsate

D = Duplicate TB = Trip blank

EB = Equipment blank

Validated Samples:

water

	WOC C			
1	M-122B	11	21	31
2	M-122BDISS	12	22	32
3	776 M-122BMS	13	23	33
4	M-122BDUP	14	24	34
5	M-122BDISSMS	15	25	35
6	M-122BDISSDUP	16	26	36
7	PBW	17	27	37
8		18	28	38
9		19	29	39
10		20	30	40

Notes:		
	·	

LDC #: 22232E39 SDG #: 340965

EET

2nd Reviewer:

Reviewer:

Page: __of_/

|--|

e cover	
See	
(Method:	
Radiochemistry	
METHOD:	

Were field blanks identified in this SDG?

Were target isotopes detected in the field blanks?

Blank units: PCi/L Associated sample units: PCi/L Associated Samples and date: 9-25-09

Field blank type: (circle one) Field Blank / Rinsate Other Filter Blank Associated Samples:

(· · · · ·							
(AN)			0	وه			-							
R		iffication	· · · ·	1 4011+11 C										
d Samples;		Sample identification	20/::	(m										•
2 Associate			012000	12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1							•	-		
er Blank			No			+		1				-		
Other) Filt									-					_
k / Rinsate A					•					-				
e) Field Blan	Blank	Action	Limit						-					
Field blank type: (circle one) Field Blank / Rinsate Ather Filter Blank Associated Samples:	Blank (D		1509-42	- 00	00.1			-						
eld blank ty	Analyte	1	#11 DU 2509-42	0.000	4 KL NA - 448 1.00									
ī Ļ				; ,	¥ √		<u></u>							

Associated sample units: Sampling date: Blank units:

Field blank type: (circle one) Field Blank / Rinsate / Other:

Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, Sample identification Associated Samples: Blank Action Umit Blank 1D Analyte

FBLKASC4.35

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Data Validation Reports LDC #22232

Isotopic Uranium & Isotopic Thorium



Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: October 13 through October 29, 2009

LDC Report Date: December 31, 2009

Matrix: Soil

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 4

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 238974

Sample Identification

RSAN8-10BSPLP SA52-15BSPLP

SA52-28BSPLP

RSAQ8-10BSPLP

RSAQ8-31BSPLP

SA34-10BSPLP

SA34-31BSPLP

RSAN8-10BSPLPMS

RSAN8-10BSPLPDUP

Introduction

This data review covers 9 soil samples listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

No field blanks were identified in this SDG.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Tracer Recovery

All tracer recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
RSAN8-10BSPLP	Thorium-228 Uranium-233/234	0.0381 0.0389	0.03 0.03	None None	Р
SA52-28BSPLP	Thorium-228 Uranium-233/234	0.046 0.0304	0.03 0.03	None None	Р
RSAQ8-10BSPLP	Thorium-228 Uranium-233/234	0.0449 0.0429	0.03 0.03	None None	Р
RSAQ8-31BSPLP	Thorium-228 Thorium-230	0.0467 0.033	0.03 0.03	None None	Р
SA34-10BSPLP	Thorium-228	0.0499	0.03	None	Р
SA34-31BSPLP	Thorium-228 Uranium-238	0.041 0.0348	0.03 0.03	None None	Р

The MDA was greater than the PQL as listed above.

VI. Sample Result Verification and Project Quantitation Limit

All sample result verifications were acceptable.

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 238974	All isotopes reported below the PQL.	J (all detects)	Α

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 238974

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
238974	RSAN8-10BSPLP SA52-28BSPLP RSAQ8-10BSPLP	Thorium-228 Uranium-233/234	None None	Р	Minimum detectable activity
238974	RSAQ8-31BSPLP	Thorium-228 Thorium-230	None None	Р	Minimum detectable activity
238974	SA34-10BSPLP	Thorium-228	None	Р	Minimum detectable activity
238974	SA34-31BSPLP	Thorium-228 Uranium-238	None None	Р	Minimum detectable activity
238974	RSAN8-10BSPLP SA52-15BSPLP SA52-28BSPLP RSAQ8-10BSPLP RSAQ8-31BSPLP SA34-10BSPLP SA34-31BSPLP	All isotopes reported below the PQL.	J (all detects)	А	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 238974

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 238974

No Sample Data Qualified in this SDG

Tronox Northgate Henderson

LDC #:	22232A59	VALIDATION COMPLETENESS WORKSHEET
SDG #:	238974	Stage 2 B : Ц
Laboratory	y: <u>GEL Laboratories L</u>	LC and

Date: 12-21-09 Page: _i_of_i Reviewer: MG 2nd Reviewer: ______

METHOD: Isotopic Uranium (DOE EML HASL-300, U-02-RC Modified), Isotopic Thorium (DOE EML HASL-300, Th-01-RC Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
l, _	Technical holding times	Α	Sampling dates: 10-13-09 through 10-29-09
lla.	Initial calibration	A	U U
llb.	Calibration verification	Α	
III.	Blanks	Α	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/DUP
IVa.	Laboratory control samples	A	LCS
V.	Tracer Recovery	A	
VI.	Minimum Detectable Activity (MDA)	SW	
VII.	Sample result verification	Ar	
VIII.	Overall assessment of data	A	
IX.	Field duplicates	N	
x	Field blanks	N	

Note:

A = Acceptable

N = Not provided/applicable SW = See worksheet

ND = No compounds detected

R = Rinsate FB = Field blank

D = Duplicate

TB = Trip blank

EB = Equipment blank

Validated Samples:

all soil

	1	RSAN8-10BSPLP	11	rbs	21	31	
	2	SA52-15BSPLP	12	PB SPLP	22	32	
	3	SA52-28BSPLP	13		23	33	
	4	RSAQ8-10BSPLP	14		24	34	
	5	RSAQ8-31BSPLP	15		25	35	
A	6	SA34-10SPLP	16		26	36	
l	7	SA34-31BSPLP	17		27	37	
ľ	8	RSAN8-10BSPLPMS	18		28	38	
	9	RSAN8-10BSPLPDUP Th	19		29	39	
	10		20		30	40	

Notes:	Fluid	3 (Reagent	water))	
			V			

		•
SDG	#:	238974

	rage:_	 OT <u>&</u>
	Reviewer:	 MG
2nd	Reviewer:	 \sim

Method:Radiochemistry(EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met,				
II. Calibration				
Were all instruments and detectors calibration as required?	1			
Were NIST traceable standards used for all calibrations?	/			
Was the check source identified by activity and radionuclide?	/			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	/			
III, Blanks				
Were blank analyses performed as required?	/			
Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see the Blanks validation completeness worksheet.		/		
IV. Matrix spikes and Duplicates				
Were a matrix spike (MS) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	/			
Were the MS percent recoveries (%R) within the QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.				
Was a duplicate sample analyzed at the required frequency of 5% in this SDG?				
Were all duplicate sample duplicate error rations (DER) ≤1.42?.				
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	/			``
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	/			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?	/			
Were tracer/carrier recoveries within the QC limits?	/			
MI: Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?				
Were the performance evaluation (PE) samples within the acceptance limits?				
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
Were the Minimum Detectable Activities (MDA) < RL?				

AMPINATION LINDINGS CHECKIST

SDG #: 238974

rage: o o o Reviewer: MG 2nd Reviewer: ______

Validation Area	Yes	No	NA	Findings/Comments
IX. Overall essessment of data				
Overall assessment of data was found to be acceptable.	/			
X. Field duplicates				
Field duplicate pairs were identified in this SDG.		/		ı
Target analytes were detected in the field duplicates.			/	
XI: Field blanks				
Field blanks were identified in this SDG.				
Target analytes were detected in the field blanks.			\checkmark	

3333A59 238974 LDC #:_ SDG #:

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: lof leviewer: MG

Reviewer:___ 2nd Reviewer:_

METHOD: Radiochemistry (Method: SEE Cover

The following sample MDAs are above the RDL:

#	Sample ID	Isotope	AAPP POL RDL (units)	QAPP POL Lab DL RDL (units) MBA (units)	Elizilina	
		Tu-338	0.03 (pg/)	100301 (PC://		ĕ II `
	4	U-323/324		20301 11-12	Lab UL	None / P
		150/500		10.0307		
(
4	ς.	266-nl		9.046		
	7	0-333/334		p.0304		
?	η-	Th - 238		0.0449		
	->	U-333/334		0.0439		
J	5	Tn-338		0.0467		
	7	Tu-230		0.033		
ν.	9	72-238		00,000		
		000		0.0424		
		}				
9		80%-h)		0.04 (
	7	U-938	->	0.0348		
					>	>
Comments:	•					

LDC #: 3333A59 H26886 SDG #:

VALIDATION FINDINGS WORKSHEET Level IV Recalculation Worksheet

Page: Reviewer: 2nd Reviewer:

> COVE/ 9ec METHOD: Radiochemistry (Method:_

Percent recoveries (%R) for a laboratory control sample, a matrix spike and a matrix spike duplicate sample were recaluculated using the following formula:

%R = Found x 100

Found = activity of each analyte measured in the analysis of the sample. True = activity of each analyte in the source. Where,

A matrix spike and matrix spike duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = $\frac{|S-D|}{(S+D)/2} \times 100$

S = Original sample activity D = Duplicate sample activity Where,

					Recalculated	Reported	
Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	%R or RPD	%R or RPD	Acceptable (Y/N)
	Laboratory control sample						
765		U-338	9.78 (pc://	3.78 (PCi/L) 3.15 (PCi/L)	88.3	88 8.7	>
	Matrix spike sample						
B		Tu-330	J.19 (PG:1/	J. 19 (PC:/L) 2.68 (PC:/L)	81.7	81.8	<u> </u>
	Duplicate RPD						
Ь		V-233/234		0.159 (PC:/L) 0.179 (PC:/J)	 ⊗	11.9	
~	Chemical recovery		(mdp) 98096°E	(mdp) 3.88351 (dpm) 38029.	601	201	
		sadotos1 _ n 1					>

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated resul

	-		-: `
SDG	#:	238971	1

MALINDINGS WORKSHEE! **Sample Calculation Verification**

Page:	of_
Reviewer:	MG
2nd reviewer.	10/

METHOD: Radiochemistry (Method: See	cover
(ivieti lod.	

