Appendix J: Data Validation Reports

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Tidewater, Inc.
3761 Attucks Drive
Powell, OH 43065
ATTN: Mr. Ryan Wensink, PE

February 1, 2019

SUBJECT: Phase 1 RI OU2 Great Kills Park, Data Validation

Dear Mr. Wensink,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on December 13, 2018. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #43996:

SDG #	Fraction
1810475, 1810637	Uranium, Gross Alpha Beta, Radium-226, Radium-228

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

- Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York, September 2018
- Final Radionuclide Data Quality Evaluation Guidance, September 2008
- Multi Agency Radiological Laboratory Analytical Protocols, MARLAP, Manual, July 2004
- USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review; January 2017

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

Sincerely,

Pei Geng
pgeng@lab-data.com
Project Manager/Senior Chemist

Attachment 1

Level IV

LDC #43996 (Tidewater-Powell, OH / Phase 1 RI OU2 Great Kills Park)

LDC	SDG#	DATE REC'D	(3) DATE DUE	U (200.8)		Diss. U (200.8)		Gross α & β (724R13)		Ra-226 (903.1)		Ra-228 (724R13)																									
Matrix:	Water/Soil			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
A	1810475	12/13/18	01/09/19	6	0	-	-	6	0	6	0	6	0																						
B	1810637	12/13/18	01/09/19	2	0	1	0	3	0	3	0	3	0																						
Total	J/PG			8	0	1	0	9	0	9	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36

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

L:\Tidewater\Great Kills Park\43996ST.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 7, 2019

Parameters: Uranium

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1810475

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-SW001	1810475-1	Water	10/18/18
OU2-1-SW003	1810475-2	Water	10/18/18
OU2-1-SW004	1810475-3	Water	10/18/18
REF-1-SW001	1810475-4	Water	10/18/18
OU1-1-SW005	1810475-5	Water	10/19/18
OU2-1-SW002	1810475-6	Water	10/19/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Uranium by Environmental Protection Agency (EPA) Method 200.8

All sample results were subjected to Level IV evaluation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

IX. Serial Dilution

Serial dilution was not performed for this SDG.

X. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

All internal standard percent recoveries (%R) were within QC limits.

XIII. Sample Result Verification

All sample result verifications were acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Uranium - Data Qualification Summary - SDG 1810475

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Uranium - Laboratory Blank Data Qualification Summary - SDG 1810475

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Uranium - Field Blank Data Qualification Summary - SDG 1810475

No Sample Data Qualified in this SDG

LDC #: 43996A4a
SDG #: 1810475
Laboratory: ALS Environmental

VALIDATION COMPLETENESS WORKSHEET
Level IV

Date: 1-3-19
Page: 1 of 1
Reviewer: MG
2nd Reviewer:

METHOD: Uranium (EPA Method 200.8)

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.	Sample receipt/Technical holding times	A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	N	not performed
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	A	
XIII.	Sample Result Verification	A	
XIV	Overall Assessment of Data	A	

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; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	OU2-1-SW001	1810475-1	Water	10/18/18
2	OU2-1-SW003	1810475-2	Water	10/18/18
3	OU2-1-SW004	1810475-3	Water	10/18/18
4	REF-1-SW001	1810475-4	Water	10/18/18
5	OU1-1-SW005	1810475-5	Water	10/19/18
6	OU2-1-SW002	1810475-6	Water	10/19/18
7				
8				
9				
10				
11				
12	PBW			

Notes:

LDC #: 43996A4a

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: [signature]

Method: Metals (EPA SW 846 Method 6010/7000/6020)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?	✓			
Were %RSD of isotopes in the tuning solution ≤5%?	✓			
III. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury) QC limits?	✓			
Were all initial calibration correlation coefficients > 0.995?	✓			
IV. Blanks				
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.		✓		
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	✓			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	✓			
VI. Matrix spike/Matrix spike 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.			✓	
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were ≤ 5X the RL.			✓	
VII. Laboratory control samples				
Was an LCS anaylzed 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% QC limits for water samples and laboratory established QC limits for soils?	✓			

Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
Were all the percent recoveries (%R) within the 30-120% (6020)/60-125% (200.8) of the intensity of the internal standard in the associated initial calibration?	✓			
If the %Rs were outside the criteria, was a reanalysis performed?			✓	
IX. ICP Serial Dilution				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the MDL (ICP)/>100X the MDL(ICP/MS)?		✓		
Were all percent differences (%Ds) < 10%?			✓	
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.			✓	
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.		✓		
Target analytes were detected in the field duplicates.			✓	
XIII. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 43996A4a

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer: [illegible]

METHOD: Trace metals (EPA SW 846 Method 6010/6020/7000)

An initial and 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 (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution
True = concentration (in ug/L) of each analyte in the ICV or CCV source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalculated %R	Reported %R	Acceptable (Y/N)
	ICP (Low Level calibration)						
	ICP/MS (Low Level calibration)						
	ICP (Initial calibration)						
1030 ICV	ICP/MS (Initial calibration)	U	1.9948	2	100	100	Y
	CVAA (Initial calibration)						↓
	ICP (Continuing calibration)						
1539 CCV9	ICP/MS (Continuing calibration)	U	1.0317	1	103	103	↓
	CVAA (Continuing calibration)						

ICP-MS TUNE	Calculation	Mass	Actual (Mean Counts / Axis)	Required (Counts / Axis)	Recalculated %RSD	Acceptable (Y/N)
QCTUNE	Mass Axis	208	208.00	± 0.1 AMU	NA	Y
↓	%RSD	26	0.99	≤ 5% RSD	0.99	↓

Comments:

LDC #: 43996A4a

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: e

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

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

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

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

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

$\%D = \frac{|I-SDR|}{I} \times 100$ Where, I = Initial Sample Result (mg/L)
SDR = Serial Dilution Result (mg/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I (units)	True / D / SDR (units)	Recalculated %R / RPD / %D	Reported %R / RPD / %D	Acceptable (Y/N)
1052 ICSAB1	ICP interference check	U	0.0010203 (mg/L)	0.001 (mg/L)	102	102	Y
1554 LCS	Laboratory control sample	U	9.920 (µg/L)	10 (µg/L)	99	99	↓
—	Matrix spike	—	(SSR-SR) —	—	—	—	—
—	Duplicate	—	—	—	—	—	—
—	ICP serial dilution	—	—	—	—	—	—

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 #: 43996A4a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

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 and within the linear range of the ICP?
(Y) N N/A Are all detection limits below the CRDL?

