

**LABORATORY DATA CONSULTANTS, INC.**

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ERM  
2525 Natomas Park Drive, Suite 350  
Sacramento, CA 95833  
ATTN: Ms. Maria Barajas-Albalawi

July 31, 2008

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

Dear Ms. Barajas-Albalawi

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on July 17, 2008. Attachment 1 is a summary of the samples that were reviewed for each analysis.

**LDC Project # 19125:**

<b><u>SDG #</u></b>	<b><u>Fraction</u></b>
210150, 210228, 210334	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

**LDC #19125 (ERM-Sacramento / BRC Tronox Parcel C/D/F/G/H)**

EDD 80/20

LDC	SDG#	DATE REC'D	(3) DATE DUE	CLO, (314.0)		Ra-226 (903.1)		Ra-228 (904.0)		Iso. Th (300)		Iso. U (300)		W		S		W		S		W		S		W		S		W		S	
				W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
Matrix: Water/Soil																																	
A	210150	07/17/08	08/07/08	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6
A	210150	07/17/08	08/07/08	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6
B	210228	07/17/08	08/07/08	1	8	1	8	1	8	1	8	1	8	1	8	1	8	1	8	1	8	1	8	1	8	1	8	1	8	1	8	1	8
C	210334	07/17/08	08/07/08	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Total				2	20	2	20	2	20	2	20	2	20	2	20	2	20	2	20	2	20	2	20	2	20	2	20	2	20	2	20	2	20
T/LR																																	

Shaded cells indicate Level IV validation (all other cells are Level III validation). These sample counts do not include MS/MSD, and DUPS

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

**Project/Site Name:** BRC Tronox Parcel C/D/F/G/H  
**Collection Date:** June 10, 2008  
**LDC Report Date:** July 29, 2008  
**Matrix:** Soil  
**Parameters:** Perchlorate  
**Validation Level:** EPA Level III & IV  
**Laboratory:** GEL Laboratories, LLC.

**Sample Delivery Group (SDG):** 210150

**Sample Identification**

TSB-FJ-06-02-10\*\*  
TSB-FJ-06-02-20  
TSB-FJ-06-02-30\*\*  
TSB-FR-02-02-10  
TSB-FR-02-02-10-FD  
TSB-FR-02-02-20\*\*  
TSB-FR-02-02-30  
TSB-FJ-02-02-10\*\*  
TSB-FJ-02-02-20  
TSB-FJ-02-02-30

\*\*Indicates sample underwent EPA Level IV review

## **Introduction**

This data review covers 10 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.
- UU 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-FR-02-02-10 and TSB-FR-02-02-10-FD were identified as field duplicates. No perchlorate was detected in any of the samples with the following exceptions:

Analyte	Concentration (ug/Kg)		RPD (Limits)	Difference (Limits)	Flag	A or P
	TSB-FR-02-02-10	TSB-FR-02-02-10-FD				
Perchlorate	62.8	61.0	-	1.8 ( $\leq 46.1$ )	-	-

**BRC Tronox Parcel C/D/F/G/H  
Perchlorate - Data Qualification Summary - SDG 210150**

No Sample Data Qualified in this SDG

**BRC Tronox Parcel C/D/F/G/H  
Perchlorate - Laboratory Blank Data Qualification Summary - SDG 210150**

No Sample Data Qualified in this SDG

**BRC Tronox Parcel C/D/F/G/H  
Perchlorate - Field Blank Data Qualification Summary - SDG 210150**

No Sample Data Qualified in this SDG



LDC #: 19125A6

### VALIDATION COMPLETENESS WORKSHEET

Date: 7-22-08

SDG #: 210150

Level III/IV

Page: 1 of 1

Laboratory: GEL Laboratories LLC

Reviewer: *MLG*

2nd Reviewer: *[Signature]*

METHOD: (Analyte) Perchlorate (EPA Method 314.0)

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: 6-10-03
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	A	
IV	Matrix Spike/Matrix Spike Duplicates	A	MS/MSD (SDG's: 210228, 210334)
V	Duplicates	A	DUP (            ↓            ↓            )
VI.	Laboratory control samples	A	LCS
VII.	Sample result verification	A	Not reviewed for Level III validation.
VIII.	Overall assessment of data	A	
IX.	Field duplicates	SW	D = 4 + 5
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: \*\* Indicates sample underwent Level IV validation

*all soil*

1	TSB-FJ-06-02-10**	11	PBS	21		31	
2	TSB-FJ-06-02-20	12		22		32	
3	TSB-FJ-06-02-30**	13		23		33	
4	TSB-FR-02-02-10	14		24		34	
5	TSB-FR-02-02-10-FD	15		25		35	
6	TSB-FR-02-02-20**	16		26		36	
7	TSB-FR-02-02-30	17		27		37	
8	TSB-FJ-02-02-10**	18		28		38	
9	TSB-FJ-02-02-20	19		29		39	
10	TSB-FJ-02-02-30	20		30		40	

Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

LDC #: 19125A6  
 SDG #: 210130

VALIDATION FINDINGS CHECKLIST

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

Method: Inorganics (EPA Method 314.0)

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
<b>II. Calibration</b>				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
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)			✓	
Were balance checks performed as required? (Level IV only)			✓	
<b>III. Blanks</b>				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
<b>IV. Matrix Spike/Matrix spike duplicates and Duplicates</b>				
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.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of < CRDL (≤ 2X CRDL for soil) was used for samples that were < 5X the CRDL, including when only one of the duplicate sample values were < 5X the CRDL.	✓			
<b>V. Laboratory control samples</b>				
Was an LCS analyzed 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?	✓			
<b>VI. Regional Quality Assurance and Quality Control</b>				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

LDC #: 19125A6  
 SDG #: 210150

VALIDATION FINDINGS CHECKLIST

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

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

LDC #: 1912546


SDG #: 210150

# VALIDATION FINDINGS WORKSHEET

## Field Duplicates

Page: 1 of 1

Reviewer: MG

2nd reviewer: 

METHOD: Inorganics, Method 314.0

N N/A Were field duplicate pairs identified in this SDG?

N N/A Were target analytes detected in the field duplicate pairs?