Hease	see	qualifications	below for	all	questions	answered "N".	Not applicable	augetions aro	identified a	- #N1/	A
V/AL 3	LI/A				•		. io. abbiloable	questions are	iuenimeu a	SIN	A

Have results been reported and calculated correctly? Are results within the calibrated range of the instruments?

Analyte results for $\frac{\# \partial}{\partial x} = \frac{35}{236}$ and verified using the following equation: reported with a positive detect were recalculated

Activity = Recalculation:

(cpm - bckgrd cpm) (2.22)(E)(Vol)(CF)

 $\frac{m}{(3.22)(0.254802)(0.800L)(0.83604)(0.8090)} = 0.0196 \text{ pc:/L}$

CF = %R, Self-absorbance, abundance, ect.

E = Efficiency Vol = Volume

#	Sample ID	Analyte	Reported Concentration (PC:/L)	Calculated Concentration (pCi/L)	Acceptable (Y/N)
1	2	U-233/234	0.124	0.124	Y
		U-235/236	0.0196	0.0196	1
		U-238	0.122	0.122	
_					
					,
					·

Note:			
	 		
			

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: October 16 through October 20, 2009

LDC Report Date: December 31, 2009

Matrix: Soil/Water

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 239237

Sample Identification

SA108-20B SA33-33B SA108-30B SA108-20BMS SA108-45B SA108-20BDUP

SA157-10B

SA157-25B

SA157-44B

SA171-5B

SA171-15B

SA171-30B

SA171-41B

EB101909-SO1A3

SA156-0.5B

SA156-10B

SA156-30B

SA156-35B

SA156-45B

SA33-0.5B

SA33009-0.5B

SA33-10B

SA33-20B

Introduction

This data review covers 22 soil samples and one water sample listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample EB101909-SO1A3 was identified as an equipment blank. No isotopic uranium or isotopic thorium was found in this blank.

Samples FB080309-SO (from SDG 234414) and FB082809-SO (from SDG 236238) were identified as field blanks. No isotopic uranium or isotopic thorium was found in these blanks with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB082809-SO	8/28/09	Thorium-228 Uranium-235/236	0.0263 pCi/L 0.00837 pCi/L	SA108-20B SA108-30B SA108-45B SA157-10B SA157-25B SA157-44B SA171-5B SA171-15B SA171-141B SA33-0.5B SA33-0.5B SA33-0.5B SA33-10B SA33-10B SA33-20B SA33-20B

Field Blank ID	Sampling Date	isotope	Concentration	Associated Samples
FB080309-SO	8/3/09	Uranium-238	0.0126 pCi/L	SA156-0.5B SA156-10B SA156-30B SA156-35B SA156-45B

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified with the following exceptions:

Sample	Isotope	Reported Concentration	Modified Final Concentration
SA157-10B	Uranium-235/236	0.0352 pCi/g	0.04U pCi/g

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Isotope	RPD (Limits)	Difference (Limits)	Flag	A or P
SA108-20BDUP (SA108-20B	Thorium-228	20.8 (≤20)	-	J (all detects) UJ (all non-detects)	Α
SA108-30B SA108-45B	Thorium-232	24.6 (≤20)	-	J (all detects) UJ (all non-detects)	
SA157-10B					
SA157-25B					
SA157-44B					
SA171-5B					1
SA171-15B					
SA171-30B					
SA171-41B					
SA33-0.5B SA33009-0.5B					
SA33-10B			1		
SA33-20B					
SA33-33B)					

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Tracer Recovery

All tracer recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
SA108-20B	Thorium-228 Thorium-230	0.146 0.0532	0.05 0.05	None None	P
SA108-30B	Thorium-228 Thorium-230	0.135 0.0735	0.05 0.05	None None	Р
SA108-45B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	0.0917 0.0696 0.0554 0.0645	0.05 0.04 0.04 0.04	None None None None	Р
SA157-10B	Thorium-228 Thorium-230 Uranium-233/234	0.0912 0.0556 0.0477	0.05 0.05 0.04	None None None	Р
SA157-25B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	0.0834 0.0506 0.0559 0.0409 0.0498	0.05 0.05 0.04 0.04 0.04	None None None None	Р
SA157-44B	Thorium-228 Thorium-230 Uranium-233/234	0.197 0.0798 0.0563	0.05 0.05 0.04	None None None	Р
SA171-5B	Thorium-228 Thorium-230	0.127 0.160	0.05 0.05	None None	Р
SA171-15B	Thorium-228 Thorium-230	0.119 0.0885	0.05 0.05	None None	Р
SA171-30B	Thorium-228 Thorium-230	0.0549 0.0865	0.05 0.05	None None	Р
SA171-41B	Thorium-228 Uranium-233/234 Uranium-238	0.103 0.059 0.0403	0.05 0.04 0.04	None None None	Р

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
SA156-0.5B	Thorium-228 Thorium-230 Uranium-238	0.120 0.0857 0.0478	0.05 0.05 0.04	None None None	Р
SA156-10B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	0.168 0.0693 0.0594 0.0469	0.05 0.05 0.04 0.04	None None None None	Р
SA156-30B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	0.117 0.0874 0.0526 0.0432 0.0526	0.05 0.05 0.04 0.04 0.04	None None None None None	Р
SA156-35B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	0.0864 0.0615 0.0631 0.0695 0.0523	0.05 0.05 0.04 0.04 0.04	None None None None None	Р
SA156-45B	Thorium-228 Thorium-230 Uranium-235/236	0.0904 0.059 0.0445	0.05 0.05 0.04	None None None	Р
SA33-0.5B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	0.118 0.0704 0.0487 0.0477	0.05 0.04 0.04 0.04	None None None None	Р
SA33009-0.5B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	0.140 0.0788 0.0407 0.0436	0.05 0.05 0.04 0.04	None None None None	Р
SA33-10B	Thorium-228 Thorium-230	0.140 0.083	0.05 0.05	None None	Р
SA33-20B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	0.145 0.0885 0.0628 0.0484	0.05 0.05 0.04 0.04	None None None None	Р
SA33-33B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	0.140 0.0639 0.050 0.0428	0.05 0.05 0.04 0.04	None None None None	Р

The MDA was greater than the PQL as listed above.

VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 239237	All isotopes reported below the PQL.	J (all detects)	A

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA33-0.5B and SA33009-0.5B were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

:	Concentrat	ion (pCi/g)	555	D:#		
Analyte	SA33-0.5B	SA33009-0.5B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.14	1.53	29 (≤50)	-	-	<u>-</u>
Thorium-230	1.43	0.805	56 (≤50)	-	J (all detects)	Α
Thorium-232	0.911	1.02	11 (≤50)	-	-	-
Uranium-233/234	1.78	1.08	49 (≤50)	-	-	-
Uranium-238	1.50	0.877	52 (≤50)	-	J (all detects)	Α

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 239237

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
239237	SA108-20B SA108-30B SA108-45B SA157-10B SA157-25B SA157-44B SA171-5B SA171-15B SA171-30B SA171-41B SA33-0.5B SA33-0.5B SA33-10B SA33-20B SA33-33B	Thorium-228 Thorium-232	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Duplicate sample analysis (RPD) (Id)
239237	SA108-20B SA108-30B SA171-5B SA171-15B SA171-30B SA33-10B	Thorium-228 Thorium-230	None None	Р	Minimum detectable activity (PQL)
239237	SA108-45B SA33-0.5B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)
239237	SA157-10B SA157-44B	Thorium-228 Thorium-230 Uranium-233/234	None None None	Р	Minimum detectable activity (PQL)
239237	SA157-25B SA156-30B SA156-35B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None None	Р	Minimum detectable activity (PQL)
239237	SA171-41B	Thorium-228 Uranium-233/234 Uranium-238	None None None	Р	Minimum detectable activity (PQL)
239237	SA156-0.5B	Thorium-228 Thorium-230 Uranium-238	None None None	Р	Minimum detectable activity (PQL)
239237	SA156-10B SA33-33B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-238	None None None None	Р	Minimum detectable activity (PQL)