Detected analyte results for #1, U were recalculated and verified using the following equation:

Concentration = $\frac{(RD)(FV)(Dil)}{(In.\ Vol.)}$

RD = Raw data concentration
FV = Final volume (ml)
In. Vol. = Initial volume (ml) or weight (G)
Dil = Dilution factor

Recalculation:

$$\frac{(0.0535\ \mu g/L)(0.050\ L)(10)}{0.050\ L} = 0.535\ \mu g/L$$

#	Sample ID	Analyte	Reported Concentration (µg/L)	Calculated Concentration (µg/L)	Acceptable (Y/N)
1	1	U	0.53	0.54	Y
2	2	U	0.41	0.41	
3	3	U	0.21	0.21	
4	4	U	0.36	0.36	
5	5	U	0.58	0.58	
6	6	U	0.25	0.25	

Note:

LDC Report# 43996A22

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 7, 2019

Parameters: Gross Alpha & Beta

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1810475

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-SW001	1810475-1	Water	10/18/18
OU2-1-SW003	1810475-2	Water	10/18/18
OU2-1-SW004	1810475-3	Water	10/18/18
REF-1-SW001	1810475-4	Water	10/18/18
OU1-1-SW005	1810475-5	Water	10/19/18
OU2-1-SW002	1810475-6	Water	10/19/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018), the Final Radionuclide Data Quality Evaluation Guidance (September 2008), the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Gross Alpha and Beta by PAI 724 Rev. 13

All sample results were subjected to Level IV data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

Counting and detector efficiency were determined for each detector and each radionuclide.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Laboratory blanks were analyzed as required by the method. Blank results contained less than the minimum detectable concentrations (MDC).

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Minimum Detectable Concentrations

All minimum detectable concentrations (MDC) met reporting limits (RL) with the following exceptions:

Sample	Isotope	MDC	RL
OU2-1-SW001	Gross alpha	3.7 pCi/L	3 pCi/L
OU2-1-SW003	Gross alpha Gross beta	6.8 pCi/L 6.9 pCi/L	3 pCi/L 4 pCi/L
OU2-1-SW002	Gross alpha	3.1 pCi/L	3 pCi/L

The MDC was greater than the RL as listed above.

XI. Sample Result Verification

All sample result verifications were acceptable.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Gross Alpha & Beta - Data Qualification Summary - SDG 1810475

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Gross Alpha & Beta - Laboratory Blank Data Qualification Summary - SDG 1810475

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Gross Alpha & Beta - Field Blank Data Qualification Summary - SDG 1810475

No Sample Data Qualified in this SDG

LDC #: 43996A22 **VALIDATION COMPLETENESS WORKSHEET** Date: 1-3-19
SDG #: 1810475 Level IV Page: 1 of 1
Laboratory: ALS Environmental MG Reviewer: MG
2nd Reviewer:

METHOD: Gross Alpha & Beta (~~EPA Method 900.0~~) PAI 724 Rev 13

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.	Sample receipt/Technical holding times	A	
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VII.	Duplicates	N	" "
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Minimum detectable activity (MDA)	SW	
XI.	Sample result verification	A	
XII.	Overall assessment of data	A	

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; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	OU2-1-SW001	1810475-1	Water	10/18/18
2	OU2-1-SW003	1810475-2	Water	10/18/18
3	OU2-1-SW004	1810475-3	Water	10/18/18
4	REF-1-SW001	1810475-4	Water	10/18/18
5	OU1-1-SW005	1810475-5	Water	10/19/18
6	OU2-1-SW002	1810475-6	Water	10/19/18
7				
8				
9				
10				
11				
12				
13				
14	PBW			

Notes:

LDC #: 43996A22

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: [illegible]

PAI 724 Rev 13

Method: Radiochemistry(EPA Method)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments and detectors calibration as required?	✓			
Were NIST traceable standards used for all calibrations?	✓			
Was the check source identified by activity and radionuclide?	✓			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	✓			
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) $\leq$1.42?.			✓	
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	✓			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?		✓		
Were tracer/carrier recoveries within the QC limits?			✓	
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) < RL?		✓		

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.		✓		
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 #: 43996A22

VALIDATION FINDINGS WORKSHEET
Minimum Detectable Activities

Reviewer: MG
2nd Reviewer: [illegible]

METHOD: Radiochemistry (Method: PAI 724 Rev 13)

The following sample ~~MDAs~~ MDC are above the RDL:

#	Sample ID	Isotope	RDL (units)	~~MDA~~ MDC (units)	Dilution	Qualifications
1	1	Gross Alpha	3 (pCi/L)	3.7 (pCi/L)		text
2	2	Gross Alpha	3 ( )	6.8 ( )		↓
	↓	Gross Beta	4 ( )	6.9 ( )		
3	6	Gross Alpha	3 ( )	3.1 ( )		

Comments: MDC = Minimum Detectable Concentration

LDC #: 43996A22

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: [illegible]

METHOD: Radiochemistry (Method: PAI 724 Rev. 13)

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 / True 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 = |S-D| / (S+D)/2 x 100 Where, S = Original sample activity
D = Duplicate sample activity

Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	Recalculated %R or RPD	Reported %R or RPD	Acceptable (Y/N)
LCS	Laboratory control sample	Gross Alpha	277 (pCi/L)	232.9 (pCi/L)	119	119	Y
-	Matrix spike sample	-	-	-	-	-	-
-	Duplicate RPD	-	-	-	-	-	-
-	Chemical recovery	-	-	-	-	-	-

Comments: _____

LDC #: 43996A22

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: Radiochemistry (Method: PAI 724 Rev 13)

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, Gross Beta reported with a positive detect were recalculated and verified using the following equation:

Concentration = $\frac{(cpm - background)}{2.22 \times E \times SA \times Vol}$

E = Counter Efficiency
SA = Self-absorbance factor
Vol = Volume of sample

Recalculation:

$$\frac{(1.982\ cpm) - (1.500\ cpm) - (0.0089\ cpm)}{(2.22)(0.4440)(0.060\ L)(0.939)} = 8.519\ pCi/L$$

#	Sample ID	Analyte	Reported Concentration (pCi/L)	Calculated Concentration (pCi/L)	Acceptable (Y/N)
1	1	Gross Beta	8.5	8.5	Y
2	2	Gross Alpha	10.2	10.1	
3	3	Gross Beta	7.3	7.3	
4	4	Gross Alpha	3.4	3.4	
5	5	Gross Beta	5.1	5.1	
6	6	Gross Alpha	3.5	3.5	

Note:

LDC Report# 43996A29a

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 7, 2019

Parameters: Radium-226

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1810475

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-SW001	1810475-1	Water	10/18/18
OU2-1-SW003	1810475-2	Water	10/18/18
OU2-1-SW004	1810475-3	Water	10/18/18
REF-1-SW001	1810475-4	Water	10/18/18
OU1-1-SW005	1810475-5	Water	10/19/18
OU2-1-SW002	1810475-6	Water	10/19/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018), the Final Radionuclide Data Quality Evaluation Guidance (September 2008), the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Radium-226 by Environmental Protection Agency (EPA) Method 903.1

All sample results were subjected to Level IV data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

Counting and detector efficiency were determined for each detector and each radionuclide.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Laboratory blanks were analyzed as required by the method. Blank results contained less than the minimum detectable concentrations (MDC).