Analyte	Concentration ( $\mu\text{g}/\text{kg}$ )		RPD (Limit)	Difference (Limit)	Qualifier
	4	5			
ClO <sub>4</sub>	62.8	61.0		1.8 $\mu\text{g}/\text{kg}$ ( $\leq 46.1$ )	

Analyte	Concentration ( )		RPD (Limit)	Difference (Limit)	Qualifier

Analyte	Concentration ( )		RPD (Limit)	Difference (Limit)	Qualifier

Analyte	Concentration ( )		RPD (Limit)	Difference (Limit)	Qualifier

LDC #: 19125A6  
SDG #: 210150

**VALIDATION FINDINGS WORKSHEET**  
**Initial and Continuing Calibration Calculation Verification**

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

METHOD: Inorganics, Method 314.0  
The correlation coefficient (r) for the calibration of C104 was recalculated. Calibration date: 6-17-08

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

$\%R = \frac{\text{Found}}{\text{True}} \times 100$  Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution  
True = concentration of each analyte in the ICV or CCV source

Type of Analysis	Analyte	Conc (units)	Area (units)	Recalculated		Reported		Acceptable (Y/N)
				r	%R	r	%R	
Initial calibration		0.0 (µg/L)	0					
Calibration verification	Standard 1	4.0 ( )	4341					
	Standard 2	10.0 ( )	13177					
	Standard 3	25.0 ( )	32298					
	Standard 4	50.0 ( )	68365					
	Standard 5	100.0 ( )	140139					
	Standard 6	-	-					
	Standard 7	-	-					
Calibration verification	C104	24.24 (µg/L)	25. (µg/L)	97	97			
Calibration verification	C104	76.51 (µg/L)	75. (µg/L)	102	102			
Calibration verification	-	-	-	-	-			

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.

LDC #: 19135A6  
 SDG #: 210150

**VALIDATION FINDINGS WORKSHEET**  
**Level IV Recalculation Worksheet**

Page: 1 of 1  
 Reviewer: MG  
 2nd Reviewer: [Signature]

METHOD: Inorganics, Method 314.0

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

$$\%R = \frac{\text{Found}}{\text{True}} \times 100 \quad \text{Where, Found} =$$

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

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

$$RPD = \frac{|S-D|}{(S+D)/2} \times 100 \quad \text{Where, S} = \text{Original sample concentration}$$

$$D = \text{Duplicate sample concentration}$$

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated		Acceptable (Y/N)
					%R / RPD	Reported %R / RPD	
1723 LCS	Laboratory control sample	C104	481.6 (ug/kg)	500 (ug/kg)	96	96	Y
0152 TSB-CJ-09-0 MS	Matrix spike sample	C104	(SSR-SR) 263 (ug/kg)	231 (ug/kg)	114	112	
0115/0133 TSB-CJ-09-0 * DUP	Duplicate sample	C104	393 (ug/kg)	406 (ug/kg)	2	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 results.

LDC #: 19125A6  
SDG #: 210150

VALIDATION FINDINGS WORKSHEET  
Sample Calculation Verification

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

METHOD: Inorganics, Method 314.0

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

- N N/A Have results been reported and calculated correctly?
- N N/A Are results within the calibrated range of the instruments?
- N N/A Are all detection limits below the CRQL?

Compound (analyte) results for # 1, ClO<sub>4</sub> reported with a positive detect were recalculated and verified using the following equation:

Concentration =  $y = mx + b$   
where  $m = 0.0007116$   
 $b = 0.9054$   
 $dil = 10x$

Recalculation:  
 $ClO_4 \text{ mg/L} = 10 [ 0.0007116 (46618) + 0.9054 ]$   
 $= 339.79 \text{ mg/L}$   
then  $\frac{(339.79 \text{ mg/L})(0.040 \text{ L})}{(0.004 \text{ kg})(0.938)} = 3622.49 \text{ mg/kg}$

#	Sample ID	Analyte	Reported Concentration (mg/kg)	Calculated Concentration (mg/kg)	Acceptable (Y/N)
1	1	ClO <sub>4</sub>	3620	3620	Y

Note: \_\_\_\_\_  
\_\_\_\_\_

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

**Project/Site Name:** BRC Tronox Parcel C/D/F/G/H  
**Collection Date:** June 11, 2008  
**LDC Report Date:** July 30, 2008  
**Matrix:** Soil/Water  
**Parameters:** Perchlorate  
**Validation Level:** EPA Level III  
**Laboratory:** GEL Laboratories, LLC.

**Sample Delivery Group (SDG):** 210228

**Sample Identification**

TSB-GJ-08-10  
TSB-GJ-08-20  
TSB-GJ-08-30  
TSB-GJ-08-40  
TSB-GJ-09-10  
TSB-GJ-09-20  
TSB-GJ-09-30  
TSB-GJ-09-40  
Rinsate 1  
TSB-GJ-08-10MS  
TSB-GJ-08-10MSD  
TSB-GJ-08-10DUP



## Introduction

This data review covers 11 soil samples and one water sample 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.

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.
- UU 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.

Sample "Rinsate 1" was identified as a rinsate. No perchlorate was found in this blank.

## **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) and relative percent differences (RPD) were within QC limits.

## **VII. Sample Result Verification**

Raw data were not reviewed for this SDG.

## **VIII. Overall Assessment of Data**

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

## **IX. Field Duplicates**

No field duplicates were identified in this SDG.

**BRC Tronox Parcel C/D/F/G/H  
Perchlorate - Data Qualification Summary - SDG 210228**

No Sample Data Qualified in this SDG

**BRC Tronox Parcel C/D/F/G/H  
Perchlorate - Laboratory Blank Data Qualification Summary - SDG 210228**

No Sample Data Qualified in this SDG

**BRC Tronox Parcel C/D/F/G/H  
Perchlorate - Field Blank Data Qualification Summary - SDG 210228**

No Sample Data Qualified in this SDG

LDC #: 19125B6

## VALIDATION COMPLETENESS WORKSHEET

Date: 7-22-08

SDG #: 210228

Level III

Page: 1 of 1

Laboratory: GEL Laboratories LLC

Reviewer: MG

2nd Reviewer: W

METHOD: (Analyte) Perchlorate (EPA Method 314.0)

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: 6-11-08
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	A	
IV	Matrix Spike/Matrix Spike Duplicates	A	MS/MSD (SDG: 210334)
V	Duplicates	A	DUP ( ↓ )
VI.	Laboratory control samples	A	LCS/LCSD
VII.	Sample result verification	N	
VIII.	Overall assessment of data	A	
IX.	Field duplicates	N	
X	Field blanks	ND	R=9

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:

1	TSB-GJ-08-10	S	11	TSB-GJ-08-10MSD	S	21		31
2	TSB-GJ-08-20		12	TSB-GJ-08-10DUP	↓	22		32
3	TSB-GJ-08-30		13	PBS		23		33
4	TSB-GJ-08-40		14	PBW		24		34
5	TSB-GJ-09-10		15			25		35
6	TSB-GJ-09-20		16			26		36
7	TSB-GJ-09-30		17			27		37
8	TSB-GJ-09-40	↓	18			28		38
9	Rinsate 1	W	19			29		39
10	TSB-GJ-08-10MS	S	20			30		40

Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

**Project/Site Name:** BRC Tronox Parcel C/D/F/G/H  
**Collection Date:** June 12, 2008  
**LDC Report Date:** July 29, 2008  
**Matrix:** Soil/Water  
**Parameters:** Perchlorate  
**Validation Level:** EPA Level III  
**Laboratory:** GEL Laboratories, LLC.

