

LABORATORY DATA CONSULTANTS, INC.

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ERM 2525 Natomas Park Drive, Suite 350

Sacramento, CA 95833

ATTN: Ms. Maria Barajas-Albalawi

SUBJECT: BRC Tronox Parcel C/D/F/G, Data Validation

Dear Ms. Barajas-Albalawi

Enclosed are the final validation reports for the fractions listed below. This SDG was received on June 27, 2008. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project # 19034:

SDG # Fraction

209755 Perchlorate, Radium-226 & Radium-228, Isotopic Uranium &

Isotopic Thorium

The data validation was performed under EPA Level III and Level IV guidelines. The analyses were validated using the following documents, as applicable to each method:

- USEPA, Contract Laboratory Program National Functional Guidelines for Organic Data Review, October 1999
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; Update IV, February 2007

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

Sincerely,

Erlinda T. Rauto

Operations Manager/Senior Chemist

July 16, 2008

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Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

BRC Tronox Parcel C/D/F/G/H

Collection Date:

June 4, 2008

LDC Report Date:

July 11, 2008

Matrix:

Soil

Parameters:

Perchlorate

Validation Level:

EPA Level III & IV

Laboratory:

GEL Laboratories, LLC.

Sample Delivery Group (SDG): 209755

Sample Identification

TSB-GJ-09-0

TSB-GJ-09-FD-0

TSB-GJ-08-0

TSB-FJ-06-2-0**

TSB-FR-02-02-0

TSB-FJ-02-02-0

TSB-GJ-09-0MS

TSB-GJ-09-0MSD

TSB-GJ-09-0DUP

^{**}Indicates sample underwent EPA Level IV review

Introduction

This data review covers 9 soil samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA Method 314.0 for Perchlorate.

The review follows a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (October 2004) 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 IX.

Samples indicated by a double asterisk on the front cover underwent a EPA Level IV review. A EPA Level III review was performed on all of the other samples. Raw data were not evaluated for the samples reviewed by Level III criteria since this review is 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.
- 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.

b. Calibration Verification

Calibration verification frequency and analysis criteria were met.

III. Blanks

Method blanks were reviewed for each matrix as applicable. No perchlorate was found in the initial, continuing and preparation blanks.

No field blanks were identified in this SDG.

IV. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

V. Duplicates

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

VI. Laboratory Control Samples

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

VII. Sample Result Verification

All sample result verifications were acceptable for samples on which a EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by Level III criteria.

VIII. Overall Assessment of Data

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

IX. Field Duplicates

Samples TSB-GJ-09-0 and TSB-GJ-09-FD-0 were identified as field duplicates. No perchlorate was detected in any of the samples with the following exceptions:

	Concentra	tion (ug/Kg)				
Analyte	TSB-GJ-09-0	TSB-GJ-09-FD-0	RPD (Limits)	Difference (Limits)	Flag	A or P
Perchlorate	138000	124000	11 (≤50)	-	-	-

BRC Tronox Parcel C/D/F/G/H
Perchlorate - Data Qualification Summary - SDG 209755

No Sample Data Qualified in this SDG

BRC Tronox Parcel C/D/F/G/H
Perchlorate - Laboratory Blank Data Qualification Summary - SDG 209755

No Sample Data Qualified in this SDG

BRC Tronox Parcel C/D/F/G/H Perchlorate - Field Blank Data Qualification Summary - SDG 209755