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Minimum Detectable Concentrations

All minimum detectable concentrations (MDC) met reporting limits (RL).

XI. Sample Result Verification

All sample result verifications were acceptable.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Radium-226 - Data Qualification Summary - SDG 1810475

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Radium-226 - Laboratory Blank Data Qualification Summary - SDG 1810475

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Radium-226 - Field Blank Data Qualification Summary - SDG 1810475

No Sample Data Qualified in this SDG

LDC #: 43996A29a
SDG #: 1810475
Laboratory: ALS Environmental

VALIDATION COMPLETENESS WORKSHEET
Level IV

Date: 1-3-19
Page: 1 of 1
Reviewer: MG
2nd Reviewer:

METHOD: Radium 226 (EPA Method 903.1)

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.	Sample receipt/Technical holding times	A	
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VII.	Duplicates	N	" "
VIII.	Laboratory control samples	A	LCS/LCSD
IX.	Field duplicates	N	
X.	Carrier recovery	A	
XI.	Minimum detectable activity (MDA)	A	
XII.	Sample result verification	A	
XIII.	Overall assessment of data	A	

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; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	OU2-1-SW001	1810475-1	Water	10/18/18
2	OU2-1-SW003	1810475-2	Water	10/18/18
3	OU2-1-SW004	1810475-3	Water	10/18/18
4	REF-1-SW001	1810475-4	Water	10/18/18
5	OU1-1-SW005	1810475-5	Water	10/19/18
6	OU2-1-SW002	1810475-6	Water	10/19/18
7				
8				
9				
10				
11				
12				
13	PBW			

Notes:

LDC #: 43996A29a

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer:

Method: Radiochemistry (EPA Method 903.1)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments and detectors calibration as required?	✓			
Were NIST traceable standards used for all calibrations?	✓			
Was the check source identified by activity and radionuclide?	✓			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	✓			
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) $\leq$1.42?.			✓	
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	✓			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?	✓			
Were tracer/carrier recoveries within the QC limits?	✓			
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) < RL?	✓			

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.		✓		
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 #: 43996A29a

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: [illegible]

METHOD: Radiochemistry (Method: 903.1)

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 / True 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 = |S-D| / (S+D)/2 x 100 Where, S = Original sample activity
D = Duplicate sample activity

Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	Recalculated %R or RPD	Reported %R or RPD	Acceptable (Y/N)
LCS	Laboratory control sample	Ra-226	55.75 (pCi/L)	47.87 (pCi/L)	116	116	Y
-	Matrix spike sample	-	-	-	-	-	-
-	Duplicate RPD	-	-	-	-	-	-
1	Chemical recovery	Ba	14520 (mg)	17610 (mg)	82.5	82.5	Y

Comments: _____

LDC #: 43996A29a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: Radiochemistry (Method: 903.1)

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 # 2, Ra-226 reported with a positive detect were recalculated and verified using the following equation:

Concentration = $\frac{(cpm - background)}{2.22 \times E \times SA \times Vol}$

E = Counter Efficiency
SA = Self-absorbance factor
Vol = Volume of sample

Recalculation:

$$\frac{(28\ cts/15\ min) - (2\ cts/15\ min)}{(2.22)(1.5502)(0.995\ L)(0.912)} \times \frac{1}{0.752} \times \frac{1}{0.970} \times 1.001 = 0.762\ \frac{pCi}{L}$$

#	Sample ID	Analyte	Reported Concentration (pCi/L)	Calculated Concentration (pCi/L)	Acceptable (Y/N)
1	2	Ra-226	0.76	0.76	Y
2	5	Ra-226	0.47	0.47	
3	6	Ra-226	0.81	0.81	

Note: Samples 1, 3 and 4 are N.D.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 7, 2019

Parameters: Radium-228

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1810475

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-SW001	1810475-1	Water	10/18/18
OU2-1-SW003	1810475-2	Water	10/18/18
OU2-1-SW004	1810475-3	Water	10/18/18
REF-1-SW001	1810475-4	Water	10/18/18
OU1-1-SW005	1810475-5	Water	10/19/18
OU2-1-SW002	1810475-6	Water	10/19/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018), the Final Radionuclide Data Quality Evaluation Guidance (September 2008), the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Radium-228 by PAI 724 Rev. 13

All sample results were subjected to Level IV data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

Counting and detector efficiency were determined for each detector and each radionuclide.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Laboratory blanks were analyzed as required by the method. Blank results contained less than the minimum detectable concentrations (MDC).

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Minimum Detectable Concentrations

All minimum detectable concentrations (MDC) met reporting limits (RL) with the following exceptions:

Sample	Isotope	MDC	RL
OU2-1-SW001	Radium-228	3.3 pCi/L	1 pCi/L
OU2-1-SW003	Radium-228	3.2 pCi/L	1 pCi/L
OU2-1-SW004	Radium-228	3.0 pCi/L	1 pCi/L
REF-1-SW001	Radium-228	3.0 pCi/L	1 pCi/L
OU1-1-SW005	Radium-228	3.3 pCi/L	1 pCi/L
OU2-1-SW002	Radium-228	3.0 pCi/L	1 pCi/L

The MDC was greater than the RL as listed above.

XI. Sample Result Verification

All sample result verifications were acceptable.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Radium-228 - Data Qualification Summary - SDG 1810475

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Radium-228 - Laboratory Blank Data Qualification Summary - SDG 1810475

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Radium-228 - Field Blank Data Qualification Summary - SDG 1810475

No Sample Data Qualified in this SDG

LDC #: 43996A29b
SDG #: 1810475
Laboratory: ALS Environmental

VALIDATION COMPLETENESS WORKSHEET
Level IV

PAI 724 Rev. 13

Date: 1-4-19
Page: 1 of 1
Reviewer: MG
2nd Reviewer:

METHOD: Radium 228 (~~EPA Method 904.0~~) 9M4

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.	Sample receipt/Technical holding times	A	
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VII.	Duplicates	N	" "
VIII.	Laboratory control samples	A	LCS/LCSD
IX.	Field duplicates	N	
X.	Carrier recovery	A	
XI.	Minimum detectable activity (MDA)	SW	
XII.	Sample result verification	A	
XIII.	Overall assessment of data	A	