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
239237	SA156-45B	Thorium-228 Thorium-230 Uranium-235/236	None None None	Р	Minimum detectable activity (PQL)
239237	SA33009-0.5B SA33-20B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	None None None None	Р	Minimum detectable activity (PQL)
239237	SA108-20B SA108-30B SA108-45B SA157-10B SA157-25B SA157-44B SA171-5B SA171-15B SA171-30B SA171-41B EB101909-SO1A3 SA156-0.5B SA156-10B SA156-30B SA156-35B SA156-35B SA156-45B SA33-0.5B SA33-0.5B SA33-0.5B SA33-0.5B SA33-0.5B SA33-0.5B	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)
239237	SA33-0.5B SA33009-0.5B	Thorium-230 Uranium-238	J (all detects) J (all detects)	А	Field duplicates (RPD) (fd)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 239237

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Equipment Blank Data Qualification Summary - SDG 239237

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 239237

SDG	Sample	Isotope	Modified Final Concentration	A or P	Code
239237	SA157-10B	Uranium-235/236	0.04U pCi/g	А	bf

Tronox Northgate Henderson

LDC #: 22232B59	VALIDATION COMPLETENESS WORKSHEET	Date: <u>1∂ −∂ 1</u> − 0°
SDG #: 239237	Stage 2B	Page: <u>1_of_1</u>
Laboratory: GEL Laboratori	es LLC	Reviewer: MG
-		2nd Reviewer:

METHOD: Isotopic Uranium (DOE EML HASL-300, U-02-RC Modified), Isotopic Thorium (DOE EML HASL-300, Th-01-RC Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I,	Technical holding times	A	Sampling dates: 10-16-09 through 10-20-09
ila.	Initial calibration	Α	Ü
llb.	Calibration verification	Α	
III.	Blanks	Α	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS/DUP
IVa.	Laboratory control samples	Α	MS/DUA LCS/LCSD
V.	Tracer Recovery	A	
VI.	Minimum Detectable Activity (MDA)	SW	
VII.	Sample result verification	N	
VIII.	Overall assessment of data	A	
IX.	Field duplicates	SW	D= 17+18
X	Field blanks	SW	EB=*11 FB= FB087809-50 (506:736738)

FB= FB080309- SO (SDG: 234414)
D= Duplicate

A = Acceptable Note:

N = Not provided/applicable SW = See worksheet

¥ = ND = No compounds detected

R = Rinsate FB = Field blank TB = Trip blank EB = Equipment blank

Validated Samples:

1	SA108-20B	S	₁₁ 2	EB101909-SO1A3	W	21	0.100	31
2	SA108-30B	1	12	SA156-0.5B	5	22	SA108-20BMS	32
3	SA108-45B		13	SA156-10B		23	SA108-20BDUP	33
4	SA157-10B		14	SA156-30B		24	PB5	34
5	SA157-25B		15	SA156-35B		₂₅ ð	PBW	35
6	SA157-44B		16	SA156-45B		26		36
7	SA171-5B		17	SA33-0.5B		27		37
8	SA171-15B		18	SA33009-0.5B		28		38
9	SA171-30B		19	SA33-10B		29		39
10	SA171-41B	y	20	SA33-20B		30		40

Notes:_	 	 	

LDC #: 33333 BS9 SDG #: 239237

VALIDATION FINDINGS WORKSHEET

2nd Reviewer: Reviewer: MG Page: 1 of

Field Blanks

Were field blanks identified in this SDG?

COVES

METHOD: Radiochemistry (Method: See

Qual: 4 bf

Were target isotopes detected in the field blanks? ON NA NA NA

Field blank type: (circle one) Field Blank) Rinsate / Other: Blank units: PCi/L Associated sample units: pCi/Sampling date: 8-38-09

141017421 Sample Identification Associated Samples:_ 10.0352 Blank Action Limit U-335/336|0.00837 F B 08 3801 50 Th-338 0.0363 Blank ID Analyte R せく

V

Associated sample units: PC:/4 Sampling date: 8-3-09 Blank units: PC:/L

Field blank type: (circle one) (Field Blank) Rinsate / Other:

Analyte

(> RL) 13-16 Sample Identification Associated Samples: ၇ ႗ Blank Action Limit Blank ID

9 Walitied Mere Sample F 8 08 309-50 0.0136 U-338

Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected,

FBLKASC4.35

3389	1337
828666	239
#	#
SO	SDG

VALIDATION FINDINGS WORKSHEET Duplicate Analysis

†, 5.1	ک ا	۷
Lage:	Reviewer:_	2nd Reviewer:

20702 METHOD: Radiochemistry (Method: See

Act = sample activity

 $\delta = 1$ sigma error

Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations. LEVEL IV ONLY:

Y N N/A W

	T	- T	- T	T	T	Т	1	_			T	П	T	1	\neg			7	П		
:	Qualifications	5/U5/A 14	7																		
	Associated Samples	1710 17731	7																		
RPD	-DER (Limits)	30.8 (5 30)																			
	Isotope	866- MT	Tn-332																		
	Matrix	Soil	1																		
	Duplicate ID	23	7																		
1			-		 -	╂	+	+	+-	1-	 	1-	+	1	+	 	 	+-	1	1	1

Comments:_

LDC #: 339337 B59

VALIDATION FINDINGS WORKSHEET

Minimum Detectable Activities

see cover

METHOD: Radiochemistry (Method:_

The following sample MDAs are above the RDL:

Jo 0

Page:

2nd Reviewer:_ Reviewer:

Qualifications None > GAPP POL Finding **D**L Lab 10.146 (PC:/A Lab DL MBA (units) 0.0554 0.0532 0.0735 0.0556 0.0798 0.0696 0.0912 0.0506 0.0477 0.0834 0.0498 0.0917 0.0559 0.0409 0.197 0.0563 10.127 0.135 0.160 (pc:/d) POL QAPP PC RDL (units) 0.05 0.05 0.05 0.04 0.05 0.05 0.05 0.05 0.04 0.05 0.05 0.05 O.04 0.04 0.05 0.05 0.04 0.04 0.04 U-333/334 U-335/336 U-333/234 U-333/334 U-335/336 U-333/234 Th - 230 Th-230 T4-238 8ee-41 Tu-330 8ee - n1 Th - 338 Th-230 T4-228 Tn-230 Th-338 Isotope Th- 238 Tu-230 0-238 U-338 Sample ID 7 7 Comments: 4 3 ノ J

LDC #: 339337859 SDG #: 239237

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page. 2 of 4

Reviewer: 2nd Reviewer:

METHOD: Radiochemistry (Method: SCC Cover

The following sample MDAs are above the RDL:

*	Sample ID	Isotone	QAPP FOL	Late DL		
æ	α	Th-228	(o) (o)	JI_`	Linging	ബ `
	-	022		0.11	LAS DL / WART FOR	None / P
	>	T4-230	0.05	0.0885		
3-	7	Th-338	0.05	0.0549		
	7	Tu-330	0.05	5980.0		
0	01	3ee-41	0.05	0.103		
		U-333/234	0.04	0.059		
	*	0-238	0.04	0.0403		
	6	Th-228	0.05	0.120		
		Tu-330	0.05	0.0857		
	->	U-938	0.04	0.0478		
7	13	Th - 228	200	07/0		
		7 720	, , , ,	001.0		
		029 /20	0.05	0.0693		
		PE 2/ CC 2 - C	0.04	0.0594		
	-\$	U-338	0.04	6940.0		
3	14	Tu-228	0.05	0.117		
		Tn-330	0.05	0.0874		
		U-233/234	40.0	0.0526		
		U-335/236	०,०प	0.0432		
	7	U - 238	↑ ho.o	0.0596	3	
_						
Somments:	;s;					

LDC #: 339337859 SDG #: 239337

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 3 of 4

BG

Reviewer:_ 2nd Reviewer:

METHOD: Radiochemistry (Method: SPE Cover

The following sample MDAs are above the RDL:

#	Sample ID	Isotope	AAPP POL RDL (units)	MADA (units)	Flacina	, in the second
14	15	Th-238		10.0864 (PC:/4	Lat Di	Now / P
		Th-230		0.0615		J
		U-333/334		0.0631		
		U-235/236	h0.04	0.0695		
			0.04	0.0593		
12	9)	14-338	0.05	0.0904		
		Th -330	0.05	0.059		
	>	U-335/236	0.0y	0.0445		
9	1.1	Tr-338	0.05	811.0		
		U-333/334	0.0v	0.0704		
		U-235/236	ho.04	0.0487		
	→	J - 238	40.04	0.0477		
	18	TH-338	0.05	0 140		
			0.05	0.0788		
		U-333/234	0.04	70000		
	->	720/22011	70.0	0.013/		
				90.10		
81	61	Tu-228	0.05	Onio		
	7	TH-230	0.05	0.083		
<u>6</u>	20	Tu-238	0.05	0.148		
		130	0.05	0.0885		
			h0.04	0.0638		
	~		P 40.0	0.0484		
					>	>
comments;						

LDC #: 339337 1259 SDG #: 239237

VALIDATION FINDINGS WORKSHEET

Page: 4 of 4

Reviewer: 2nd Reviewer:

Minimum Detectable Activities

METHOD: Radiochemistry (Method: SEE Cover

The following sample MDAs are above the RDL:

*	Sample ID		RDL (units) MBA (un	La b DL MBA (units)	Finding	Ottoothon
90	٦	14-338	(pc://)	10.140 (PC:/4)	Lab D	None / P
			0.05	0.0639		
			h0.0	0.050		
			0.04	o.0438 ↓	->	
Somments:						

LDC#: 32332 B59 SDG#: 339237

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page: lof | Reviewer: MG 2nd Reviewer:

METHOD: Radio Chemistry (Method: see cover)

N NA

Were field duplicate pairs identified in this SDG?
Were target analytes detected in the field duplicate pairs?