No Sample Data Qualified in this SDG

_abor	atory: <u>GEL Laboratories</u>	LLC								viewer: <u>M</u> viewer:
METH	HOD: (Analyte) Perchlora	ite (EF	PA Method	314.0)						
	amples listed below were tion findings worksheets		wed for ead	ch of the f	ollowing	y valida	ition areas. Validation	n find	dings are no	oted in attac
	Validation	Area					Commo	ents		
I.	Technical holding times			A	Samplir	ng dates:	6-4-08			
lla.	Initial calibration			Α	<u> </u>					
llb.	Calibration verification			A						·····
III.	Blanks			Α						
IV	Matrix Spike/Matrix Spike D	uplicate	es	Α	MS	MSD	(SDG: 20	9-	765)	
V	Duplicates	·		Α	DU	5	(↓	<u> </u>	
VI.	Laboratory control samples			Α	LC	ŝ				
VII.	Sample result verification			Α	Not rev	riewed fo	r Level III validation.			
VIII.	Overall assessment of data	1		A						
IX.	Field duplicates	SW	D =	1+2			" · ·			
х	Field blanks			7						
Note:	A = Acceptable N = Not provided/applicable SW = See worksheet	е	R = Rin	o compound sate eld blank	ds detecte	ed	D = Duplicate TB = Trip blank EB = Equipment blank	ζ		
/alidat	ed Samples: ** Indicates sam	ple und	erwent Level	IV validation)					
1	TSB-GJ-09-0	11			2	1		31		
2	TSB-GJ-09-FD-0	12			2	2		32		
3	TSB-GJ-08-0	13			2	3		33		
4	TSB-FJ-06-2-0**	14			2	4		34		
5	TSB-FR-02-02-0	15			2	5		35		
6	TSB-FJ-02-02-0	16			2	6		36		
7	TSB-GJ-09-0MS	17			2	7		37		
8	TSB-GJ-09-0MSD	18			2	8		38		
9	TSB-GJ-09-0DUP	19			2	9		39		
	PBS	20			3	_		40		

Level III/IV

Date: 7-10-08

Page: 1 of 1

LDC #: 19034A6 VALIDATION COMPLETENESS WORKSHEET

SDG #: 209755

LDC #: 19034 A6 SDG #: 209755

VALIDATION FINDINGS CHECKLIST

Page: __lof_2 Reviewer: ______ 2nd Reviewer: ______

Method:Inorganics (EPA Method 314.0)

Method:Inorganics (EPA Method ५१५०)	r		T	T T T T T T T T T T T T T T T T T T T
Validation Area	Yes	No	NA	Findings/Comments
L:Technical holding times.	18.4	38.7e	i i i	
All technical holding times were met.	1		<u> </u>	
Coolor temperature criteria was met.	/			
III. Calibration	.			
Were all instruments calibrated daily, each set-up time?	/			
Were the proper number of standards used?	V			
Were all initial calibration correlation coefficients ≥ 0.995?	/			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	/			
Were titrant checks performed as required? (Level IV only)			\angle	
Were balance checks performed as required? (Level IV only)			<u> </u>	
III Blanks		10.0		
Was a method blank associated with every sample in this SDG?	V			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		/		
IV. Matrix Spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) 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/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	1			
Were the MS/MSD or duplicate relative percent differences (RPD) \leq 20% for waters and \leq 35% for soil samples? A control limit of \leq CRDL(\leq 2X CRDL for soil) was used for samples that were \leq 5X the CRDL, including when only one of the duplicate sample values were \leq 5X the CRDL.	✓			
V Laboratory control samples				
Was an LCS anaytzed for this SDG?	/			
Was an LCS analyzed per extraction batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?				A AND THE STATE OF
VI, Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		V		
		- 1	./	i

LDC #: 19034A6 SDG #: 209755

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: MG

2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
Were detection limits < RL?	/			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.	1			
Target analytes were detected in the field duplicates.	1			
X. Field blanks				
Field blanks were identified in this SDG.		/		
Target analytes were detected in the field blanks.			V	

LDC #:	19034A6
SDG #·	209755

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page: 1	of _ <u>1</u>
Reviewer:	MG
2nd reviewer:	

METHOD: Inorganics, Method 314.0

	Concentration (ug/kg,			
Analyte	Concentration (2	RPD (Limit)	Difference (Limit)	Qualifie
C104	138000.	124000.	11 (= 50)		
	Concentration (,			
Analyte	Concentration (RPD (Limit)	Difference (Limit)	Qualifie
, irony to			200		
	Concentration ()	RPD (Limit)	Difference (Limit)	Qualifie
Analyte			Ki D (Limit)	Difference (Limit)	Quantie
					<u></u>
	Concentration ()			
Analyte			RPD (Limit)	Difference (Limit)	Qualifie

LDC #: 19034A6 SDG #: 309755

VALIDATION FINDINGS WORKSHEET Initial and Continuing Calibration Calculation Verification

Page: 1 of 1 Reviewer: 46

METHOD: Inorganics, Method 3 (4.0

was recalculated. Calibration date:_ Ċ104 The correlation coefficient (f) for the calibration of _

80-11-98

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

Where, Found = concentration of each analyte <u>measured</u> in the analysis of the ICV or CCV solution.