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; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	OU2-1-SW001	1810475-1	Water	10/18/18
2	OU2-1-SW003	1810475-2	Water	10/18/18
3	OU2-1-SW004	1810475-3	Water	10/18/18
4	REF-1-SW001	1810475-4	Water	10/18/18
5	OU1-1-SW005	1810475-5	Water	10/19/18
6	OU2-1-SW002	1810475-6	Water	10/19/18
7				
8				
9				
10				
11				
12				
13	PBW			

Notes:

LDC #: 43996A296

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer:

PAI 724 Rev. 13

Method: Radiochemistry(~~EPA Method~~)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments and detectors calibration as required?	✓			
Were NIST traceable standards used for all calibrations?	✓			
Was the check source identified by activity and radionuclide?	✓			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	✓			
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) $\leq$1.42?.			✓	
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	✓			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?	✓			
Were tracer/carrier recoveries within the QC limits?	✓			
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) < RL?		✓		

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.		✓		
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 #: 43996A296

VALIDATION FINDINGS WORKSHEET
Minimum Detectable Activities

Reviewer: MG
2nd Reviewer: [illegible]

METHOD: Radiochemistry (Method: PAI 724 Rev. 13)

The following sample ~~MDA~~MDCs are above the RDL: —— (pCi/L) ——

#	Sample ID	Isotope	RDL (units)	~~MDA~~ MDC (units)	Dilution	Qualifications
1	1	Ra-228	1	3.3		text
2	2			3.2		
3	3			3.0		
4	4			3.0		
5	5			3.3		
6	6			3.0		

Comments: MDC = Minimum Detectable Concentration

LDC #: 43996A29b

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: [signature]

METHOD: Radiochemistry (Method: PAI 724 Rev 13)

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 / True 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 = |S-D| / (S+D)/2 x 100 Where, S = Original sample activity
D = Duplicate sample activity

Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	Recalculated %R or RPD	Reported %R or RPD	Acceptable (Y/N)
LCS	Laboratory control sample	Ra-228	9.234 (pCi/L)	8.615 (pCi/L)	107	107	Y
-	Matrix spike sample	-	-	-	-	-	-
-	Duplicate RPD	-	-	-	-	-	-
1	Chemical recovery	Ba	27770 (µg)	31270 (µg)	88.8	88.8	Y

Comments: _____

LDC #: 43996A29b

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: Radiochemistry (Method: PAI 724 Rev 13)

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 #4, Ra-228 reported with a positive detect were recalculated and verified using the following equation:

Concentration = (cpm - background) / 2.22 x E x SA x Vol

Recalculation: decay

$$\frac{(7.627\ cpm) - (2.042\ cpm)}{(2.22)(0.4506)(0.249\ L)(0.965)} \times 1.266 = 29.416\ pCi/L$$

E = Counter Efficiency
SA = Self-absorbance factor
Vol = Volume of sample

#	Sample ID	Analyte	Reported Concentration (pCi/L)	Calculated Concentration (pCi/L)	Acceptable (Y/N)
1	4	Ra-228	29.8	29.4	Y

Note: samples 1, 2, 3, 5 and 6 are N.D.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 7, 2019

Parameters: Uranium

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1810637

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-MW008I	1810637-1	Water	10/30/18
OU2EB103018-001	1810637-3	Water	10/30/18
OU2-1-MW008IMS	1810637-1MS	Water	10/30/18
OU2-1-MW008IMSD	1810637-1MSD	Water	10/30/18
OU2-1-MW008I-F	1810637-2F	Water	10/30/18
OU2-1-MW008I-FMS	1810637-2FMS	Water	10/30/18
OU2-1-MW008I-FMSD	1810637-2FMSD	Water	10/30/18

Samples appended with "F" were analyzed for dissolved Uranium

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Uranium by Environmental Protection Agency (EPA) Method 200.8

All sample results were subjected to Level IV evaluation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample OU2EB103018-001 was identified as an equipment blank. No contaminants were found.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

IX. Serial Dilution

Serial dilution analysis was performed on an associated project sample. Percent differences (%D) were within QC limits.

X. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

No field duplicates were identified in this SDG.

XII. Internal Standards (ICP-MS)

All internal standard percent recoveries (%R) were within QC limits.

XIII. Sample Result Verification

All sample result verifications were acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Uranium - Data Qualification Summary - SDG 1810637

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Uranium - Laboratory Blank Data Qualification Summary - SDG 1810637

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Uranium - Field Blank Data Qualification Summary - SDG 1810637

No Sample Data Qualified in this SDG

LDC #: 43996B4a
SDG #: 1810637
Laboratory: ALS Environmental

VALIDATION COMPLETENESS WORKSHEET
Level IV

Date: 1-4-19
Page: 1 of 1
Reviewer: MG
2nd Reviewer:

METHOD: Uranium (EPA Method 200.8)

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.	Sample receipt/Technical holding times	A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	ND	EB = 2
VII.	Matrix Spike/Matrix Spike Duplicates	A	MS/MSD
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	A	SD: 1, 5
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	N	
XII.	Internal Standard (ICP-MS)	A	
XIII.	Sample Result Verification	A	
XIV	Overall Assessment of Data	A	

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; SB=Source blank; OTHER:

Samples appended with "F" were analyzed as dissolved

	Client ID	Lab ID	Matrix	Date
1	OU2-1-MW008I	1810637-1	Water	10/30/18
2	OU2EB103018-001	1810637-3	Water	10/30/18
3	OU2-1-MW008IMS	1810637-1MS	Water	10/30/18
4	OU2-1-MW008IMSD	1810637-1MSD	Water	10/30/18
5	OU2-1-MW008I-F	1810637-2F	Water	10/30/18
6	OU2-1-MW008I-FMS	1810637-2FMS	Water	10/30/18
7	OU2-1-MW008I-FMSD	1810637-2FMSD	Water	10/30/18
8				
9				
10				
11				
12	PBW			

Notes:

LDC #: 43996B4a

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer:

Method: Metals (EPA SW 846 Method 6010/7000/6020)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?	✓			
Were %RSD of isotopes in the tuning solution ≤5%?	✓			
III. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury) QC limits?	✓			
Were all initial calibration correlation coefficients > 0.995?	✓			
IV. Blanks				
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.		✓		
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	✓			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	✓			
VI. Matrix spike/Matrix spike 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.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were ≤ 5X the RL.	✓			
VII. Laboratory control samples				
Was an LCS anaylzed 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% QC limits for water samples and laboratory established QC limits for soils?	✓			

Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
Were all the percent recoveries (%R) within the 30-120% (6020)/60-125% (200.8) of the intensity of the internal standard in the associated initial calibration?	✓			
If the %Rs were outside the criteria, was a reanalysis performed?			✓	
IX. ICP Serial Dilution				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the MDL (ICP)/>100X the MDL(ICP/MS)?	✓			
Were all percent differences (%Ds) < 10%?	✓			
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.		✓		
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.		✓		
Target analytes were detected in the field duplicates.			✓	
XIII. Field blanks				
Field blanks were identified in this SDG.	✓			
Target analytes were detected in the field blanks.		✓		