**Sample Delivery Group (SDG):** 210334

**Sample Identification**

TSB-CJ-09-0  
TSB-CJ-09-10  
Rinsate 2  
TSB-CJ-09-0MS  
TSB-CJ-09-0MSD  
TSB-CJ-09-0DUP

## Introduction

This data review covers 5 soil samples and one water sample 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.

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- 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.
- UU 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.

Sample "Rinsate 2" was identified as a rinsate. No perchlorate was found in this blank.

## **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) and relative percent differences (RPD) were within QC limits.

## **VII. Sample Result Verification**

Raw data were not reviewed for this SDG.

## **VIII. Overall Assessment of Data**

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



## **IX. Field Duplicates**

No field duplicates were identified in this SDG.

**BRC Tronox Parcel C/D/F/G/H  
Perchlorate - Data Qualification Summary - SDG 210334**

No Sample Data Qualified in this SDG

**BRC Tronox Parcel C/D/F/G/H  
Perchlorate - Laboratory Blank Data Qualification Summary - SDG 210334**

No Sample Data Qualified in this SDG

**BRC Tronox Parcel C/D/F/G/H  
Perchlorate - Field Blank Data Qualification Summary - SDG 210334**

No Sample Data Qualified in this SDG

LDC #: 19125C6

**VALIDATION COMPLETENESS WORKSHEET**

Date: 7-29-08

SDG #: 210334

Level III

Page: 1 of 1

Laboratory: GEL Laboratories LLC

Reviewer: MG

2nd Reviewer: [Signature]

METHOD: (Analyte) Perchlorate (EPA Method 314.0)

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: 6-12-08
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	A	
IV	Matrix Spike/Matrix Spike Duplicates	A	MS/MSD (SDG: 210228)
V	Duplicates	A	DUP ( ↓ )
VI.	Laboratory control samples	A	LCS/LCSD
VII.	Sample result verification	N	
VIII.	Overall assessment of data	A	
IX.	Field duplicates	N	
X	Field blanks	ND	R = 3

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:

1	TSB-CJ-09-0	S	11		21		31	
2	TSB-CJ-09-10	↓	12		22		32	
3	2 Rinsate 2	w	13		23		33	
4	TSB-CJ-09-0MS	S	14		24		34	
5	TSB-CJ-09-0MSD	↓	15		25		35	
6	TSB-CJ-09-0DUP	↓	16		26		36	
7	1 PBS		17		27		37	
8	2 PBW		18		28		38	
9			19		29		39	
10			20		30		40	

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Laboratory Data Consultants, Inc. Data Validation Report

**Project/Site Name:** BRC Tronox Parcel C/D/F/G/H  
**Collection Date:** June 10, 2008  
**LDC Report Date:** July 29, 2008  
**Matrix:** Soil  
**Parameters:** Radium-226 & Radium-228  
**Validation Level:** EPA Level III & IV  
**Laboratory:** GEL Laboratories, LLC.

**Sample Delivery Group (SDG):** 210150

### Sample Identification

TSB-FJ-06-02-10\*\*  
TSB-FJ-06-02-20  
TSB-FJ-06-02-30\*\*  
TSB-FR-02-02-10  
TSB-FR-02-02-10-FD  
TSB-FR-02-02-20\*\*  
TSB-FR-02-02-30  
TSB-FJ-02-02-10\*\*  
TSB-FJ-02-02-20  
TSB-FJ-02-02-30

\*\*Indicates sample underwent EPA Level IV review

## Introduction

This data review covers 10 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.
- UU 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 with the following exceptions:

DUP ID (Associated Samples)	Analyte	Difference (Limits)	Flag	A or P
TSB-GJ-08-10DUP (All samples in SDG 210150)	Radium-228	1.44 pCi/g ( $\leq 1.00$ )	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. Chemical Recovery

All chemical recoveries were within validation criteria.

## V. Minimum Detectable Activity

All minimum detectable activities met required detection limits.

The QAPP reporting limits were met with the following exceptions:

Sample	Analyte	Sample MDA	Required Detection Limit (RDL)	Flag	A or P
TSB-FJ-06-02-10** TSB-FJ-06-02-30** TSB-FJ-02-02-10**	Radium-228	1.01 pCi/g	1.0 pCi/g	None	P
TSB-FJ-06-02-20 TSB-FR-02-02-30	Radium-228	1.02 pCi/g	1.0 pCi/g	None	P
TSB-FR-02-02-10	Radium-228	1.10 pCi/g	1.0 pCi/g	None	P
TSB-FR-02-02-10-FD	Radium-228	1.57 pCi/g	1.0 pCi/g	None	P

## 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-FR-02-02-10 and TSB-FR-02-02-10-FD were identified as field duplicates. No radium-226 or radium-228 was detected in any of the samples with the following exceptions:



Isotope	Concentration (pCi/g)		RPD (Limits)	Difference (Limits)	Flags	A or P
	TSB-FR-02-02-10	TSB-FR-02-02-10-FD				
Radium-228	1.67	0.442U	-	1.228 ( $\leq 1.00$ )	J (all detects) UJ (all non-detects)	A
Radium-226	2.31	1.24	-	1.07 ( $\leq 1.00$ )	J (all detects)	A

**BRC Tronox Parcel C/D/F/G/H  
Radium-226 & Radium-228 - Data Qualification Summary - SDG 210150**

SDG	Sample	Isotope	Flag	A or P	Reason
210150	TSB-FJ-06-02-10** TSB-FJ-06-02-20 TSB-FJ-06-02-30** TSB-FR-02-02-10 TSB-FR-02-02-10-FD TSB-FR-02-02-20** TSB-FR-02-02-30 TSB-FJ-02-02-10** TSB-FJ-02-02-20 TSB-FJ-02-02-30	Radium-228	J (all detects) UJ (all non-detects)	A	Duplicate analysis (Difference)
210150	TSB-FJ-06-02-10** TSB-FJ-06-02-30** TSB-FJ-02-02-10** TSB-FJ-06-02-20 TSB-FR-02-02-30 TSB-FR-02-02-10 TSB-FR-02-02-10-FD	Radium-228	None	P	Minimum detectable activity
210150	TSB-FR-02-02-10 TSB-FR-02-02-10-FD	Radium-228	J (all detects) UJ (all non-detects)	A	Field duplicates (Difference)
210150	TSB-FR-02-02-10 TSB-FR-02-02-10-FD	Radium-226	J (all detects)	A	Field duplicates (Difference)