True = concentration of each enalyte in the ICV or CCV source %R = Found x 100 True

					Recalculated	Reported	
Type of Analysis	Analyte		Conc (units)	Area (units)	r or %R	ror %R	Acceptable (Y/N)
Initial calibration		Blank	(7/Bm) 0.0	0			
Calibration verification		Stendard 1	()	14841			
		Standard 2	() 0.01	13177			
	(Standard 3	() 0.50	33398	6		
	750	Standard 4	() 0.05	68345	V =0.999617 15=0.999617	r = 0.999617	>
		Standard 5	100.0 (1)	140138			٠
		Standard 6		_			
		Standard 7	1	1		•.	
Calibration verification		1001					
	Croy	CCV	75.56 (mg/L)	75.56 (mg/L) 75 (mg/L)	101	101	→
Calibration verification							
)	ŀ		}			1
Calibration verification	1		1				-
			•.	l	})	l

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

19034 AG 27POG SDG #: LDC #:

VALIDATION FINDINGS WORKSHEET Level IV Recalculation Worksheet

Page: Reviewer: 2nd Reviewer:_

> 314.0 METHOD: Inorganics, Method_

Percent recoveries (%R) for a laboratory control sample and a matrtx spike sample were recalculated using the following formula:

Where, %R = Found x 100

Found =

True =

concentration of each analyte <u>measured</u> in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result). concentration of each analyte in the source.

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

RPD = <u>1S-D1</u> x 100 Where, (S+D)/2

S 0

Original sample concentration Duplicate sample concentration

		-	Found		Recalculated	Reported	
Sample ID	Type of Analysis	Element	(units)	(units)	%R / RPD	%R / RPD	Acceptable (Y/N)
99 7 99	Laboratory control sample						
700		C104	498.6 (49/4) 500 (49/49	500 (mg/kg	(00)	001	>
1314	Matrix spike sample		(SSR-SR)				
7		"010	CIO4 - 7991.9 (mg/2) 101 (mg/2) - 7913	101 (49/	- 7913	not reported	
1937 / 1956 Duplicate sample	Duplicate sample						
6		ClO_{4}	C104 138441.9 (Mg/) 136519.8 (Mg/Mg)	136519.8 (Mg/Mg)			
							2

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

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LDC #: 1903 4 A6 SDG #: 209755

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

				2nd reviewe	r:
METH	OD: Inorganics, Metho	od 314.0			
Please N N N N N	N/A Have results N/A Are results v	low for all questions answered "N". Not a been reported and calculated correctly within the calibrated range of the instrum ction limits below the CRQL?	?	are identified as "	N/A".
Comp	ound (analyte) results	for # 4, CIO4 ng the following equation:	repo	rted with a positi	e detect were
Concen	tration =	Recalculation: C104 = 200 [0.0007116 (47181	, -		
	6= 0.8054 dil=200x	= 6875.88 Mg/L then $\rightarrow (0.0)$	15.88 Mg/L)(0.04 0404 kg) (0.9	102) = 69 18 84) =	34.98 mg/
#	Sample ID	Analyte	Reported Concentration (Mg/Kg)	Calculated Concentration (Mg / Kq)	Acceptable (Y/N)
1.	4	CIO4	69200.	69200.	Y
				·	
Note:_					

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

BRC Tronox Parcel C/D/F/G/H

Collection Date:

June 4, 2008

LDC Report Date:

July 10, 2008

Matrix:

Soil

Parameters:

Radium-226 & Radium-228

Validation Level:

EPA Level III & IV

Laboratory:

GEL Laboratories, LLC.

Sample Delivery Group (SDG): 209755

Sample Identification

TSB-GJ-09-0

TSB-GJ-09-FD-0

TSB-GJ-08-0

TSB-FJ-06-2-0**

TSB-FR-02-02-0

TSB-FJ-02-02-0

^{**}Indicates sample underwent EPA Level IV review

Introduction

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

The review follows a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (October 2004) 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.