LDC #: 43996B4a

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer: [illegible]

METHOD: Trace metals (EPA SW 846 Method 6010/6020/7000)

An initial and 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 (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution
True = concentration (in ug/L) of each analyte in the ICV or CCV source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalculated %R	Reported %R	Acceptable (Y/N)
	ICP (Low Level calibration)						
	ICP/MS (Low Level calibration)						
	ICP (Initial calibration)						
1030 ICV	ICP/MS (Initial calibration)	U	1.9948	2	100	100	
	CVAA (Initial calibration)						
	ICP (Continuing calibration)						
1634 CCV10	ICP/MS (Continuing calibration)	U	1.0147	1	101	101	
	CVAA (Continuing calibration)						

ICP-MS TUNE	Calculation	Mass	Actual (Mean Counts / Axis)	Required (Counts / Axis)	Recalculated %RSD	Acceptable (Y/N)
QCTUNE	Mass Axis	59	59.00	± 0.1 AMU	NA	Y
↓	%RSD	115	0.44	≤ 5% RSD	0.44	↓

Comments:

LDC #: 43996B4a

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: 2

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

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

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

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

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

$\%D = \frac{|I-SDR|}{I} \times 100$ Where, I = Initial Sample Result (mg/L)
SDR = Serial Dilution Result (mg/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I (units)	True / D / SDR (units)	Recalculated %R / RPD / %D	Reported %R / RPD / %D	Acceptable (Y/N)
1052 ICSAB1	ICP interference check	U	0.0010203 (mg/L)	0.001 (mg/L)	102	102	Y
1554 LCS	Laboratory control sample	U	9.920 (ug/L)	10 (ug/L)	99	99	
1651 3	Matrix spike	U	(SSR-SR) 10.06 (ug/L)	10 (ug/L)	101	101	
1651/1654 3/4	Duplicate	U	11.52 (ug/L)	11.63 (ug/L)	1.0	not reported	
1645/1648 1	ICP serial dilution	U	0.00146 (mg/L)	0.00132 (mg/L)	10	10	

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 #: 43996B4a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

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 and within the linear range of the ICP?
(Y) N N/A Are all detection limits below the CRDL?

Detected analyte results for #1, U were recalculated and verified using the following equation:

Concentration = $\frac{(RD)(FV)(Dil)}{(In.\ Vol.)}$

RD = Raw data concentration
FV = Final volume (ml)
In. Vol. = Initial volume (ml) or weight (G)
Dil = Dilution factor

Recalculation:

$$\frac{(0.1455\ mg/L)(0.050\ L)(10)}{0.050\ L} = 1.455\ mg/L$$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
1	1	U	1.4	1.5	Y
					↓
2	5	U	1.4	1.4	↓

Note: Sample 2 is N.D.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 7, 2019

Parameters: Gross Alpha & Beta

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1810637

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-MW008I	1810637-1	Water	10/30/18
OU2-1-MW008I-F	1810637-2	Water	10/30/18
OU2EB103018-001	1810637-3	Water	10/30/18
OU2-1-MW008IMS	1810637-1MS	Water	10/30/18
OU2-1-MW008IDUP	1810637-1DUP	Water	10/30/18
OU2-1-MW008I-FMS	1810637-2MS	Water	10/30/18
OU2-1-MW008I-FDUP	1810637-2DUP	Water	10/30/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018), the Final Radionuclide Data Quality Evaluation Guidance (September 2008), the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Gross Alpha and Beta by PAI 724 Rev. 13

All sample results were subjected to Level IV data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

Counting and detector efficiency were determined for each detector and each radionuclide.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Laboratory blanks were analyzed as required by the method. Blank results contained less than the minimum detectable concentrations (MDC).

V. Field Blanks

Sample OU2EB103018-001 was identified as an equipment blank. No contaminants were found.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Isotope	%R (Limits)	Flag	A or P
OU2-1-MW008IMS (OU2-1-MW008I OU2EB103018-001)	Gross alpha Gross beta	70.1 (72-130) 85.8 (86-115)	J- (all detects) UJ (all non-detects) J- (all detects) UJ (all non-detects)	A
OU2-1-MW008I-FMS (OU2-1-MW008I-F)	Gross alpha Gross beta	59.9 (72-130) 80.8 (86-115)	J- (all detects) J- (all detects)	A

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Minimum Detectable Concentrations

All minimum detectable concentrations (MDC) met reporting limits (RL) with the following exceptions:

Sample	Isotope	MDC	RL
OU2-1-MW008I	Gross alpha	3.1 pCi/L	3 pCi/L
OU2-1-MW008I-F	Gross alpha	3.4 pCi/L	3 pCi/L

The MDC was greater than the RL as listed above.

XI. Sample Result Verification

All sample result verifications were acceptable.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to MS %R, data were qualified as estimated in three samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Gross Alpha & Beta - Data Qualification Summary - SDG 1810637

Sample	Isotope	Flag	A or P	Reason
OU2-1-MW008I OU2-1-MW008I-F OU2EB103018-001	Gross alpha Gross beta	J- (all detects) UJ (all non-detects) J- (all detects) UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R)

Phase 1 RI OU2 Great Kills Park
Gross Alpha & Beta - Laboratory Blank Data Qualification Summary - SDG 1810637

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Gross Alpha & Beta - Field Blank Data Qualification Summary - SDG 1810637

No Sample Data Qualified in this SDG

LDC #: 43996B22
SDG #: 1810637
Laboratory: ALS Environmental

VALIDATION COMPLETENESS WORKSHEET
Level IV

PAI 724 Rev. 13

Date: 1-4-19
Page: 1 of 1
Reviewer: MG
2nd Reviewer:

METHOD: Gross Alpha & Beta (~~EPA Method 900.0~~) 9M4

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.	Sample receipt/Technical holding times	A	
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	EB = 3
VI.	Matrix Spike/Matrix Spike Duplicates	SW	MS
VII.	Duplicates	A	DUP
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Minimum detectable activity (MDA)	SW	
XI.	Sample result verification	A	
XII.	Overall assessment of data	A	

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; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	OU2-1-MW008I	1810637-1	Water	10/30/18
2	OU2-1-MW008I-F	1810637-2	Water	10/30/18
3	OU2EB103018-001	1810637-3	Water	10/30/18
4	OU2-1-MW008IMS	1810637-1MS	Water	10/30/18
5	OU2-1-MW008IDUP	1810637-1DUP	Water	10/30/18
6	OU2-1-MW008I-FMS	1810637-2MS	Water	10/30/18
7	OU2-1-MW008I-FDUP	1810637-2DUP	Water	10/30/18
8				
9				
10				
11				
12				
13				
14	PBW			

Notes:

LDC #: 43996B22

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer:

PAI 724 Rev 13

Method: Radiochemistry(~~EPA Method~~)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments and detectors calibration as required?	✓			
Were NIST traceable standards used for all calibrations?	✓			
Was the check source identified by activity and radionuclide?	✓			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	✓			
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) $\leq$1.42?.	✓			
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	✓			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?		✓		
Were tracer/carrier recoveries within the QC limits?			✓	
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) < RL?		✓		

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.		✓		
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 #: 43996B22
SDG #: —

VALIDATION FINDINGS WORKSHEET
Matrix Spike Analysis

Reviewer: MG
2nd Reviewer: [signature]

METHOD: Radiochemistry (Method: PAI 724 Rev 13)

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

(Y) N N/A Was a matrix spike analyzed at the required frequency in this SDG?