**BRC Tronox Parcel C/D/F/G/H  
Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG  
210150**

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 210150**

No Sample Data Qualified in this SDG

LDC #: 19125A29

**VALIDATION COMPLETENESS WORKSHEET**

Date: 7-22-08

SDG #: 210150

Level III/IV

Page: 1 of 1

Laboratory: GEL Laboratories LLC

Reviewer: MG

2nd Reviewer: W

**METHOD:** Radium 226 (EPA Method 903.1) <sup>Mod.</sup> ~~GL-RAD-A-008 REV #12~~ Radium 228 (EPA Method 904.0) <sup>Mod.</sup> ~~GL-RAD-A-009 REV #14~~

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: 6-10-08
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	A	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS/MSD/DUP (SDG: 210228, 210334)
IVb.	Laboratory control samples	A	LCS
IVc.	Chemical recovery	A	
V.	Sample result verification	A	Not reviewed for Level III validation.
VI.	Minimum detectable activity (MDA)	SW	
VII.	Overall assessment of data	A	
VIII.	Field duplicates	SW	D = 4+5
XIV.	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: \*\* Indicates sample underwent Level IV validation  
 all soil

1	TSB-FJ-06-02-10**	11	PBS	21	31
2	TSB-FJ-06-02-20	12		22	32
3	TSB-FJ-06-02-30**	13		23	33
4	TSB-FR-02-02-10	14		24	34
5	TSB-FR-02-02-10-FD	15		25	35
6	TSB-FR-02-02-20**	16		26	36
7	TSB-FR-02-02-30	17		27	37
8	TSB-FJ-02-02-10**	18		28	38
9	TSB-FJ-02-02-20	19		29	39
10	TSB-FJ-02-02-30	20		30	40

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

LDC #: 19125A29  
 SDG #: 210150

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2  
 Reviewer: MG  
 2nd Reviewer: [Signature]

Method: Radiochemistry (EPA Method *See cover*)

Validation Area	Yes	No	NA	Findings/Comments
<b>i. Technical holding times</b>				
All technical holding times were met.	✓			
<b>ii. Calibration</b>				
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 required frequency and within laboratory control limits?	✓			
<b>iii. Blanks</b>				
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.		✓		
<b>iv. Matrix spikes and Duplicates</b>				
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 ratios (DER) $\leq 1.42$ ?		✓		
<b>v. Laboratory control samples</b>				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%?	✓			
<b>vi. Sample Chemical/Carrier Recovery</b>				
Was a tracer/carrier added to each sample?	✓			
Were tracer/carrier recoveries within the QC limits?	✓			
<b>vii. Regional Quality Assurance and Quality Control</b>				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
<b>viii. Sample Result Verification</b>				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) < RL?			✓	

LDC #: 19125A09  
 SDG #: 210150

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2  
 Reviewer: MG  
 2nd Reviewer: [Signature]

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





**VALIDATION FINDINGS WORKSHEET**  
**Field Duplicates**

METHOD: Radiochemistry (Method: see cover)

N N/A  
 N N/A

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

Isotopes	Activity ( <u>PCi/g</u> )		by difference Qual parent only RPD-
	4	5	
Ra-228	1.67	0.442 U	1.228 ( $\leq 1.00$ ) J/UJ/A
Ra-226	2.31	1.24	1.07 ( $\downarrow$ ) Jdets/A

Isotopes	Activity (            )		RPD

Isotopes	Activity (            )		RPD

Isotopes	Activity (            )		RPD



LDC #: 19125A29  
SDG #: 210150

**VALIDATION FINDINGS WORKSHEET**  
**Level IV Recalculation Worksheet**

Page: 1 of 1  
Reviewer: MG  
2nd Reviewer: [Signature]

METHOD: Radiochemistry (Method: See Cover)

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

$$\%R = \frac{\text{Found}}{\text{True}} \times 100$$

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

Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	Recalculated		Reported		Acceptable (Y/N)
					%R or RPD	%R or RPD			
LCS	Laboratory control sample	Ra-226	10.5 (pci/g)	9.70 (pci/g)	108	108			Y
TSB-GJ-08-10 MS	Matrix spike sample	Ra-226	10.35 (pci/g)	11.6 (pci/g)	89	90			
TSB-GJ-09-10 DUP	Duplicate RPD	Ra-228	2.73 u (pci/g)	1.29 (pci/g)	72	72			
1	Chemical recovery	Ba-133 for Ra-228	161.9 (cpm)	289.5 (cpm)	56	56			

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 #: 19125A29  
 SDG #: 210150

**VALIDATION FINDINGS WORKSHEET**  
**Sample Calculation Verification**

Page: 1 of 1  
 Reviewer: MG  
 2nd reviewer: [Signature]

METHOD: Radiochemistry (Method: see cover)

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

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

Analyte results for # 1, Ra-228 reported with a positive detect were recalculated and verified using the following equation:

Activity = 
$$\frac{(cpm - bckgrd\ cpm)}{(2.22)(E)(Vol)(CF)} = \frac{(64/90) - 0.356}{(2.22)(0.6792)(0.500g)(0.5592)} \times \frac{1}{0.999} \times \frac{1}{0.669} \times 1.087 = 1.384\ \text{pCi/g}$$

Recalculation:

E = Efficiency  
 Vol = Volume  
 CF = %R, Self-absorbance, abundance, ect.

#	Sample ID	Analyte	Reported Concentration (pCi/g)	Calculated Concentration (pCi/g)	Acceptable (Y/N)
1	1	Ra-228	1.38	1.38	Y
		Ra-226	1.26	1.26	↓

Note: \_\_\_\_\_

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

**Project/Site Name:** BRC Tronox Parcel C/D/F/G/H  
**Collection Date:** June 11, 2008  
**LDC Report Date:** July 29, 2008  
**Matrix:** Soil/Water  
**Parameters:** Radium-226 & Radium-228  
**Validation Level:** EPA Level III  
**Laboratory:** GEL Laboratories, LLC.  
**Sample Delivery Group (SDG):** 210228

**Sample Identification**

TSB-GJ-08-10  
TSB-GJ-08-20  
TSB-GJ-08-30  
TSB-GJ-08-40  
TSB-GJ-09-10  
TSB-GJ-09-20  
TSB-GJ-09-30  
TSB-GJ-09-40  
Rinsate 1  
TSB-GJ-08-10MS  
TSB-GJ-08-10MSD  
TSB-GJ-08-10DUP

## Introduction

This data review covers 11 soil samples and one water sample 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.

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.
- 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.
- UU 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) with the following exceptions:

Method Blank ID	Isotope	Activity (pCi/L)	Associated Samples
PBW	Radium-228	0.753	All water samples in SDG 210228

No sample data were qualified based on the contaminants found in the method blanks.