Samples indicated by a double asterisk on the front cover underwent a EPA Level IV review. A EPA Level III review was performed on all of the other samples. Raw data were not evaluated for the samples reviewed by Level III criteria since this review is 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.
- U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.
- J Indicates an estimated value.
- R Quality control indicates the data is not usable.
- N Presumptive evidence of presence of the constituent.
- UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.
- 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 detector and each radionuclide.

Self absorption factors were determined for each sample when applicable.

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 Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) 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

All minimum detectable activities met required detection limits.

VI. Sample Result Verification

All sample result verifications were acceptable for samples on which a EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by Level III criteria.

VII. Overall Assessment of Data

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

VIII. Field Duplicates

Samples TSB-GJ-09-0 and TSB-GJ-09-FD-0 were identified as field duplicates. No radium-226 or radium-228 was detected in any of the samples with the following exceptions:

	Concentra	ition (pCi/g)	222	D.//		
Isotope	TSB-GJ-09-0	TSB-GJ-09-FD-0	RPD (Limits)	Difference (Limits)	Flags	A or P
Radium-228	2.32	0.850	-	1.470 (≤1.00)	J (all detects)	А
Radium-226	1.07	0.920	-	0.150 (≤1.00)	J (all detects)	А

BRC Tronox Parcel C/D/F/G/H Radium-226 & Radium-228 - Data Qualification Summary - SDG 209755

SDG	Sample	Isotope	Flag	A or P	Reason
209755	TSB-GJ-09-0 TSB-GJ-09-FD-0	Radium-228 Radium-226	J (all detects) J (all detects)	А	Field duplicates (difference)

BRC Tronox Parcel C/D/F/G/H

Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 209755

No Sample Data Qualified in this SDG

BRC Tronox Parcel C/D/F/G/H

Radium-226 & Radium-228 - Field Blank Data Qualification Summary - SDG 209755

No Sample Data Qualified in this SDG

SDG#	t: 19034A29 #: 209755		IDATIO		evel III/I		VORKSHEET	Date:_7 Page: Povinyar:	_of_ <u>i</u>
_abora	atory: <u>GEL Laboratorie</u>	s LLC			gn &			Reviewer: 2nd Reviewer:	MG · /
			•	Mod	·		/	Mod	
VIETH REV#		'A Metho	d 903.1 / 6	3L-RAD-A	-008 RE\	/ #12) R	dadium 228 (EPA	Method 904.0 /GL-RAD	A-009
	•							6. 1	
	amples listed below we tion findings worksheel		ved for ea	ach of the t	following	validation	n areas. Validation	n findings are noted in att	tached
	Validatio	n Area					Comme	ents	
ı.	Technical holding times			A	Sampling	dates:	6-4-08		
IIa.	Initial calibration			Α					
IIb.	Calibration verification			A					
III.	Blanks			Α					
IVa.	Matrix Spike/(Matrix Spike	e) Duplicate	es	Α	M5/	MSD/	DUP (SDG:	209765)	
IVb.	Laboratory control sample	es		Α	LCS				
IVc.	Chemical recovery			Α					
V.	Sample result verification			A	Not revie	wed for Le	vel III validation.		
VI.	Minimum dectectable act	ivity (MDA)		Α					
VII.	VII. Overall assessment of data			A					
VIII.	/III. Field duplicates			SW	D=1+2				
XIV									
Note:	A = Acceptable N = Not provided/applica SW = See worksheet	ble	R = Ri	No compound nsate Field blank	ds detected	-	D = Duplicate IB = Trip blank EB = Equipment blank	:	
Validat	ed Samples: ** Indicates sa	ample unde	rwent Level	IV validation	า				
1	TSB-GJ-09-0	11		<u> </u>	21			31	
2	TSB-GJ-09-FD-0	12			22			32	
3	TSB-GJ-08-0	13			23			33	
4	TSB-FJ-06-2-0**	14			24			34	
5	TSB-FR-02-02-0	15			25			35	
6	TSB-FJ-02-02-0	16			26			36	
7	PBS	17			27			37	
8		18			28			38	
9		19			29			39	
10		20			30			40	

VALIDATION FINDINGS CHECKLIST

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

 $\begin{tabular}{ll} \textbf{Method:} Radiochemistry (EPA Method See cover) \\ \end{tabular}$