Y (N) N/A Were matrix spike percent recoveries (%R) within the control limits of _____? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

LEVEL IV ONLY:

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

#	Date	Matrix Spike ID	Matrix	Analyte	%R	Associated Samples	Qualifications
1		4	water	Gross Alpha	70.1 (72-130)	1, 3	J-/UJ/A (det & ND)
		↓	↓	Gross Beta	85.8 (86-115)	↓	(↓)
2		6	↓	Gross Alpha	59.9 (72-130)	2	(det)
		↓	↓	Gross Beta	80.8 (86-115)	↓	(↓)

Comments: _____

LDC #: 43996B22

VALIDATION FINDINGS WORKSHEET
Minimum Detectable Activities

Reviewer: MG
2nd Reviewer:

METHOD: Radiochemistry (Method: PAI 724 Rev. 13 MDC)

The following sample ~~MDA~~s are above the RDL: – (pCi/L) —

#	Sample ID	Isotope	RDL (units)	MDC ~~MDA~~ (units)	Dilution	Qualifications
1	1	Gross Alpha	3	3.1		text
2	2	Gross Alpha	↓	3.4		↓
3	7	Gross Alpha	↓	3.3		↓

Comments:

LDC #: 43996B22

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer:

METHOD: Radiochemistry (Method: PAI T24 Rev. 13)

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

$\%R = \frac{Found}{True} \times 100$ 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 %R or RPD	Reported %R or RPD	Acceptable (Y/N)
LCS	Laboratory control sample	Gross Beta	208.4 (pCi/L)	211.8 (pCi/L)	98.4	98.4	Y
4	Matrix spike sample	Gross Alpha	362.7 (pCi/L)	518 (pCi/L)	70.0	70.1	↓
5	Duplicate RPD	Gross Beta	18.4 (pCi/L) ± 3.4	18.3 (pCi/L) ± 3.4	DER 0.0208	DER 0.00446	↓
-	Chemical recovery	-	-	-	-	-	-

Comments: _____

LDC #: 43996B22

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: Radiochemistry (Method: PAI 724 Rev. 13)

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, Gross Alpha reported with a positive detect were recalculated and verified using the following equation:

Concentration = $\frac{(cpm - background)}{2.22 \times E \times SA \times Vol}$

E = Counter Efficiency
SA = Self-absorbance factor
Vol = Volume of sample

Recalculation:

$$\frac{(0.234\ cpm) - (0.162\ cpm) - (0.004\ cpm)}{(2.22)(0.2232)(0.090\ L)(0.457)} = 3.337\ pCi/L$$

#	Sample ID	Analyte	Reported Concentration (pCi/L)	Calculated Concentration (pCi/L)	Acceptable (Y/N)
1	1	Gross Alpha	3.3	3.3	Y
					↓
2	2	Gross Beta	20.7	20.7	↓

Note: Sample 3 is N.D.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 7, 2019

Parameters: Radium-226

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1810637

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-MW008I	1810637-1	Water	10/30/18
OU2-1-MW008I-F	1810637-2	Water	10/30/18
OU2EB103018-001	1810637-3	Water	10/30/18
OU2-1-MW008IDUP	1810637-1DUP	Water	10/30/18
OU2-1-MW008I-FDUP	1810637-2DUP	Water	10/30/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018), the Final Radionuclide Data Quality Evaluation Guidance (September 2008), the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Radium-226 by Environmental Protection Agency (EPA) Method 903.1

All sample results were subjected to Level IV data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

Counting and detector efficiency were determined for each detector and each radionuclide.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Laboratory blanks were analyzed as required by the method. Blank results contained less than the minimum detectable concentrations (MDC).

V. Field Blanks

Sample OU2EB103018-001 was identified as an equipment blank. No contaminants were found.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Minimum Detectable Concentrations

All minimum detectable concentrations (MDC) met reporting limits (RL).

XI. Sample Result Verification

All sample result verifications were acceptable.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Radium-226 - Data Qualification Summary - SDG 1810637

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Radium-226 - Laboratory Blank Data Qualification Summary - SDG 1810637

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Radium-226 - Field Blank Data Qualification Summary - SDG 1810637

No Sample Data Qualified in this SDG

LDC #: 43996B29a
SDG #: 1810637
Laboratory: ALS Environmental

VALIDATION COMPLETENESS WORKSHEET
Level IV

Date: 1-4-19
Page: 1 of 1
Reviewer: MG
2nd Reviewer:

METHOD: Radium 226 (EPA Method 903.1)

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.	Sample receipt/Technical holding times	A	
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	EB = 3
VI.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VII.	Duplicates	A	DUP
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Carrier recovery	A	
XI.	Minimum detectable activity (MDA)	A	
XII.	Sample result verification	A	
XIII.	Overall assessment of data	A	

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; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	OU2-1-MW008I	1810637-1	Water	10/30/18
2	OU2-1-MW008I-F	1810637-2	Water	10/30/18
3	OU2EB103018-001	1810637-3	Water	10/30/18
4	OU2-1-MW008IDUP	1810637-1DUP	Water	10/30/18
5	OU2-1-MW008I-FDUP	1810637-2DUP	Water	10/30/18
6				
7				
8				
9				
10				
11				
12				
13	PBW			

Notes:

LDC #: 43996B29a

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer: [signature]

Method: Radiochemistry (EPA Method 903.1)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments and detectors calibration as required?	✓			
Were NIST traceable standards used for all calibrations?	✓			
Was the check source identified by activity and radionuclide?	✓			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	✓			
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) $\leq$1.42?.	✓			
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	✓			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?	✓			
Were tracer/carrier recoveries within the QC limits?	✓			
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) < RL?	✓			

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.		✓		
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 #: 43966 (9) B29a

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: [illegible]

METHOD: Radiochemistry (Method: 903.1)