	Concentrat	ion (pCi/g)	(≤50)	(pCi/g)	(pCi/g)	Qualifications
Compound	17	18	RPD	Difference	Limits	(Parent Only)
Th-228	1.14	1.53	29			
Th-230	1.43	0.805	56			J dets/ A fd
Th-232	0.911	1.02	11			
U-233/234	1.78	1.08	49			
U-238	1.50	0.877	52			J dets/ A fd

V:\FIELD DUPLICATES\FD_inorganic\22232B59.wpd

Laboratory Data Consultants, Inc. **Data Validation Report**

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: October 23 through November 2, 2009

LDC Report Date: December 30, 2009

Matrix: Water

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 4

GEL Laboratories, LLC. Laboratory:

Sample Delivery Group (SDG): 239753

Sample Identification

M-141B M-145BMS M-141009B M-145BDUP

PB102309-A3

M-145B

M-139B

M-146B

M-144B

M-138B

M-138009B

M-138BDISS

M-138009BDISS

M-137B

M-137BDISS

M-148B

EB103009-GWA4

M-147B

M-147009B

EB110209-GWA3

PB102309-A3MS

PB102309-A3DUP

Introduction

This data review covers 22 water samples listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Method Blank ID	Isotope	Activity	Associated Samples
PB (prep blank)	Uranium-235/236	0.00895 pCi/L	All samples in SDG 239753

Sample concentrations were compared to concentrations detected in the method blanks as required by the QAPP. No sample data was qualified.

Samples EB103009-GWA4 and EB110209-GWA3 were identified as equipment blanks. No isotopic uranium or isotopic thorium was found in these blanks with the following exceptions:

Equipment Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
EB103009-GWA4	10/30/09	Uranium-233/234	0.0272 pCi/L	No associated samples in this SDG
EB110209-GWA3	11/2/09	Uranium-233/234 Uranium-238	0.067 pCi/L 0.035 pCi/L	M-147B M-147009B

Sample concentrations were compared to concentrations detected in the equipment blanks as required by the QAPP. No sample data was qualified.

Sample FB080409-GW (from SDG 233776) was identified as a field blank. No isotopic uranium or isotopic thorium was found in this blank.

Samples PB100209-A2 (from SDG 237885) and PB102309-A3 were identified as pump blanks. No isotopic uranium or isotopic thorium was found in these blanks.

Sample FiltB092509-A2 (from SDG 237885) was identified as a filter blank. No isotopic uranium or isotopic thorium was found in this blank with the following exceptions:

Filter Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FiltB092509-A2	9/25/09	Thorium-230	0.0112 pCi/L	M-138BDISS M-138009BDISS M-137BDISS

Sample concentrations were compared to concentrations detected in the filter blanks as required by the QAPP. No sample data was qualified.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Tracer Recovery

All tracer recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
M-141B	Thorium-228	0.0638	0.03	None	Р
	Uranium-233/234	0.0887	0.03	None	
	Uranium-235/236	0.0567	0.03	None	Į.
	Uranium-238	0.0571	0.03	None	
	Cranium-230	0.0571	0.03	Notie	
M-141009B	Thorium-228	0.0436	0.03	None	Р
	Thorium-230	0.0322	0.03	None	
	Thorium-232	0.0322	0.03	None	
	Uranium-233/234	0.140	0.03	None	ŀ
	Uranium-235/236	0.0569	0.03	None	
	Uranium-238	0.0973	0.03	None	
					_
PB102309-A3	Thorium-228	0.0322	0.03	None	P
	Uranium-233/234	0.0599	0.03	None	
	Uranium-235/236	0.0371	0.03	None	
	Uranium-238	0.042	0.03	None	
M-145B	Uranium-233/234	0.0384	0.03	None	P
	Uranium-235/236	0.0365	0.03	None	1
	Uranium-238	0.0408	0.03	None	
	Oranium-200	0.0400	0.00	140116	
M-139B	Thorium-228	0.0485	0.03	None	Р
	Uranium-233/234	0.0533	0.03	None	
M-146B	Thorium-228	0.0436	0.03	None	Р
	Uranium-233/234	0.0512	0.03	None	
	Uranium-235/236	0.0366	0.03	None	
	Uranium-238	0.0359	0.03	None	
	Granium-230	0.0039	0.00	None	
M-144B	Thorium-228	0.0329	0.03	None	Р
	Uranium-233/234	0.0414	0.03	None	1
	Uranium-235/236	0.0481	0.03	None	
M-138B	Uranium-233/234	0.0434	0.03	None	Р
	<u> </u>			-	<u> </u>
M-138009B	Uranium-233/234	0.0436	0.03	None	P
	Uranium-235/236	0.0467	0.03	None	
	Uranium-238	0.0377	0.03	None	
M-138BDISS	Uranium-233/234	0.0507	0.03	None	P
	Uranium-238	0.0507	0.03	None	
M-138009BDISS	Thorium-228	0.039	0.03	None	P
	Uranium-233/234	0.0728	0.03	None	1
	Uranium-235/236	0.0468	0.03	None	
	Uranium-238	0.0302	0.03	None	
M 127D	Therium 000	0.0204	0.02	Ala	
M-137B	Thorium-228	0.0394	0.03	None	Р
	Uranium-233/234	0.0359	0.03	None	1
	Uranium-238	0.0323	0.03	None	1

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
M-137BDISS	Thorium-228 Uranium-235/236 Uranium-238	0.033 0.038 0.0462	0.03 0.03 0.03	None None None	P
M-147B	Uranium-233/234	0.0398	0.03	None	Р
M-147009B	Uranium-233/234 Uranium-235/236	0.044 0.0311	0.03 0.03	None None	Р
EB110209-GWA3	Uranium-238	0.0307	0.03	None	Р

The MDA was greater than the PQL as listed above.

VI. Sample Result Verification and Project Quantitation Limit

All sample result verifications were acceptable.

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 239753	All isotopes reported below the PQL.	J (all detects)	Α

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples M-141B and M-141009B, samples M-138B and M-138009B, samples M-138BDISS and M-138009BDISS, and samples M-147B and M-147009B were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

	Concentra	tion (pCi/L)	RPD	D:#*			
Analyte	M-141B M-141009B		(Limits)	Difference (Limits)	Flags	A or P	
Uranium-233/234	ium-233/234 76.5 75.1		2 (≤30)	-	-	-	
Uranium-235/236	235/236 2.85 2.95		3 (≤30)	-	-	-	

	Concentrat	ion (pCi/L)		D.14		A or P	
Analyte	M-141B	M-141009B	RPD (Limits)	Difference (Limits)	Flags		
Uranium-238 49.2		50.7	3 (≤30)	•	-	-	

	Concentration (pCi/L)			D.111		
Analyte	M-138B	M-138009B	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-230	0.0327	0.00817U	-	0.02453 (≤0.03)	-	-
Thorium-232	0.019	0.0131U	-	0.0059(≤0.03)	-	-
Uranium-233/234	40.9	41.6	2 (≤30)	-	-	-
Uranium-235/236	1.20	1.53	24 (≤30)	-	-	_
Uranium-238	20.7	20.9	1 (≤30)	-	-	-

	Concentration (pCi/L)		222	514			
Analyte	M-138BDISS M-138009BDISS		RPD (Limits)	Difference (Limits)	Flags	A or P	
Uranium-233/234	39.1	38.5	2 (≤30)	-	-	-	
Uranium-235/236	1.03	1.10	7 (≤30)	-	-	-	
Uranium-238	19.5 19.2		2 (≤30)	-	-	-	

	Concentration (pCi/L)			Diff		
Analyte	M-147B M-147009B		RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	0.017	0.00564U	-	0.01136 (≤0.03)	-	•
Uranium-233/234	26.1	26.2	0 (≤30)	-	-	-
Uranium-235/236	1.09	1.07	2 (≤30)	-	-	-
Uranium-238	19.6	19.6	0 (≤30)	-	-	

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 239753

					Bassar (O. da)	
SDG	Sample	Isotope	Flag	A or P	Reason (Code)	
239753	M-141B PB102309-A3 M-146B M-138009BDISS	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity	
239753	M-141009B	Thorium-228 Thorium-230 Thorium-232 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None None	P	Minimum detectable activity	
239753	M-145B M-138009B	Uranium-233/234 Uranium-235/236 Uranium-238	None None None	Р	Minimum detectable activity	
239753	M-139B	Thorium-228 Uranium-233/234	None None	Р	Minimum detectable activity	
239753	M-144B	Thorium-228 Uranium-233/234 Uranium-235/236	None None None	Р	Minimum detectable activity	
239753	M-138B M-147B	Uranium-233/234	None	Р	Minimum detectable activity	
239753	M-138BDISS	Uranium-233/234 Uranium-238	None None	Р	Minimum detectable activity	
239753	M-137B	Thorium-228 Uranium-233/234 Uranium-238	None None None	Р	Minimum detectable activity	
239753	M-137BDISS	Thorium-228 Uranium-235/236 Uranium-238	None None None	Р	Minimum detectable activity	
239753	M-147009B	Uranium-233/234 Uranium-235/236	None None	Р	Minimum detectable activity	
239753	EB110209-GWA3	Uranium-238	None	Р	Minimum detectable activity	