Sample "Rinsate 1" was identified as a rinsate. No radium-226 or radium-228 was found in this blank with the following exceptions:

Rinsate ID	Sampling Date	Isotope	Concentration	Associated Samples
Rinsate 1	6/11/08	Radium-226	0.505 pCi/L	All soil samples in SDG 210228

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
TSB-GJ-08-10	Radium-226	0.949 pCi/g	1.00U pCi/g
TSB-GJ-09-30	Radium-226	0.327 pCi/g	1.00U pCi/g

#### 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 with the following exceptions:

DUP ID (Associated Samples)	Analyte	Difference (Limits)	Flag	A or P
TSB-GJ-08-10DUP (All soil samples in SDG 210228)	Radium-228	1.44 pCi/g ( $\leq 1.00$ )	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. Chemical Recovery

All chemical recoveries were within validation criteria.

#### V. Minimum Detectable Activity

All minimum detectable activities met required detection limits.

The QAPP reporting limits were met with the following exceptions:

Sample	Analyte	Sample MDA	Required Detection Limit (RDL)	Flag	A or P
TSB-GJ-08-10	Radium-228	1.15 pCi/g	1.0 pCi/g	None	P
TSB-GJ-08-20	Radium-228	1.29 pCi/g	1.0 pCi/g	None	P

Sample	Analyte	Sample MDA	Required Detection Limit (RDL)	Flag	A or P
TSB-GJ-08-30 TSB-GJ-09-20	Radium-228	1.02 pCi/g	1.0 pCi/g	None	P
TSB-GJ-08-40	Radium-228	1.13 pCi/g	1.0 pCi/g	None	P
TSB-GJ-09-10	Radium-228	1.45 pCi/g	1.0 pCi/g	None	P
TSB-GJ-09-30 TSB-GJ-09-40	Radium-228	1.01 pCi/g	1.0 pCi/g	None	P

### VI. Sample Result Verification

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.

**BRC Tronox Parcel C/D/F/G/H  
Radium-226 & Radium-228 - Data Qualification Summary - SDG 210228**

SDG	Sample	Isotope	Flag	A or P	Reason
210228	TSB-GJ-08-10 TSB-GJ-08-20 TSB-GJ-08-30 TSB-GJ-08-40 TSB-GJ-09-10 TSB-GJ-09-20 TSB-GJ-09-30 TSB-GJ-09-40	Radium-228	J (all detects) UJ (all non-detects)	A	Duplicate analysis (Difference)
210228	TSB-GJ-08-10 TSB-GJ-08-20 TSB-GJ-08-30 TSB-GJ-09-20 TSB-GJ-08-40 TSB-GJ-09-10 TSB-GJ-09-30 TSB-GJ-09-40	Radium-228	None	P	Minimum detectable activity

**BRC Tronox Parcel C/D/F/G/H  
Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG  
210228**

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 210228**

SDG	Sample	Isotope	Modified Final Concentration	A or P
210228	TSB-GJ-08-10	Radium-226	1.00U pCi/g	A
210228	TSB-GJ-09-30	Radium-226	1.00U pCi/g	A



LDC #: 19125B29

**VALIDATION COMPLETENESS WORKSHEET**

Date: 7-22-08

SDG #: 210228

Level III

Page: 1 of 1

Laboratory: GEL Laboratories LLC

Reviewer: MG

2nd Reviewer: [Signature]

9m A  
Mod

Mod

**METHOD:** Radium 226 (EPA Method 903.1/~~GL-RAD-A-008~~ REV #12) Radium 228 (EPA Method 904.0/~~GL-RAD-A-009~~ REV #14)

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: 6-11-08
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	SW	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS/MSD/DUP (SDG: 209606, 210334)
IVb.	Laboratory control samples	A	LCS
IVc.	Chemical recovery	A	
V.	Sample result verification	N	
VI.	Minimum detectable activity (MDA)	SW	
VII.	Overall assessment of data	A	
VIII.	Field duplicates	N	
XIV.	Field blanks	SW	R = 9

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:

1	TSB-GJ-08-10	S	11	TSB-GJ-08-10MSD <sup>226, 228</sup>	S	21		31	
2	TSB-GJ-08-20		12	TSB-GJ-08-10DUP <sup>226, 228</sup>	↓	22		32	
3	TSB-GJ-08-30		13			23		33	
4	TSB-GJ-08-40		14			24		34	
5	TSB-GJ-09-10		15			25		35	
6	TSB-GJ-09-20		16			26		36	
7	TSB-GJ-09-30		17			27		37	
8	TSB-GJ-09-40		18			28		38	
9	Rinsate 1	W	19			29		39	
10	TSB-GJ-08-10MS <sup>226, 228</sup>	S	20			30		40	

Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

LDC #: 19125 B29  
SDG #: 210228

**VALIDATION FINDINGS WORKSHEET**  
**Blanks**

Page: 1 of 1  
Reviewer: MG  
2nd Reviewer: [Signature]

METHOD: Radiochemistry (Method: See cover)

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

Units: pCi/L Associated Samples: all water

Isotope	Blank ID	Blank Action Level	Sample Identification			
Ra-228	PBW	0.753	No sample was qualified			

Units: Associated Samples:

Isotope	Blank ID	Blank Action Level	Sample Identification			

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 #: 19125B29  
 SDG #: 210228

**VALIDATION FINDINGS WORKSHEET**  
**Field Blanks**

Page: 1 of 1  
 Reviewer: MG  
 2nd Reviewer: [Signature]

METHOD: Radiochemistry (Method: See cover)

N N/A Were field blanks identified in this SDG?  
 N N/A Were target isotopes detected in the field blanks?  
 Blank units: pCi/L Associated sample units: pCi/g  
 Sampling date: 6-11-08  
 Field blank type: (circle one) Field Blank / ~~Rinsate~~ / Other: \_\_\_\_\_

Associated Samples: all soil

Analyte	Blank ID	Blank Action Limit	Sample Identification															
	9		1	7														
Ra-226	0.505		0.949 / 1.00	0.327 / 1.00														

Blank units: \_\_\_\_\_ Associated sample units: \_\_\_\_\_  
 Sampling date: \_\_\_\_\_  
 Field blank type: (circle one) Field Blank / Rinsate / Other: \_\_\_\_\_

Analyte	Blank ID	Blank Action Limit	Sample Identification															

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





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

**Project/Site Name:** BRC Tronox Parcel C/D/F/G/H

**Collection Date:** June 12, 2008

**LDC Report Date:** July 29, 2008

**Matrix:** Soil/Water

**Parameters:** Radium-226 & Radium-228

**Validation Level:** EPA Level III

**Laboratory:** GEL Laboratories, LLC.

**Sample Delivery Group (SDG):** 210334

**Sample Identification**

TSB-CJ-09-0  
TSB-CJ-09-10  
Rinsate 2  
TSB-CJ-09-0MS  
TSB-CJ-09-0MSD  
TSB-CJ-09-0DUP  
Rinsate 2MS  
Rinsate 2MSD  
Rinsate 2DUP

## Introduction

This data review covers 4 soil samples and 4 water 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.