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?	/		<u> </u>	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?	/			+
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?.	1			
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				
Nas a tracer/carrier added to each sample?	/			
Nere tracer/carrier recoveries within the QC limits?	$\sqrt{\ }$			
/It: Regional Quality Assurance and Quality Control				
Vere performance evaluation (PE) samples performed?		/		
Vere the performance evaluation (PE) samples within the acceptance limits?			/	
III, Sample Result Verification				
Vere activities adjusted to reflect all sample dilutions and dry weight factors pplicable to level IV validation?	\checkmark			
Vere the Minimum Detectable Activities (MDA) < RL?	/	_		

LDC #:	19034A29
SDG #:	209755

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.	/			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.			/	

LDC #: 19034A 29 VALIDATION FINDINGS WORKSHEET SDG #: 209755 Field Duplicates

Page:___of__

	<u>riela Duplic</u>	<u>ates</u>	Reviewer: MG 2nd reviewer: 1
METHOD: Radiochemistry (Method:S	ee cover)	
N N/A Were field duplicate pairs in N/N N/A Were target isotopes detections.	dentified in this SDG? sted in the field duplicate	pairs?	
	Activity (oci/q)	by difference
Isotopes		2	Qual pavent only
Ra - 228	2.32	0.850	1.470 PCi/g (\$1.00) Jdets/A
Ra-226	1.07	0.920	0.150 1 (1)
	Activity (
Isotopes			RPD
	Activity ()	
Isotopes			RPD
		· · · · · · · · · · · · · · · · · · ·	
Isotopes	Activity ()	RPD
			·

190341939 309755 LDC #:_ SDG #:

VALIDATION FINDINGS WORKSHEET **Level IV Recalculation Worksheet**

o Page: Reviewer: 2nd Reviewer:

See

0000 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						
703		Ra-336	11.5 (mg/kg) 11.1 (mg/kg)	11.1 (mg/kg)	hOI	/03	>
	Matrix spike sample			2			
TRX-HR-04-0 MS		Ra-236	=	39 (mg/kg) 11.8 (mg/kg)	26	96	
	Duplicate RPD						
78×-48-04-0		Ra-338	2.93 (mg/hg)	93 (mg/mg) 3.35 (mg/mg)	20	8	
	Chemical recovery	Ba-133		i i			
7		for Ra-238	323.5 (cpm)	323.5 (cpm) 327.2 (cpm)	66	66	

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	#:	19034A29
enc	4.	209755

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:	of
Reviewer:	MG
2nd reviewer:	1

METHOD:	Radiochemistry	(Method:_	see	cover	ļ

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

N/A Have results been reported and calculated correctly?

Are results within the calibrated range of the instruments?

Analyte results for reported with a positive detect were recalculated and verified using the following equation: Recalculation: Activity =

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

 $\frac{(228/70) - 0.640}{(2.22)(0.6416)(0.5000g)(0.9887)} \times \frac{1}{0.995} \times \frac{1}{0.735} \times 1.067 = 5.423 \text{ pci/g}$

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

E = Efficiency Vol = Volume

#	Sample ID	Analyte	Reported Concentration (PCi/q)	Calculated Concentration	Acceptable (Y/N)
	4	. Ra-228	5.43	5.42	Y
		Ra-226	. 1.53	1.54	
		r - 10		, I	
			•		
		11. 1		!	
		:			
					·
	<u> </u>				

Note:		_		

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name:

BRC Tronox Parcel C/D/F/G/H

Collection Date:

June 4, 2008

LDC Report Date:

July 10, 2008

Matrix:

Soil

Parameters:

Isotopic Uranium & Isotopic Thorium

Validation Level:

EPA Level III & IV

Laboratory:

GEL Laboratories, LLC.

Sample Delivery Group (SDG): 209755

Sample Identification

TSB-GJ-09-0

TSB-GJ-09-FD-0

TSB-GJ-08-0

TSB-FJ-06-2-0**

TSB-FR-02-02-0

TSB-FJ-02-02-0

^{**}Indicates sample underwent EPA Level IV review

Introduction

This data review covers 6 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.

The review follows a modified outline of the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (October 2004) 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.