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
239753	M-141B M-141009B PB102309-A3 M-145B M-139B M-146B M-144B M-138B M-138009B M-1388DISS M-138009BDISS M-137B M-137BDISS M-148B EB103009-GWA4 M-147B M-147009B EB110209-GWA3	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 239753

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Equipment Blank Data Qualification Summary - SDG 239753

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 239753

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Pump Blank Data Qualification Summary - SDG 239753

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Filter Blank Data Qualification Summary - SDG 239753

No Sample Data Qualified in this SDG

Tronox Northgate Henderson VALIDATION COMPLETENESS WORKSHEET

.DC #	‡: <u>239753</u>	_	VALIDATION COMPLETENESS WORKSHEET Stage 2B 니							Date: <u>12 - 31 -</u> 09 Page: <u> </u> _of_		
_abora	atory: <u>GEL Laboratories</u>	LLC			an t					Reviewer: MG 2nd Reviewer:		
∕lodifi The sa	ed)	e revie						·		EML HASL-300, Th-01-RC dings are noted in attached		
	Validation	Area						Comr	nents			
l.	Technical holding times			Α	Sam	pling d	ates: 10- 2	3-09	thr	ough 11-2-09		
IIa.	Initial calibration			A		.				T		
IIb.	Calibration verification			A				,				
10.	Blanks			SW								
IVa.	Matrix Spike/(Matrix Spike)	Duplica	ates	Α	M	5/	DUP					
IVa.	Laboratory control samples			Α	L	cs						
V.	Tracer Recovery			A				•				
VI.	Minimum Detectable Activit	y (MDA	٨)	SW								
VII.	Sample result verification			AN								
VIII.	Overall assessment of data	<u> </u>		Α								
IX.	Field duplicates			SW	_	= +	2 D=8	+9 D:	= 10 -	+11 D=16+17		
Х	Field blanks			SW	Pun	7	ink=*3,*	PB 1008	209-	A2 (506. 237885)		
lote:	A = Acceptable N = Not provided/applicable SW = See worksheet	e	₩ # ND = N R = Rir FB = Fi	lo compound sate leid blank	(cted	TB = Tri	p blank	nk	Fil+ B 092509- A2 (506: 237		
/alidat	ed Samples: <u>all</u> Water		·			. 6 -	"FBO86	1409-6	÷W	(sog: 233776)		
1	M-141B	11	M-138009BD	oiss		21	M-145BMS	ч	31			
2	M-141009B	12	M-137B			22	M-145BDUP	ч	32			
3	PB102309-A3	13	M-137BDISS	<u> </u>		23	PBW		33			
4	M-145B	14	Ч М-1 3 8В	Ч М-1 3 8В 9 М					34			
5	M-139B	15	EB103009-GWA4			25		_	35			
6	M-146B	16	M -147B			26			36			
7	M-144B	17	M-147009B			27			37			
8	M-138B	18	EB110209-G			28			38			
9	M-138009B	19	PB102309-A	3MS	Tu ——	29			39			
10	M-138BDISS	20	PB102309-A	3DUP	Tu	30	:		40			

LDC #: 22232C59 SDG #: 239753 Page: 1 of 2 Reviewer: MG 2nd Reviewer: 1

Method: Radiochemistry (EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	/			
II. Calibration				
Were all instruments and detectors calibration as required?	1			
Were NIST traceable standards used for all calibrations?	/			
Was the check source identified by activity and radionuclide?	/			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	V			
III, Blanks				
Were blank analyses performed as required?	✓			
Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see the Blanks validation completeness worksheet.	/			
IV. Matrix spikes and Duplicates				
Were a matrix spike (MS) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	/			
Were the MS percent recoveries (%R) within the QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	\			
Was a duplicate sample anaylzed at the required frequency of 5% in this SDG?	V			
Were all duplicate sample duplicate error rations (DER) ≤1.42?.	/			
Y. Laboratory control samples				
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	<u> </u>			
VI. Sample Cherrycal/Carrier Recovery				
Was a tracer/carrier added to each sample?	\checkmark			
Were tracer/carrier recoveries within the QC limits?	<u> </u>			
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		/]	
Were the performance evaluation (PE) samples within the acceptance limits?				
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
Were the Minimum Detectable Activities (MDA) < RL?		<u> </u>	<u></u>	

LDC #: 22732 C59 SDG #: 239753

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: MG
2nd Reviewer: V

Validation Area	Yes	No	NA	Findings/Comments
IX Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			
X. Field duplicates				
Field duplicate pairs were identified in this SDG.	/			ı
Target analytes were detected in the field duplicates.	/			
XI. Field blanks				
Field blanks were identified in this SDG.				
Target analytes were detected in the field blanks.				

3333259 339753 SDG #: LDC #:_

VALIDATION FINDINGS WORKSHEET Blanks

Page: 1 of 1 Reviewer: 2nd Reviewer:

METHOD: Radiochemistry (Method: Sec Cover

QN N/A

Were blank analyses performed as required? If no, please see qualifications below. Were any activities detected in the blanks greater than the minimum detectable activity (MDA)? If yes, please see qualifications below.

(> RL OV ND.

Units:

	Units:	ا / ٦		Associated Samples: All (7 RL or ND.)	1	
	sotope	Blank ID	Blank	Sample Identification		
		PBW	Level	NO Samoles		
78	0-335/336	0.00895				
===						7
-						
						T
ر	Units:			Accominated Committee.		7
<u></u>				Associated Sattiples:		
	Isotope	Blank iD	Blank	Sample Identification		H .
			Level			
-						T
1						
ᆚ.						T
=						7

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT: If there is activity in the blank above the MDA, sample results within 10x the blank activity will be qualified as not detected "U".

LDC #: 3333C59 239753 SDG #:_

VALIDATION FINDINGS WORKSHEET

Field Blanks

₫ 2nd Reviewer: Page: Reviewer:

> see cover METHOD: Radiochemistry (Method:__

Were field blanks identified in this SDG? ON NA NA NA

Wore target isotopes detected in the field blanks?

Blank units: Pci/L Associated sample units: Pci/L
Sampling date: 9-25-09

Field blank type: (circle one) Field Blank / Rinsate /Other) Filter Blank

Ru Th-330 0.011 a Samples were qualitied S

Blank units: PC: /L Associated sample units: PC: /L Sampling date: 10-30-09

EB Field blank type: (circle one) Field Blank / Rinsate (Other:

None Sample Identification Associated Samples:____ Blank Action Blank ID Analyte

	T	7	7		T		T	-		-	T		T		76
															rusted field blank concentration are listed above, these sample results were qualified as not detected
	╟	1	t		\dagger		\dagger				\dagger		†		as not
															alffied a
	-	\star			\mid	•	\dagger		1	 			\dagger		ere que
	٠	<u>,</u>													ults w
	<u> </u>	1: /:			-				\dagger		 		\dagger		ple res
	,	were gaali fied													e sam
	-	y					-		T				-		e, thes
	9	2													dabov
		ري								1					e liste
	2														tion ar
	No	,													centra
	Ž						-								TK COT
	١									T					eid Dia
					-									7	
														100000	associ E
_														Se tho	
														Ja film	
	1													Iffin fi	
	E E						-					Ī		w suoi	
-	<u> </u>					L	-							entra	
١,	7		272											e con	
			0.0	_										isotop	•
		\	3/234											s with	
			Kr U-333/334 0.0272							.*	į			Samples with isotope concentrations within five firmes the	<u>.</u>
₩.	التتو		٠, ۲							 -		<u></u>		ĸ	پ

3333659 239753 SDG #: LDC #:

VALIDATION FINDINGS WORKSHEET

Field Blanks

Page: of 2nd Reviewer: Reviewer:

METHOD: Radiochemistry (Method: See cove

Were field blanks identified in this SDG? ON NA NA NA

More target isotopes detected in the field blanks?

Blank units: PC: /L Associated sample units: PC: /L

Sampling date: 11-3-09

CR Field blank type: (circle one) Field Blank / Rinsate Cother)

1.0. 1. 31</th <th>(×2×)</th> <th></th> <th></th> <th>f.jed +</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	(×2×)			f.jed +									
& B Associated Samples:		Sample Identification	No Campio	Samples Went qual: fied									
The control of the diality / ninsale (Other)	Blank	Action	- E		0.67		0.35					-7:-	
ادم: (ماا ماد ما	Blank ID		8)		0.067	1	0.035			-	-		
	Analyte			. 022/2	-KL U-353/334 0.067 0.67	2000	14 0-030 0.035 0.35						
				•	•	,	•						

Associated sample units: Blank units:

Sampling date: Field blank type: (circle one) Field Blank / Rinsate / Other:

Associated Samples: Blank Blank ID Analyte

Action Limit	Sample Identification								nin live times the associated field blank concentration are listed above these	income and the search of the s
Samples with isotope conce	Action							l sactorius	ei iti atiolis W	
Samples with "U".					-,-			Solone Conce	Sollon adams	
								Samples with is	-	

DC #: 3233C59 239753 DG #:

VALIDATION FINDINGS WORKSHEET

Page: 1 of 3

MG

Minimum Detectable Activities

COVEN

See

IETHOD: Radiochemistry (Method:___

he following sample MDAs are above the RDL:

#	Sample ID	Isotope	AAPP POL Late DL RDL (units) MBA (units	Lab DL MBA (units)	raile in	
-		98	10.03 (00:/1	10.0638 (PCi/)	17	≌II `
] 4		0 0007	י אם אר ה	None/F
				0.0687		
	->	11-228		0.038/		
				0.05 (1		
7	2	Tu-238		0.0436		
	_	Tr 220		05150		
		Th - 22.0		0.0398		
		U-333/334		2.00		
		U - 235/236		0.0569		
	*	U-238		0.0973		
3	3	Tu-228		0.0322		
		U - 233/234		0.0549		
		4-326/326		22.5		
		. 1 ~		0.0371		
				0.049		
	10					
	7	√ J		0.0384		
		U- 235/236		0.0365		
	-	U-938		0.0408		
0	-	866-41		0.0485		
	->	U-333/334		0.0533		
,						
9	6	- 1		0,0436		
		\sim 1		0.0513		
		0 - 335/936		0.0366		
	7	J 0 - 338	7	0.0359		
omments:						•

LDC #: 72332C59 SDG #: 239753

VALIDATION FINDINGS WORKSHEET Winimum Detectable Activities

Page: 2 of 3

See cover

METHOD: Radiochemistry (Method: SCC Co The following sample MDAs are above the RDL:

*	Sample ID	Sotone	WAPP POL	u		
٢	7	3.7 H	HDL (units)	MDA (units)	Finding	
		800-41	0.03 (pc;/L)	0.0329 (PC:/) 121 D	80 40	Qualifications
		U-333/33H		0 04111	- 1	None / P
	•	U-335/936		5 0 0 0		
B	Ø			1012:3		
	0	U-933/934				
0				0.0434		
,-	0	11 332 /22				
		HS 0/500 - 0		0.0436		
		0-235/236		17TO 0		
		U-238		0.0277		
9				200		
	01	0-232/124				
	7	11-720		0.0507		
		0-0-0		0.0507		
_						
		Tu-238		0.0		
		0-333/334		0.034		
		U-326 /221	2	0.0738		
	~	- 1	2	0.0468		
		057-0	9	0.0303		
5						
6	(2)	Tu-238				
		()- 322 / 32.11	9	0.0394		
	->	1 230	0	0.0359	+	
		0.00	0	0.0333		
13	-13	100 H				
			0	.033		
		U-455/236	0	030		
	•	U-238	5	C 7700 0		
3			5	768		
-	9	U-233/234	+			
			Ċ	0.0348		
Ommenter						•
CHILLIANS.						

2233C59 239753 LDC #: SDG #:

VALIDATION FINDINGS WORKSHEET

Minimum Detectable Activities

Cover

See

METHOD: Radiochemistry (Method:__

Page: 3 of 3 Reviewer: 2nd Reviewer:

The following sample MDAs are above the RDL:

#	Sample ID	- Cardon	QAPP POL	700		
15	[7]	edoss:	RDL (units)	MDA (units)		
		0-233/334	0.03 (pc:/L)	0.044 (PC:/	All Control of the Co	┸
	***************************************	U-235/236	-	0.0311	Lab DL > GAPP POL	None
9	0					
	0	0-238		0.0307		
						->
1						
+						
Ommonte.						

LDC#: 22232C59 SDG#: 239753

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page: 1 of 2
Reviewer: MG
2nd Reviewer:

METHOD: Radio Chemistry (Method: see cover)

MN NA MN NA Were field duplicate pairs identified in this SDG? Were target analytes detected in the field duplicate pairs?

	Concentrati	on (pCi/L)	(≤30)	(pCi/L)	(pCi/L)	Qualifications
Compound	1	2	RPD	Difference	Limits	(Parent Only)
U-233/234	76.5	75.1	2			
U-235/236	2.85	2.95	3			
U-238	49.2	50.7	3			

V:\FIELD DUPLICATES\FD_inorganic\22232C59.wpd

	Concentra	tion (pCi/L)	(≤30)	(pCi/L)	(pCi/L)	Qualifications
Compound	8	9	RPD	Difference	Limits	(Parent Only)
Th-280 230	0.0327	0.00817U		0.02453	(<0.03)	
Th-232	0.019	0.0131U		0.0059	(≤0.03)	
U-233/234	40.9	41.6	2			
U-235/236	1.20	1.53	24			
U-238	20.7	20.9	1			

V:\FIELD DUPLICATES\FD_inorganic\22232C59.wpd

	Concentrati	on (pCi/L)	(≤30)	(pCi/L)	(pCi/L)	Qualifications
Compound	10	11	RPD	Difference	Limits	(Parent Only)
U-233/234	39.1	38.5	2			
U-235/236	1.03	1.10	7			
U-238	19.5	19.2	2			

V:\FIELD DUPLICATES\FD_inorganic\22232C59.wpd

	Concentrat	ion (pCi/L)	(≤30)	(pCi/L)	(pCi/L)	Qualifications
Compound	16	17	RPD	Difference	Limits	(Parent Only)
Th-228	0.017	0.00564U		0.01136	(≤0.03)	

LDC#: 20032C59 SDG#: 039753

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

	Page:_	<u> 2</u> of <u>2</u>	<u> </u>
	Reviewer:	M	_
2nd	Reviewer:		

METHOD: Metals (EPA Method 6010B/6020/7000)

NA NA

Were field duplicate pairs identified in this SDG? Were target analytes detected in the field duplicate pairs?

	Concentrati	on (pCi/L)	(≤30)	(pCi/L)	(pCi/L)	Qualifications
Compound	16	17	RPD	Difference	Limits	(Parent Only)
U-233/234	26.1	26.2	0			
U-235/236	1.09	1.07	2			
U-238	19.6	19.6	0			

V:\FIELD DUPLICATES\FD_inorganic\22232C59.wpd

LDC #: 32332C59 SDG #: 339753

VALIDATION FINDINGS WORKSHEET **Level IV Recalculation Worksheet**

Page: / of 3 Reviewer: 2nd Reviewer:

, '·

See cover METHOD: Radiochemistry (Method:__ Percent recoveries (%R) for a laboratory control sample, a matrix spike and a matrix spike duplicate sample were recaluculated using the following formula:

%R = Found x 100

Where, Found = activity of each analyte measured in the analysis of the sample. True = activity of each analyte in the source.

A matrix spike and matrix spike duplicate relative percent difference (RPD) was recalculated using the following formula:

RPD = $\frac{|S-D|}{(S+D)/2} \times 100$

Where,

S = Original sample activity D = Duplicate sample activity

					Recalculated	Reported	
Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	%R or RPD	%R or RPD	Acceptable (Y/N)
	Laboratory control sample						
507		Tu-330	3.11 (pci/L)	11 (pci/L) 3.68 (pci/L)	78.7	78.7	7
	Matrix spike sample						
61		T4-230	3.22 (pci/)	3.22 (pci/) 3.68 (pci/)	83.8	82.9	
	Duplicate RPD						
32		0- 335/336	0.702 (PCi,) 0.635 (PCi,)	0.635 (PCi/)	10.02	4.99	
	Chemical recovery		,	,		1	
		U-332	3.12198 (dpm)	198 (dpm) 5.053% (dpm)	59.4	59.4	→

Comments: Refer to appropriate worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

.......

LDC #: <u>22232C59</u> SDG #: <u>23975</u>3

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	of1
Reviewer:_	MG
2nd reviewer:	1

METHOD: Radiochemistry (Method: See cover	2nd reviewer:
Y/N N/A Have results	low for all questions answered "N". It been reported and calculated correlations the calibrated range of the ins	
Analyte results forand verified using the follow	井! U-238 ing equation:	reported with a positive detect were recalculated
Activity =	Recalculation:	
(cpm - bckgrd cpm) (2.22)(E)(Vol)(CF)	(13212.0/1000.0)	
E = Efficiency Vol = Volume CF = %R, Self-absorbance, abunda	(0.254206)(0.800 L)(0.59	= 49.224 pCi/

#	Sample ID	Analyte	Reported Concentration (PC / L)	Calculated Concentration (PC; / L)	Acceptable (Y/N)
1		U-233/234	76.5	76.5	Y
		U-235/236	2.85	2.85	1
		U- 738	49. 2	49.2	
2	11	U - 233/234	38.5	38.5	
		U-235/236	1.10	1.10	
		U- 238	19.2	19.2	
					·

Note:	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: November 5, 2009

LDC Report Date: December 31, 2009

Matrix: Soil

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 240560

Sample Identification

SA77-0.5B SA77-10B SA77009-10B SA77-10BMS SA77-10BDUP

Introduction

This data review covers 5 soil samples listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA) with the following exceptions:

Method Blank ID	Isotope	Activity	Associated Samples
PBS (prep blank)	Thorium-232	0.0262 pCi/g	All samples in SDG 240560

Sample concentrations were compared to concentrations detected in the method blanks as required by the QAPP. No sample data was qualified.