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.
- 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.
- UU 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) with the following exceptions:

Method Blank ID	Isotope	Activity (pCi/L)	Associated Samples
PBW	Radium-228	0.753	All water samples in SDG 210334

No sample data were qualified based on the contaminants found in the method blanks.

Sample "Rinsate 2" was identified as a rinsate. No radium-226 or radium-228 was found in this blank.

## 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.

The QAPP reporting limits were met with the following exceptions:

Sample	Analyte	Sample MDA	Required Detection Limit (RDL)	Flag	A or P
TSB-CJ-09-0	Radium-228	2.34 pCi/g	1.0 pCi/g	None	P
TSB-CJ-09-10	Radium-228	1.02 pCi/g	1.0 pCi/g	None	P

**VI. Sample Result Verification**

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.

**BRC Tronox Parcel C/D/F/G/H  
Radium-226 & Radium-228 - Data Qualification Summary - SDG 210334**

SDG	Sample	Isotope	Flag	A or P	Reason
210334	TSB-CJ-09-0 TSB-CJ-09-10	Radium-228	None	P	Minimum detectable activity

**BRC Tronox Parcel C/D/F/G/H  
Radium-226 & Radium-228 - Laboratory Blank Data Qualification Summary - SDG 210334**

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 210334**

No Sample Data Qualified in this SDG

LDC #: 19125C29

**VALIDATION COMPLETENESS WORKSHEET**

Date: 7-22-08

SDG #: 210334

Level III

Page: 1 of 1

Laboratory: GEL Laboratories LLC

Reviewer: MG

2nd Reviewer: [checkmark]

**METHOD:** Radium 226 (EPA Method 903.1/<sup>Mod</sup>~~GL-RAD-A-008 REV #12~~) Radium 228 (EPA Method 904.0/<sup>Mod</sup>~~GL-RAD-A-009 REV#14~~)

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: 6-12-08
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	SW	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/MSD/DUP (SDG: 209606)
IVb.	Laboratory control samples	A	LCS
IVc.	Chemical recovery	A	
V.	Sample result verification	N	
VI.	Minimum detectable activity (MDA)	SW	
VII.	Overall assessment of data	A	
VIII.	Field duplicates	N	
XIV.	Field blanks	ND	R=3

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:

1	TSB-CJ-09-0	S	11 <sup>2</sup>	PBW	21	31
2	TSB-CJ-09-10	↓	12		22	32
3 <sup>2</sup>	Rinsate 2	W	13		23	33
4	TSB-CJ-09-0MS <sup>226, 228</sup>	S	14		24	34
5	TSB-CJ-09-0MSD <sup>226, 228</sup>	↓	15		25	35
6	TSB-CJ-09-0DUP <sup>226, 228</sup>	↓	16		26	36
7 <sup>2</sup>	Rinsate 2 MS <sup>228</sup>	W	17		27	37
8 <sup>2</sup>	Rinsate 2 MSD <sup>228</sup>	↓	18		28	38
9 <sup>2</sup>	Rinsate 2 DUP <sup>228</sup>	↓	19		29	39
10 <sup>1</sup>	PB 5		20		30	40

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_





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

**Project/Site Name:** BRC Tronox Parcel C/D/F/G/H  
**Collection Date:** June 10, 2008  
**LDC Report Date:** July 30, 2008  
**Matrix:** Soil  
**Parameters:** Isotopic Uranium & Isotopic Thorium  
**Validation Level:** EPA Level III & IV  
**Laboratory:** GEL Laboratories, LLC.

**Sample Delivery Group (SDG):** 210150

**Sample Identification**

TSB-FJ-06-02-10\*\*  
TSB-FJ-06-02-20  
TSB-FJ-06-02-30\*\*  
TSB-FR-02-02-10  
TSB-FR-02-02-10-FD  
TSB-FR-02-02-20\*\*  
TSB-FR-02-02-30  
TSB-FJ-02-02-10\*\*  
TSB-FJ-02-02-20  
TSB-FJ-02-02-30

\*\*Indicates sample underwent EPA Level IV review

## Introduction

This data review covers 10 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	Uranium-233/234	0.461	All samples in SDG 210150

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

Sample	Isotope	Reported Concentration	Modified Final Concentration
TSB-FJ-06-02-10**	Uranium-233/234	0.829 pCi/g	100U pCi/g
TSB-FJ-02-02-10**	Uranium-233/234	0.987 pCi/g	100U pCi/g

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.

The QAPP reporting limits were met with the following exceptions:

Sample	Analyte	Sample MDA	Required Detection Limit (RDL)	Flag	A or P
TSB-FJ-06-02-30**	Uranium-233/234 Uranium-238	1.42 pCi/g 1.18 pCi/g	1.0 pCi/g 1.0 pCi/g	None None	P

#### 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-FR-02-02-10 and TSB-FR-02-02-10-FD were identified as field duplicates. No isotopic uranium or isotopic thorium was detected in any of the samples with the following exceptions:

Isotope	Concentration (pCi/g)		RPD (Limits)	Difference (Limits)	Flags	A or P
	TSB-FR-02-02-10	TSB-FR-02-02-10-FD				
Thorium-228	1.46	1.67	-	0.21 ( $\leq 1.00$ )	-	-
Thorium-230	1.01	0.847	-	0.163 ( $\leq 1.00$ )	-	-
Thorium-232	1.25	1.12	-	0.13 ( $\leq 1.00$ )	-	-
Uranium-233/234	1.26	1.76	-	0.50 ( $\leq 1.00$ )	-	-
Uranium-238	0.696	1.73	-	1.034 ( $\leq 1.00$ )	J (all detects)	A

**BRC Tronox Parcel C/D/F/G/H  
Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 210150**

SDG	Sample	Isotope	Flag	A or P	Reason
210150	TSB-FJ-06-02-30**	Uranium-233/234 Uranium-238	None None	P	Minimum detectable activity
210150	TSB-FR-02-02-10 TSB-FR-02-02-10-FD	Uranium-238	J (all detects)	A	Field duplicates (Difference)