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 / True 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 = |S-D| / (S+D)/2 x 100 Where, S = Original sample activity
D = Duplicate sample activity

Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	Recalculated %R or RPD	Reported %R or RPD	Acceptable (Y/N)
LCS	Laboratory control sample	Ra-226	52.13 (pCi/L)	47.87 (pCi/L)	109	109	Y
—	Matrix spike sample	—	—	—	—	—	—
4	Duplicate RPD	Ra-226	1.15 (pCi/L) ± 0.52	1.36 (pCi/L) ± 0.63	DER 0.257	DER 0.266	Y
1	Chemical recovery	Ba	18090 (µg)	19450 (µg)	93.0	93.0	↓

Comments: _____

LDC #: 43996 B29a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: Radiochemistry (Method: 903.1)

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-226 reported with a positive detect were recalculated and verified using the following equation:

Concentration = $\frac{(cpm - background)}{2.22 \times E \times SA \times Vol}$

E = Counter Efficiency
SA = Self-absorbance factor
Vol = Volume of sample

Recalculation:

$$\frac{(31\ cts/15\ min) - (1\ cts/15\ min)}{(2.22)(1.5127)(0.995\ L)(0.930)} \times \frac{1}{0.578} \times \frac{1}{0.970} \times 1.001 = 1.149\ \frac{pCi}{L}$$

#	Sample ID	Analyte	Reported Concentration (pCi/L)	Calculated Concentration (pCi/L)	Acceptable (Y/N)
1	1	Ra-226	1.15	1.15	Y
					↓
2	2	Ra-226	0.86	0.86	↓

Note: Sample 3 is N.D.

LDC Report# 43996B29b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 7, 2019

Parameters: Radium-228

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1810637

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-MW008I	1810637-1	Water	10/30/18
OU2-1-MW008I-F	1810637-2	Water	10/30/18
OU2EB103018-001	1810637-3	Water	10/30/18
OU2-1-MW008IDUP	1810637-1DUP	Water	10/30/18
OU2-1-MW008I-FDUP	1810637-2DUP	Water	10/30/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018), the Final Radionuclide Data Quality Evaluation Guidance (September 2008), the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Radium-228 by PAI 724 Rev. 13

All sample results were subjected to Level IV data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

Counting and detector efficiency were determined for each detector and each radionuclide.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Laboratory blanks were analyzed as required by the method. Blank results contained less than the minimum detectable concentrations (MDC).

V. Field Blanks

Sample OU2EB103018-001 was identified as an equipment blank. No contaminants were found.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Minimum Detectable Concentrations

All minimum detectable concentrations (MDC) met reporting limits (RL).

XI. Sample Result Verification

All sample result verifications were acceptable.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Radium-228 - Data Qualification Summary - SDG 1810637

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Radium-228 - Laboratory Blank Data Qualification Summary - SDG 1810637

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Radium-228 - Field Blank Data Qualification Summary - SDG 1810637

No Sample Data Qualified in this SDG

LDC #: 43996B29b

SDG #: 1810637

Laboratory: ALS Environmental

VALIDATION COMPLETENESS WORKSHEET

Level IV

Date: 1-4-19

Page: 1 of 1

Reviewer: MG

2nd Reviewer:

METHOD: Radium 228 (~~EPA Method 904.0~~) PAI 724 Rev. 13 9M4

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.	Sample receipt/Technical holding times	A	
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	EB = 3
VI.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VII.	Duplicates	A	DUP
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Carrier recovery	A	
XI.	Minimum detectable activity (MDA)	A	
XII.	Sample result verification	A	
XIII.	Overall assessment of data	A	

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; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	OU2-1-MW008I	1810637-1	Water	10/30/18
2	OU2-1-MW008I-F	1810637-2	Water	10/30/18
3	OU2EB103018-001	1810637-3	Water	10/30/18
4	OU2-1-MW008IDUP	1810637-1DUP	Water	10/30/18
5	OU2-1-MW008I-FDUP	1810637-2DUP	Water	10/30/18
6				
7				
8				
9				
10				
11				
12				
13	PBW			

Notes:

LDC #: 43996B29b

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer:

PAI 724 Rev 13

Method: Radiochemistry(~~EPA Method~~)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments and detectors calibration as required?	✓			
Were NIST traceable standards used for all calibrations?	✓			
Was the check source identified by activity and radionuclide?	✓			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	✓			
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) $\leq$1.42?.	✓			
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	✓			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?	✓			
Were tracer/carrier recoveries within the QC limits?	✓			
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) < RL?	✓			

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.		✓		
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 #: 43996B296

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer:

METHOD: Radiochemistry (Method: PAI 724 Rev 13)

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 / True 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 = |S-D| / (S+D)/2 x 100 Where, S = Original sample activity
D = Duplicate sample activity

Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	Recalculated %R or RPD	Reported %R or RPD	Acceptable (Y/N)
LCS	Laboratory control sample	Ra-228	8.249 (pCi/L)	8.618 (pCi/L)	95.7	95.7	Y
-	Matrix spike sample	-	-	-	-	-	-
4	Duplicate RPD	Ra-228	0.74 (pCi/L) ± 0.40	0.86 (pCi/L) ± 0.43	DER 0.204	DER 0.196	Y
1	Chemical recovery	Ba	29480 (ug)	30070 (ug)	98.0	98.1	↓

Comments: _____

LDC #: 43996B29b

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: MG
2nd reviewer: 4

METHOD: Radiochemistry (Method: PAI 724 Rev 13)

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:

Concentration = $\frac{(cpm - background)}{2.22 \times E \times SA \times Vol}$

E = Counter Efficiency
SA = Self-absorbance factor
Vol = Volume of sample

Recalculation: decay

$$\frac{(2.413\ cpm) - (1.866\ cpm)}{(2.22)(0.4652)(0.997\ L)(0.981)} \times 1.356 = 0.734\ pCi/L$$

#	Sample ID	Analyte	Reported Concentration (pCi/L)	Calculated Concentration (pCi/L)	Acceptable (Y/N)
1	1	Ra-228	0.74	0.73	Y
					↓
2	2	Ra-228	0.76	0.76	↓

Note: Sample 3 is N.D.