Sample FB082809-SO (from SDG 236238) was identified as a field blank. No isotopic uranium or isotopic thorium was found in this blank with the following exceptions:

Field Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FB082809-SO	8/28/09	Thorium-228 Uranium-235/236	0.0263 pCi/L 0.00837 pCi/L	All samples in SDG 240560

Sample concentrations were compared to concentrations detected in the field blanks as required by the QAPP. No sample data was qualified.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Isotope	RPD (Limits)	Difference (Limits)	Flag	A or P
SA77-10BDUP (All samples in SDG 240560)	Thorium-230	28.9 (≤20)	-	J (all detects) UJ (all non-detects)	A

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Tracer Recovery

All tracer recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/g)	PQL (pCi/g)	Flag	A or P
SA77-0.5B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	0.161 0.0696 0.0617 0.0441	0.05 0.05 0.04 0.04	None None None None	Р
SA77-10B	Thorium-228 Thorium-230	0.109 0.0999	0.05 0.05	None None	Р
SA77009-10B	Thorium-228 Thorium-230 Uranium-233/234	0.120 0.0694 0.0467	0.05 0.05 0.04	None None None	Р

The MDA was greater than the PQL as listed above.

VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 240560	All isotopes reported below the PQL.	J (all detects)	A

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

Samples SA77-10B and SA77009-10B were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

!	Concentration (pCi/g)					
Analyte	SA77-10B	SA77009-10B	(Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.60	1.68	5 (≤50)	-	-	-
Thorium-230	0.791	1.16	38 (≤50)	-	-	-
Thorium-232	1.27	1.49	16 (≤50)	-	-	-
Uranium-233/234	1.35	1.44	6 (≤50)	-	-	-
Uranium-235/236	0.059	0.0862	-	0.0272 (≤0.04)	-	-
Uranium-238	1.07	1.17	9 (≤50)	-	-	-

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 240560

SDG	Sample	Isotope	Flag	A or P	Reason (Code)		
240560	SA77-0.5B SA77-10B SA77009-10B	Thorium-230	J (all detects) UJ (all non-detects)	А	Duplicate sample analysis (RPD) (ld)		
240560	SA77-0.5B	Thorium-228 Thorium-230 Uranium-233/234 Uranium-235/236	rium-230 None nium-233/234 None nium-235/236 None				
240560	SA77-10B	Thorium-228 Thorium-230	None None	Р	Minimum detectable activity (PQL)		
240560	SA77009-10B	Thorium-228 Thorium-230 Uranium-233/234	None None None	Р	Minimum detectable activity (PQL)		
240560	SA77-0.5B SA77-10B SA77009-10B	All isotopes reported below the PQL.	J (all detects)	A	Sample result verification (PQL) (sp)		

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 240560

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 240560

No Sample Data Qualified in this SDG

SDG#:	22232D59 240560 tory: GEL Laboratories					NESS	derson WORKSHEET	•	Date: 12-22-0 Page: _L of _L Reviewer: _MG 2nd Reviewer:
Modifie The sa	d)	e revie							EML HASL-300, Th-01-RC dings are noted in attached
	Validation	Area					Comr	nents	
l.	Technical holding times			Α	Sampling	dates:	11-5-09		
lla.	Initial calibration			A					
lib.	Calibration verification			Α					
III.	Blanks			SW					
IVa.	Matrix Spike/(Matrix Spike)	Duplica	tes	SW	MS/	AUD'			
IVa.	Laboratory control samples		Α	LCS					
V.	Tracer Recovery			Α					
VI.	Minimum Detectable Activit	v (MDA)	sw					
VII.	Sample result verification	, (/	N					
VIII.	Overall assessment of data			Α				-	
IX.	Field duplicates			SW	D= 2	+3			
x	Field blanks			SW	FB=	FE	3087809-50	(SDG: 236238)
vote:	A = Acceptable N = Not provided/applicable SW = See worksheet	е	R = Rin	io compound sate leld blank	s detected	d	D = Duplicate TB = Trip blank EB = Equipment bla	nk	
/alidate	d Samples								
1 5	SA77-0.5B	11			21			31	
2 5	SA77-10B	12			22			32	
3 5	SA77009-10B	13			23			33	
4 5	SA77-10BMS 4 Th	14		14 ·	24			34	
5 5	SA77-10BDUP U TH	15			25	5		35	
6	PBS	16			26	,		36	
7		17			27	,]		37	

38

39

40

 8
 18
 28

 9
 19
 29

 10
 20
 30

Notes:

LDC #: 2233059 34056U SDG #:

VALIDATION FINDINGS WORKSHEET Blanks

see cover

Page: Lof 1 Reviewer:_

MG 2nd Reviewer:_

>																			Ī
s belov	-																		
ications																			
: qualif				-	_														_
olease see			7	5									:						
) 17 If no, please see qualifications below. greater than the minimum detectable activity (MDA)? If yes, please see qualifications below.			and Lie																
:y (MDA)		ation	ı								won								
w. activii		dentifica	Mario								nemice								
ons belc tectable	: :	Sample Identification	3						,	Comple	Sample Identification								İ
ualificati mum de	RL)		Glows																
see qu ne mini	(> RL)			<u> </u>										_					
o, please er than th	911		3/																
ired? If n ks greate	ples:								ples:										
is requ	d Sam		-						 d Sam		-	\dashv	1	-				_	
see cover arformed as re ected in the b	Associated Samples:								Associated Samples:										
o to	1	Blank	Level						†	Blank	Action								
istry (M blank ar any acti				63			+			<u> </u>		+	+	+	+	+	-	-	
Jiochem Were I	pc.b	Blank ID	PBS	6.0367						Blank ID									
METHOD: Radiochemistry (Method: YN N/A Were blank analyses YN N/A Were any activities d	Units:	Isotope		T4-232					Units:	Isotope									
	<u>ا</u> ا			Ja,		 بلجد		<u>l_</u>	 ⊃[J. S. S. S.	<u> </u>							

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT: If there is activity in the blank above the MDA, sample results within 10x the blank activity will be qualified as not detected "U".

LDC #: 33332D59 SDG #: 240560

VALIDATION FINDINGS WORKSHEET Field Blanks

Reviewer: MS 2nd Reviewer: Page: / of

> COVES METHOD: Radiochemistry (Method: See

Were target isotopes detected in the field blanks? Were field blanks identified in this SDG? ON NA NA NA

Blank units: PCi/L Associated sample units: pCi

Field blank type: (circle one) Field Blanky Rinsate / Other:

> RL OV ND samples were qualitied <u>a</u> Sample Identification Associated Samples: 200 Blank Actlon Limit U-335/336 0.00837 FE 08 280150 Re T4-338 10.0363 Blank iD Analyte 7d >

٧

Associated sample units: Blank units:

Sampling date: Field blank type: (circle one) Field Blank / Rinsate / Other:

Sample Identification Associated Samples: Blank Action Limit Blank ID Analyte

Samples with isotope concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected "U".

Version 1 0 (3/2/2000)

LDC #: 33332059 SDG #: 340560

VALIDATION FINDINGS WORKSHEET Duplicate Analysis

2nd Reviewer:_ Reviewer:__ Page:__

METHOD: Radiochemistry (Method: See Cover

Act = sample activity $\delta = 1$ sigma error

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

7	G 275.9	2	00000	RPD DEB (limits)	Associated Samples	Qualifications
‡ -	Duplicate 10	Matrix	76-930	289 (4.20)		J/UJ/A 14
		5		1		
<u> </u>						
<u></u>						
So	Comments:					

LDC #: 3333D59 SDG #: 340560

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1 Reviewer: MG

2nd Reviewer:

Cover

See

METHOD: Radiochemistry (Method:_

The following sample MDAs are above the RDL:

Minimum Detectable Activities

Qualifications None > GAPP POL Finding 2 Lab Lab DL MBA (units) 0.0696 0.0467 0.044 1 0.0999 0.0694 0.130 0.05 (pc;/4) 0.161 0.109 QAPP POL RDL (units) 0.0H 0.05 0.05 0.0H 0.05 Th- 228 Th -230 U-233/234 0-335/336 U-233/234 Tu-338 TH-238 Tu-230 Tu-230 Isotope Sample ID 160 4 * 7 3

NETI MAIT SE

Comments:

LDC#: 27732D59 SDG#: 240560_

VALIDATION FINDINGS WORKSHEET <u>Field Duplicates</u>

Page: I of I
Reviewer: MG
2nd Reviewer: V

METHOD: Radio Chemistry (Method: see cover)

YN NA YN NA Were field duplicate pairs identified in this SDG?
Were target analytes detected in the field duplicate pairs?

	Concentra	tion (pCi/g)	(≤50)	(pCi/g)	(pCi/g)	Qualifications
Compound	2	3	RPD	Difference	Limits	(Parent Only)
Th-228	1.60	1.68	5			
Th-230	0.791	1.16	38			
Th-232	1.27	1.49	16			1
U-233/234	1.35	1.44	6			
U-235/236	0.059	0.0862		0.0272	(<0.04)	
U-238	1.07	1.17	9		_ ", .	

V:\FIELD DUPLICATES\FD_inorganic\22232D59.wpd

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Tronox LLC Facility, 2009 Phase B Investigation,

Henderson, Nevada

Collection Date: November 11, 2009

LDC Report Date: December 31, 2009

Matrix: Water

Parameters: Isotopic Uranium & Isotopic Thorium

Validation Level: Stage 2B

Laboratory: GEL Laboratories, LLC.