**BRC Tronox Parcel C/D/F/G/H  
Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification Summary - SDG 210150**

SDG	Sample	Isotope	Modified Final Concentration	A or P
210150	TSB-FJ-06-02-10**	Uranium-233/234	100U pCi/g	A
210150	TSB-FJ-02-02-10**	Uranium-233/234	100U pCi/g	A

**BRC Tronox Parcel C/D/F/G/H  
Isotopic Uranium & Isotopic Thorium - Field Blank Data Qualification Summary - SDG 210150**

No Sample Data Qualified in this SDG

**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: 6-10-08
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	SW	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/MSD/DUP (SDG: 210223)
IVa.	Laboratory control samples	A	LCS
V.	Tracer Recovery	A	
VI.	Minimum Detectable Activity (MDA)	SW	
VII.	Sample result verification	A	Not reviewed for Level III validation.
VIII.	Overall assessment of data	A	
IX.	Field duplicates	SW	D = 4 + 5
X.	Field blanks	N	

Note: A = Acceptable      ND = No compounds detected      D = Duplicate  
 N = Not provided/applicable      R = Rinsate      TB = Trip blank  
 SW = See worksheet      FB = Field blank      EB = Equipment blank

Validated Samples: \*\* Indicates sample underwent Level IV validation

all soil

1	TSB-FJ-06-02-10**	11	PBS	21	31
2	TSB-FJ-06-02-20	12		22	32
3	TSB-FJ-06-02-30**	13		23	33
4	TSB-FR-02-02-10	14		24	34
5	TSB-FR-02-02-10-FD	15		25	35
6	TSB-FR-02-02-20**	16		26	36
7	TSB-FR-02-02-30	17		27	37
8	TSB-FJ-02-02-10**	18		28	38
9	TSB-FJ-02-02-20	19		29	39
10	TSB-FJ-02-02-30	20		30	40

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

LDC #: 19125A59  
 SDG #: 210150

VALIDATION FINDINGS CHECKLIST

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

Method: Radiochemistry (EPA Method *see cover*)

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
All technical holding times were met.	✓			
<b>II. Calibration</b>				
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 required frequency and within laboratory control limits?	✓			
<b>III. Blanks</b>				
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.	✓			
<b>IV. Matrix spikes and Duplicates</b>				
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 ratios (DER) $\leq 1.42$ ?	✓			
<b>V. Laboratory control samples</b>				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%?	✓			
<b>VI. Sample Chemical/Carrier Recovery</b>				
Was a tracer/carrier added to each sample?	✓			
Were tracer/carrier recoveries within the QC limits?	✓			
<b>VII. Regional Quality Assurance and Quality Control</b>				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
<b>VIII. Sample Result Verification</b>				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) < RL?			✓	

LDC #: 19125A59  
 SDG #: 210150

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2  
 Reviewer: MG  
 2nd Reviewer: [Signature]

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







**VALIDATION FINDINGS WORKSHEET**  
**Field Duplicates**

METHOD: Radiochemistry (Method: See cover)

- N N/A Were field duplicate pairs identified in this SDG?  
 N N/A Were target isotopes detected in the field duplicate pairs?

Isotopes	Activity ( pCi/g )		by difference Qual parent only RPD
	4	5	
Th-228	1.46	1.67	0.21 ( ≤ 1.00 )
Th-230	1.01	0.847	0.163 (   )
Th-232	1.25	1.12	0.13 (   )
U-233/234	1.26	1.76	0.50 (   )
U-238	0.696	1.73	1.034 ( ↓ ) Jdets/A

Isotopes	Activity ( )		RPD

Isotopes	Activity ( )		RPD

Isotopes	Activity ( )		RPD

LDC #: 19125A59  
 SDG #: 210150

**VALIDATION FINDINGS WORKSHEET**  
**Level IV Recalculation Worksheet**

Page: 1 of 1  
 Reviewer: MG  
 2nd Reviewer: [Signature]

METHOD: Radiochemistry (Method: See cover)

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

$$\%R = \frac{\text{Found}}{\text{True}} \times 100$$
 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

Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	Recalculated		Reported		Acceptable (Y/N)
					%R or RPD	%R or RPD	%R or RPD	%R or RPD	
LCS	Laboratory control sample	U-233	24.3 (pci/g)	23.8 (pci/g)	102		102		Y
TSB-GJ-08-10 MS	Matrix spike sample	Th-232	10.19 (pci/g)	10.1 (pci/g)	101		101		
TSB-GJ-08-10 DUP	Duplicate RPD	U-233/234	1.52 (pci/g)	1.68 (pci/g)	10		10		
1	Chemical recovery	Th-229	2.21153 (dpm)	2.27964 (dpm)	97		97		

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 #: 19125A59  
SDG #: 210150

VALIDATION FINDINGS WORKSHEET  
Sample Calculation Verification

Page: 1 of 1  
Reviewer: MG  
2nd reviewer: [Signature]

METHOD: Radiochemistry (Method: See cover)

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

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

Analyte results for #1 Th-230 reported with a positive detect were recalculated and verified using the following equation:

Activity = 
$$\frac{(cpm - bckgrd\ cpm)}{(2.22)(E)(Vol)(CF)}$$

Recalculation: 
$$\frac{(47.489^*)}{505} = 1.449\ \text{pCi/g}$$

\* net area corrected due to tracer impurity

$$(2.22)(0.142092)(0.212g)(0.97012)$$

E = Efficiency  
Vol = Volume  
CF = %R, Self-absorbance, abundance, ect.

#	Sample ID	Analyte	Reported Concentration (pCi/g)	Calculated Concentration (pCi/g)	Acceptable (Y/N)
1	1	Th-228	1.85	1.83	Y
		Th-230	1.45	1.45	
		Th-232	1.66	1.66	
		U-233/234	0.829	0.829	
		U-238	1.42	1.42	↓

Note: \_\_\_\_\_

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

**Project/Site Name:** BRC Tronox Parcel C/D/F/G/H  
**Collection Date:** June 11, 2008  
**LDC Report Date:** July 30, 2008  
**Matrix:** Soil/Water  
**Parameters:** Isotopic Uranium & Isotopic Thorium  
**Validation Level:** EPA Level III  
**Laboratory:** GEL Laboratories, LLC.

**Sample Delivery Group (SDG):** 210228

**Sample Identification**

- TSB-GJ-08-10
- TSB-GJ-08-20
- TSB-GJ-08-30
- TSB-GJ-08-40
- TSB-GJ-09-10
- TSB-GJ-09-20
- TSB-GJ-09-30
- TSB-GJ-09-40
- Rinsate 1
- TSB-GJ-08-10MS
- TSB-GJ-08-10MSD
- TSB-GJ-08-10DUP
- TSB-GJ-08-10MSRE
- TSB-GJ-08-10DUPRE

## Introduction

This data review covers 13 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.

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.