Samples indicated by a double asterisk on the front cover underwent a EPA Level IV review. A EPA Level III review was performed on all of the other samples. Raw data were not evaluated for the samples reviewed by Level III criteria since this review is 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.
- 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 (pCi/g)	Associated Samples
PBS	Thorium-228	0.342	All samples in SDG 209755

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

No field blanks were identified in this SDG.

IV. Accuracy and Precision Data

a. Matrix Spike/(Matrix Spike) Duplicate

Matrix spike (MS) and matrix spike duplicate (MSD) samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) 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 detection limits.

VI. Sample Result Verification

All sample result verifications were acceptable for samples on which a EPA Level IV review was performed. Raw data were not evaluated for the samples reviewed by EPA Level III criteria.

VII. Overall Assessment of Data

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

VIII. Field Duplicates

Samples TSB-GJ-09-0 and TSB-GJ-09-FD-0 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)		nnn	D.W		
Isotope	TSB-GJ-09-0	TSB-GJ-09-FD-0	RPD (Limits)	Difference (Limits)	Flags	A or P
Thorium-228	1.51	1.76	-	0.25 (≤1.00)	-	-
Thorium-230	0.933	1.03	-	0.097 (≤1.00)	-	-
Thorium-232	1.28	1.52	-	0.24 (≤1.00)	-	-
Uranium-233/234	1.41	1.18	-	0.23 (≤1.00)	-	-
Uranium-233/234	0.897	0.659	-	0.238 (≤1.00)	-	-

BRC Tronox Parcel C/D/F/G/H Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 209755

No Sample Data Qualified in this SDG

BRC Tronox Parcel C/D/F/G/H Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 209755

No Sample Data Qualified in this SDG

BRC Tronox Parcel C/D/F/G/H Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 209755

No Sample Data Qualified in this SDG

SDG a	t: 19034A59 #: 209755 atory: <u>GEL Laborator</u>			PLETENE evel III/IV	SS WORKSHI	EET	Date: 7-10-08 Page: 1 of 1 Reviewer: MG 2nd Reviewer:
Modifi The s	ed)	vere reviewed					EML HASL-300, Th-01-RC lings are noted in attached
		on Area			C	omments	
1.	Technical holding times		Α	Sampling da	/ 11-		
lla.	Initial calibration		A				
IIb.	Calibration verification		A				
III.	Blanks		Sw				
IVa.	Matrix Spike/(Matrix Spi	ke) Duplicates	A	MS/M	5D/DUP (SDG: 20	09765)
IVa.	Laboratory control samp		A	LCS	•		
V.	Tracer Recovery		A			- · · ·	
VI.	Minimum Detectable Ac	tivity (MDA)	A				
VII.	Sample result verification	n	Α	Not reviewe	d for Level III validation	n.	
VIII.	Overall assessment of	data	A				
IX.	Field duplicates		SW	D= 1+	- 2		
_x	Field blanks	1444					
Note: Validat	A = Acceptable N = Not provided/applic SW = See worksheet ed Samples: ** Indicates		ND = No compound R = Rinsate FB = Field blank ant Level IV validation		D = Duplicate TB = Trip blant EB = Equipme		
		11		21		31	
1 2	TSB-GJ-09-0 TSB-GJ-09-FD-0	12		22		32	
3	TSB-GJ-08-0	13		23		33	
4	TSB-FJ-06-2-0**	14		24		34	
5	TSB-FR-02-02-0	15		25		35	
6	TSB-FJ-02-02-0	16		26		36	
7	PBS	17		27		37	
8		18		28		38	
9		19		29		39	
10	-	20		30		40	

Notes:

LDC	#:	19034A59
SDG	#:	209755

VALIDATION FINDINGS CHECKLIST

Page: of 2
Reviewer: MG
2nd Reviewer:

Method:Radiochemistry(EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
1. Technical holding times				
All technical holding times were met.	/			
II, Calibration				
Were all instruments and detectors calibration as required?	ÿ			
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?	/			
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?	<u> </u>			
Were all duplicate sample duplicate error rations (DER) ≤1.42?.	. 🗸			
/ Laboratory control samples				
Vas an LCS analyzed per analytical batch?	\checkmark			·
Vere the LCS percent recoveries (%R) and relative percent difference (RPD) vithin the 75-125%	✓			
I. Sample Chemical/Carrier Recovery				
Vas a tracer/carrier added to each sample?	/			•
/ere tracer/carrier recoveries within the QC limits?	\checkmark			
II: Regional Quality Assurance and Quality Control				
ere performance evaluation (PE) samples performed?		\checkmark		
ere the performance evaluation (PE) samples within the acceptance limits?			$\sqrt{}$	
II. Sample Result Verification				
ere activities adjusted to reflect all sample dilutions and dry weight factors oplicable to level IV validation?	1			
ere the Minimum Detectable Activities (MDA) < RL?	/			

LDC #:	19034A59
SDG #:	209755

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.	1			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.				

LDC #: 19034 A59 309755 SDG #:

VALIDATION FINDINGS WORKSHEET <u>Blanks</u>

Page: Reviewer:_

2nd Reviewer:_

00100 METHOD: Radiochemistry (Method: See

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. PCi. N N/A N/A

<u>2</u>

Associated Samples:

Units:

oua C Sample Identification Nere Samples ż Blank Action Level 0.342 Blank ID PBS Th- 338 Isotope < RL

Blank ID

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 #: 19034 A59 SDG #: 209755

VALIDATION FINDINGS WORKSHEET Field Duplicates

Page:_	<u> </u>
Reviewer:_	MG
2nd reviewer:	1~

METHOD: Radiochemistry (Method: See cover

Were field duplicate pairs identified in this SDG?

Were target isotopes detected in the field duplicate pairs?

	Activity (oci/a)	by difference
Isotopes		2	RPD
Tu-228	1.51	1.76	0.25 Pci/a (\$ 1.00
Th-230	0.933	1.03	0.097 (
Th-232	1.28	1.52	0.24
U- 233/234	1.41	1.18	0.23 ()
U-238	0.897	0.659	0.238

	Activity ()	
Isotopes		RPD

	Activity ()	
Isotopes		RPD
·		

	Activity ()	
Isotopes		RPD

19034A59 209755 LDC #:__ SDG #:

VALIDATION FINDINGS WORKSHEET **Level IV Recalculation Worksheet**

2 т о ~ Page: 2nd Reviewer: Reviewer:

; -

cover see 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.

Where,

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	%B or BPD	Acceptable
	Laboratory control sample						(1/1)
7.05		Th-332	6.59 (Pci/4)	6.59 (Pci/g) 7.00 (Pci/g)	76	Hb	>
	Matrix spike sample						-
TRX-HR-04-0		0-938	8.35 (PCi/2)	.35 (PC/4) 9.53 (PC/4)	හ න	88	
	Duplicate RPD						
TRX-HR-04-0 DUP		Th-338	1.99 (PC/4)	19 (PG/4) 1.72 (PCi/4)	7	7	
	Chemical recovery		A	1 ,			
2		0-332	4.96855 (dpm) 5,31040 (dpm)	5,31040 (dpm)	76	46	

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 #:_	19034A59
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CF = %R, Self-absorbance, abundance, ect.

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page:_	<u>(</u> of
Reviewer:	MG
2nd reviewer:	10

METHOD: Radiochemistry	v (Meti	nod:	see	cover	`)	

Please see	qualifications	below for al	l questions an	swered "N". I	Not applicable	questions are	identified as "N/A".
_	•						initialities are taly th

Y) N N/A Have results been reported and calculated correctly? Are results within the calibrated range of the instruments?

Tn-228 Analyte results for reported with a positive detect were recalculated and verified using the following equation:

Activity = Recalculation: * Corrected net area (tracer impurity) (cpm - bckgrd cpm) * (82.572/240) (2.22)(E)(Vol)(CF) $\frac{7040}{(2.22)(0.313315)(0.279g)(0.92828)(0.9994)} = 1.911$ E = Efficiency Vol = Volume

#	Sample ID	Analyte	Reported Concentration (pC / q)	Calculated Concentration (PCi/g)	Acceptable (Y/N)
	Ц	Th- 228	1.94	1.91	· Y
	·	Tn-230	, 1.01	1.01	1.
		Th- 232	1.72	1.72	
		U - 233/234	1.11	1.11	
		U-)38	1.15	1.15	
			·		
			·		
				·	

Note:		
	·	