Sample Delivery Group (SDG): 240965

Sample Identification

M-122B

M-122BDISS

M-122BMS

M-122BDUP

M-122BDISSMS

M-122BDISSDUP

Introduction

This data review covers 6 water samples listed on the cover sheet. The analyses were per DOE EML HASL-300 Method and U-02-RC Method modified for Isotopic Uranium and DOE EML HASL-300 Method and Th-01-RC Method modified for Isotopic Thorium.

This review follows the Standard Operating Procedures (SOP) 40, Data Review/Validation (BRC 2009), the Quality Assurance Project Plan Tronox LLC Facility, Henderson, Nevada (June 2009), NDEP guidance (May 2006), and the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) as there are no current guidelines for the method stated above.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section III.

Field duplicates are summarized in Section VIII.

Raw data were not reviewed for this SDG. The review was based on QC data.

The following are definitions of the data qualifiers:

- J+ Data are qualified as estimated, with a high bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J- Data are qualified as estimated, with a low bias likely to occur. False positives or false negatives are unlikely to have been reported.
- J Data are qualified as estimated; it is not possible to assess the direction of the potential bias. False positives or false negatives are unlikely to have been reported.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- R Data are qualified as rejected. There is a significant potential for the reporting of false negatives or false positives.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- B The analytical result may be a false positive totally attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JB The analytical result may be biased high and partially attributable to blank contamination. This qualifier is applicable to radiochemistry analysis only.
- JK The analytical result is an estimated maximum possible concentration (EMPC).
- X The analytical result is not used for reporting because a more accurate and precise result is reported in its place.
- J-TDS The analytical result is estimated based on failure of the Total Dissolved Solids (TDS) correctness check performed in accordance with the Standard Method 1030E.
- J-CAB The analytical result is estimated based on failure of the cation-anion balance correctness check performed in accordance with Standard Method 1030E.
- J-TDS & CAB The analytical result is unreliable based on the failure of the cation-anion balance and TDS correctness check performed in accordance with standard Method 1030E.
- A Indicates the finding is based upon technical validation criteria.
- P Indicates the finding is related to a protocol/contractual deviation.
- None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. Calibration

a. Initial Calibration

All criteria for the initial calibration were met.

Detector efficiency was determined for each radionuclide of interest.

b. Continuing Calibration

Calibration verification and background determination were performed at the required frequencies. Results were within control limits.

III. Blanks

Method blanks were reviewed for each matrix as applicable. Blank results contained less than the minimum detectable activity (MDA).

Sample PB102309-A3 (from SDG 239753) was identified as a pump blank. No isotopic uranium or isotopic thorium was found in this blank.

Sample FiltB092509-A2 (from SDG 237885) was identified as a filter blank. No isotopic uranium or isotopic thorium was found in this blank with the following exceptions:

Filter Blank ID	Sampling Date	Isotope	Concentration	Associated Samples
FiltB092509-A2	9/25/09	Thorium-230	0.0112 pCi/L	M-122BDISS

Sample concentrations were compared to concentrations detected in the filter blanks as required by the QAPP. No sample data was qualified.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

Duplicate (DUP) sample analyses were reviewed for each matrix as applicable. Results were within QC limits.

b. Laboratory Control Samples

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits.

c. Tracer Recovery

All tracer recoveries were within validation criteria.

V. Minimum Detectable Activity (MDA)

All minimum detectable activities met required PQLs with the following exceptions:

Sample	Isotope	Lab DL (pCi/L)	PQL (pCi/L)	Flag	A or P
M-122B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	0.0369 0.091 0.0743 0.0521	0.03 0.03 0.03 0.03	None None None None	Р
M-122BDISS	Thorium-228 Uranium-233/234	0.0481 0.0394	0.03 0.03	None None	Р

The MDA was greater than the PQL as listed above.

VI. Sample Result Verification and Project Quantitation Limit

All isotopes reported below the PQL were qualified as follows:

Sample	Finding	Flag	A or P
All samples in SDG 240965	All isotopes reported below the PQL.	J (all detects)	Α

Raw data were not reviewed for this SDG.

VII. Overall Assessment of Data

Data flags are summarized at the end of this report if data has been qualified.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 240965

SDG	Sample	Isotope	Flag	A or P	Reason (Code)
240965	M-122B	Thorium-228 Uranium-233/234 Uranium-235/236 Uranium-238	None None None None	Р	Minimum detectable activity
240965	M-122BDISS	Thorium-228 Uranium-233/234	None None	Р	Minimum detectable activity
240965	M-122B M-122BDISS	All isotopes reported below the PQL.	J (all detects)	А	Sample result verification (PQL) (sp)

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 240965

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Pump Blank Data Qualification Summary - SDG 240965

No Sample Data Qualified in this SDG

Tronox LLC Facility, 2009 Phase B Investigation, Henderson, Nevada Isotopic Uranium & Isotopic Thorium - Filter Blank Data Qualification Summary - SDG 240965

No Sample Data Qualified in this SDG

Tronox Northgate Henderson

_DC #:	22232E59	VALIDATION COMPLETENESS WORKSHEET	Date: 12	- <u>22</u>
SDG #:_	240965	Stage 2B	Page: <u> </u>	
_aborato	ry: GEL Laboratorie	es LLC	Reviewer: M	G
			2nd Reviewer:	

METHOD: Isotopic Uranium (DOE EML HASL-300, U-02-RC Modified), Isotopic Thorium (DOE EML HASL-300, Th-01-RC Modified)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
i.	Technical holding times	Α	Sampling dates: 11-11-09
lla.	Initial calibration	A	
llb.	Calibration verification	Α	
III.	Blanks	Α	
lVa.	Matrix Spike/(Matrix Spike) Duplicates	Α	MS/DUP
IVa.	Laboratory control samples	Α	LCS
V.	Tracer Recovery	Α	
VI.	Minimum Detectable Activity (MDA)	SW	
VII.	Sample result verification	N	
VIII.	Overall assessment of data	Α	
IX.	Field duplicates	7	
L _X	Field blanks	SW	Pump Blank = * PB102309-A3 (SDG: 239753)

Filter Blank = FiltB097509-A2 (506: 237885)

Note: A = Acceptable N = Not provided/applicable SW = See worksheet

R = Rinsate

TB = Trip blank FB = Field blank EB = Equipment blank

Validated Samples:

water

	110701			
1	M-122B	11	21	31
2	M-122BDISS	12	22	32
3	M-122BMS	13	23	33
4	M-122BDUP	14	24	34
5	M-122BDISSMS	15	25	35
6	M-122BDISSDUP	16	26	36
7	PBW	17	27	37
8		18	28	38
9		19	29	39
10		20	30	40

Notes:		
	 	· - · · · · · · · · · · · · · · · · · ·

LDC #: 33333E59 SDG #: 240965

VALIDATION FINDINGS WORKSHEET

Field Blanks

AG.	
Page: Reviewer:	

see cover METHOD: Radiochemistry (Method:__

Were field blanks identified in this SDG? ON NA NA NA

WON NA Were target isotopes detected in the field blanks? Blank units: Pci/L Associated sample units: Pci/L Sampling date: 9-25-09

1											
(an)			0.0	30,				-			
18		tffication	J: 1000	1/10							
ed Samoles:		Sample Identification	No samole was auxilia of				1				
c Associate			Samole				+		+		
er Blank			No I					-	-		
Others Filt									-		
c/ Rinsate A			}		1	•					
e) Field Blan	Dient	Action	Limit						_	∓	
Field blank type: (circle one) Field Blank / Rinsate /Other Filter 81ank Associated Samples:	Blank ID	1 H	2509-43	20112							
eld blank ty	Analyte	- Colombia	• 0	< RL Th- 220 0011 A	2				-		
Ĭ.				< RL .	<u>.l.</u>					 	 _

Associated sample units: Blank units:

Sampling date:

Field blank type: (circle one) Field Blank / Rinsate / Other:

Sample Identification Blank Action Blank ID Analyte

Associated Samples:_

1		Γ		T		T		T		-	T		T	_	700
															+ datan
										-					On ag h
L						\downarrow		1							dualifie
															s were
brack	\dashv					-	_	-			_	_			e resul
												-			e samp
	1		1	-		-				1					e, thes
								L							ad abov
															are liste
	╀		\downarrow				_			-		\downarrow		_	ration
															concen
	╫		+		+		1			L		+			
														200	
•			T	•	1		1					1		Perocial	2008 2008 2008
			L								_			a tha a	
-														We tim	
	L						ļ		+		-	L		Within 1	
Emit C														Samples with isotope concentrations within five times the associated field billions.	
					-		L				-			oncen	
														otope c	•
					-	_	-		-	_		_	-	with isc	
														umples	
83 [-	<u></u> _	-	لِي			<u></u>			-	لـ	Š	?

FBLKASC4.35

LDC #: 33332E59 SDG #: 340965

VALIDATION FINDINGS WORKSHEET Minimum Detectable Activities

Page: 1 of 1 Reviewer: MG

METHOD: Radiochemistry (Method: SCC Cover

The following sample MDAs are above the RDL:

#	Sample ID	Isotope	AAPP POL Lak DL RDL (units) MBA (units)	Lab DL MBA (units)	Finding	Qualifications
_		TH-338	(7:5d) 80.0	0.0369 (PC:/L)	Lab Di	None/P
		U-233/934		0.091		
		U-335/936		0.0743		
	>	U-338		0.053		
,						
.,	4	TH -928		0.0481		
	→	1-233/234	->	1 h620.0	3	۷-
Comments:	.6					