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.
- 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
PBS1	Uranium-233/234	0.212	TSB-GJ-08-20 TSB-GJ-08-30 TSB-GJ-08-40 TSB-GJ-09-10 TSB-GJ-09-20 TSB-GJ-09-30 TSB-GJ-09-40
PBS2	Uranium-233/234	0.416	TSB-GJ-08-10

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

Sample "Rinsate 1" was identified as a rinsate. No isotopic uranium or isotopic thorium were found in this blank.



#### **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**

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.

**BRC Tronox Parcel C/D/F/G/H  
Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 210228**

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 210228**

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 210228**

No Sample Data Qualified in this SDG

**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: 6-11-08
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	SW	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	A	MS/MSD/DUP (SDG: 210334)
IVa.	Laboratory control samples	A	LCS
V.	Tracer Recovery	A	
VI.	Minimum Detectable Activity (MDA)	A	
VII.	Sample result verification	N	
VIII.	Overall assessment of data	A	
IX.	Field duplicates	N	
X.	Field blanks	ND	R = 9

Note: A = Acceptable      ND = No compounds detected      D = Duplicate  
 N = Not provided/applicable      R = Rinsate      TB = Trip blank  
 SW = See worksheet      FB = Field blank      EB = Equipment blank

Validated Samples:

1 <sup>3</sup>	TSB-GJ-08-10	S	11 <sup>3</sup>	TSB-GJ-08-10MSD <sup>Th, U</sup> S	21		31
2 <sup>1</sup>	TSB-GJ-08-20		12 <sup>1</sup>	TSB-GJ-08-10DUP <sup>Th, U</sup> ↓	22		32
3 <sup>1</sup>	TSB-GJ-08-30		13 <sup>1</sup>	PBS1	23		33
4 <sup>1</sup>	TSB-GJ-08-40		14 <sup>2</sup>	PBW	24		34
5 <sup>1</sup>	TSB-GJ-09-10		15 <sup>3</sup>	PBS2	25		35
6 <sup>1</sup>	TSB-GJ-09-20		16 <sup>3</sup>	TSB-GJ-08-10MSRE <sup>U</sup>	26		36
7 <sup>1</sup>	TSB-GJ-09-30		17 <sup>3</sup>	TSB-GJ-08-10DUPRE <sup>U</sup>	27		37
8 <sup>1</sup>	TSB-GJ-09-40	↓	18		28		38
9 <sup>2</sup>	Rinsate 1	W	19		29		39
10 <sup>1</sup>	TSB-GJ-08-10MS <sup>Th, U</sup>	S	20		30		40

Notes: \_\_\_\_\_  
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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 12, 2008  
**LDC Report Date:** July 30, 2008  
**Matrix:** Soil/Water  
**Parameters:** Isotopic Uranium & Isotopic Thorium  
**Validation Level:** EPA Level III  
**Laboratory:** GEL Laboratories, LLC.

**Sample Delivery Group (SDG):** 210334

**Sample Identification**

TSB-CJ-09-0  
TSB-CJ-09-10  
Rinsate 2  
TSB-CJ-09-0MS  
TSB-CJ-09-0MSD  
TSB-CJ-09-0DUP  
Rinsate 2MS  
Rinsate 2MSD  
Rinsate 2DUP

## Introduction

This data review covers 5 soil samples and 4 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.

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.

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.
- UU 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).

Sample "Rinsate 2" was identified as a rinsate. No isotopic uranium or isotopic thorium were found in this blank.

## 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 with the following exceptions:

DUP ID (Associated Samples)	Analyte	Difference (Limits)	Flag	A or P
TSB-CJ-09-0DUP (All soil samples in SDG 210334)	Thorium-228	1.52 pCi/g ( $\leq 1.00$ )	J (all detects) UJ (all non-detects)	A
	Thorium-230	1.88 pCi/g ( $\leq 1.00$ )	J (all detects) UJ (all non-detects)	

## 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.

The QAPP reporting limits were met with the following exceptions:

Sample	Analyte	Sample MDA	Required Detection Limit (RDL)	Flag	A or P
TSB-CJ-09-0	Thorium-228 Thorium-232	1.26 pCi/g 1.05 pCi/g	1.0 pCi/g 1.0 pCi/g	None None	P
TSB-CJ-09-10	Thorium-228 Thorium-230 Thorium-232	1.31 pCi/g 1.09 pCi/g 1.09 pCi/g	1.0 pCi/g 1.0 pCi/g 1.0 pCi/g	None None None	P

## VI. Sample Result Verification

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.

**BRC Tronox Parcel C/D/F/G/H  
Isotopic Uranium & Isotopic Thorium - Data Qualification Summary - SDG 210334**

SDG	Sample	Isotope	Flag	A or P	Reason
210334	TSB-CJ-09-0 TSB-CJ-09-10	Thorium-228 Thorium-230	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Duplicate analysis (Difference)
210334	TSB-CJ-09-0	Thorium-228 Thorium-232	None None	P	Minimum detectable activity
210334	TSB-CJ-09-10	Thorium-228 Thorium-230 Thorium-232	None None None	P	Minimum detectable activity

**BRC Tronox Parcel C/D/F/G/H  
Isotopic Uranium & Isotopic Thorium - Laboratory Blank Data Qualification  
Summary - SDG 210334**

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 210334**

No Sample Data Qualified in this SDG

**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: 6-12-09
IIa.	Initial calibration	A	
IIb.	Calibration verification	A	
III.	Blanks	A	
IVa.	Matrix Spike/(Matrix Spike) Duplicates	SW	MS/MSD/DUP
IVa.	Laboratory control samples	A	LCS
V.	Tracer Recovery	A	
VI.	Minimum Detectable Activity (MDA)	SW	
VII.	Sample result verification	N	
VIII.	Overall assessment of data	A	
IX.	Field duplicates	N	
X.	Field blanks	ND	R=3

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:

1	TSB-CJ-09-0	S	11 <sup>2</sup>	PBW	21	31
2	TSB-CJ-09-10	I	12		22	32
3 <sup>2</sup>	Rinsate 2	W	13		23	33
4	TSB-CJ-09-0MS <sup>Th,U</sup>	S	14		24	34
5	TSB-CJ-09-0MSD <sup>Th,U</sup>		15		25	35
6	TSB-CJ-09-0DUP <sup>Th,U</sup>		16		26	36
7 <sup>2</sup>	Rinsate 2MS <sup>Th,U</sup>	W	17		27	37
8 <sup>2</sup>	Rinsate 2MSD <sup>Th,U</sup>		18		28	38
9 <sup>2</sup>	Rinsate 2DUP <sup>Th,U</sup>		19		29	39
10 <sup>1</sup>	PBS		20		30	40

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
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