LDC #: 43996

EDD POPULATION COMPLETENESS WORKSHEET

Date: 01/24/19
Page: 1 of 1
2nd Reviewer:

The LDC job number listed above was entered by CBJ.
Entered from Body or Summary

	EDD Process		Comments/Action
I.	EDD Completeness	-	
Ia.	- All methods present?	y	
Ib.	- All samples present/match report?	y	
Ic.	- All reported analytes present?	y	
Id.	- 10% or 100% verification of EDD?	y	
II.	EDD Preparation/Entry	-	
IIa.	- Carryover U/J?	y	
IIb.	- Reason Codes used? If so, note which codes.	y	client
IIc.	- Additional Information (QC Level, Validator, Validated Y/N, etc.)	y	date
III.	Reasonableness Checks	-	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	y	
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	y	
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	y	
IIId.	-Does the detect flag require changing for blank qualifier? If so, are all U results marked ND?	y/NA	
IIIe.	- Do blank concentrations in report match EDD where data was qualified due to blank contamination?	NA	
IIIf.	- Were multiple results reported due to dilutions/reanalysis? If so, were results qualified appropriately?	N/NA	
IIIg.	-Are there any discrepancies between the data packet and the EDD?	N	

Notes: *see discrepancy sheet

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Tidewater, Inc.
3761 Attucks Drive
Powell, OH 43065
ATTN: Mr. Ryan Wensink, PE

February 1, 2019

SUBJECT: Phase 1 RI OU2 Great Kills Park, Data Validation

Dear Mr. Wensink,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on January 9, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #44135:

SDG #	Fraction
1810627, 1811039	Uranium, Gross Alpha & Beta, Radium-226, Radium-228, Gamma Spectroscopy

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

- Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York, September 2018
- Final Radionuclide Data Quality Evaluation Guidance, September 2008
- Multi Agency Radiological Laboratory Analytical Protocols, MARLAP, Manual, July 2004
- USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review; January 2017

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

Sincerely,

Pei Geng
pgeng@lab-data.com
Project Manager/Senior Chemist

1,333 pages-CD

Attachment 1

Level IV

LDC #44135 (Tidewater-Powell, OH / Phase 1 RI OU2 Great Kills Park)

LDC	SDG#	DATE REC'D	(3) DATE DUE	U (200.8)		Diss. U (200.8)		Gross α & β (724R13)		Ra-226 (903.1)		Ra-228 (724R13)		Gamma Spec. (713R14)																							
Matrix:	Water/Soil-Sediment			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
A	1810627	01/09/19	01/30/19	-	-	-	-	-	-	-	-	-	-	0	29																				
B	1811039	01/09/19	01/30/19	4	0	4	0	8	0	8	0	8	0	-	-																				
Total	T/PG			4	0	4	0	8	0	8	0	8	0	0	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61

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

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Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 28, 2019

Parameters: Gamma Spectroscopy

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1810627

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-SE001	1810627-1	Sediment	10/22/18
OU2-1-SE002	1810627-2	Sediment	10/22/18
OU2-1-SE004	1810627-3	Sediment	10/22/18
OU2-1-SE004-DUP	1810627-4	Sediment	10/22/18
OU2-1-SE003	1810627-5	Sediment	10/22/18
OU1-1-SE005	1810627-6	Sediment	10/23/18
REF-1-SE001	1810627-7	Sediment	10/23/18
OU2-1-SS007	1810627-8	Soil	10/23/18
OU2-1-SS003	1810627-9	Soil	10/23/18
OU2-1-SS001	1810627-10	Soil	10/23/18
OU2-1-SS005	1810627-11	Soil	10/23/18
OU2-1-SS005-DUP	1810627-12	Soil	10/23/18
OU2-1-SS004	1810627-13	Soil	10/24/18
OU2-1-SS006	1810627-14	Soil	10/24/18
OU2-1-SS002	1810627-15	Soil	10/24/18
OU2-1-SS008	1810627-16	Soil	10/24/18
OU2-1-SU002-07	1810627-17	Soil	10/25/18
OU2-1-SU004-10	1810627-18	Soil	10/25/18
OU2-1-SU004-16	1810627-19	Soil	10/25/18
OU2-1-SU004-29	1810627-20	Soil	10/25/18
OU2-1-SU005-01	1810627-21	Soil	10/26/18
OU2-1-SU005-01-DUP	1810627-22	Soil	10/26/18
OU2-1-SU005-14	1810627-23	Soil	10/26/18
OU2-1-SU006-10	1810627-24	Soil	10/26/18
OU2-1-SU006-13	1810627-25	Soil	10/26/18
OU2-1-SU008-03	1810627-26	Soil	10/26/18

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-SU001-08	1810627-27	Soil	10/29/18
OU2-1-SU003-09	1810627-28	Soil	10/29/18
OU2-1-SU007-08	1810627-29	Soil	10/29/18
OU2-1-SE004DUP	1810627-3DUP	Sediment	10/22/18
OU2-1-SS006DUP	1810627-14DUP	Soil	10/24/18
OU2-1-SU007-08DUP	1810627-29DUP	Soil	10/29/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018), the Final Radionuclide Data Quality Evaluation Guidance (September 2008), the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Gamma Spectroscopy by PAI 713 Rev. 14

All sample results were subjected to Level IV data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

Counting and detector efficiency were determined for each detector and each radionuclide.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Laboratory blanks were analyzed as required by the method. Blank results contained less than the minimum detectable concentrations (MDC).

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) analysis were not required by the method.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples OU2-1-SE004 and OU2-1-SE004-DUP, samples OU2-1-SS005 and OU2-1-SS005-DUP, and samples OU2-1-SU005-01 and OU2-1-SU005-01-DUP were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Isotope	Activity (pCi/L)		RPD (Limits)	Flag	A or P
	OU2-1-SE004	OU2-1-SE004-DUP			
Actinium-228	0.39	0.31	23 (≤50)	-	-
Bismuth-214	0.31	0.29	7 (≤50)	-	-
Potassium-40	7.8	7.9	1 (≤50)	-	-
Lead-212	0.351	0.41	16 (≤50)	-	-
Lead-214	0.34	0.46	30 (≤50)	-	-
Radium-228	0.39	0.31	23 (≤50)	-	-
Thallium-208	0.138	0.164	17 (≤50)	-	-

Isotope	Activity (pCi/L)		RPD (Limits)	Flag	A or P
	OU2-1-SS005	OU2-1-SS005-DUP			
Actinium-228	0.69	0.67	3 (≤50)	-	-
Bismuth-212	0.37	0.63	52 (≤50)	J (all detects)	A
Bismuth-214	0.70	0.68	3 (≤50)	-	-
Potassium-40	9.5	9.5	0 (≤50)	-	-
Lead-212	0.96	0.87	10 (≤50)	-	-
Lead-214	0.80	0.92	14 (≤50)	-	-
Ra-223	0.24U	0.22	9 (≤50)	-	-
Radium-226	1.44	1.35	6 (≤50)	-	-
Radium-228	0.69	0.67	3 (≤50)	-	-

Isotope	Activity (pCi/L)		RPD (Limits)	Flag	A or P
	OU2-1-SS005	OU2-1-SS005-DUP			
Thallium-208	0.261	0.253	3 (≤50)	-	-
Thallium-210	0.044	0.029U	41 (≤50)	-	-
Uranium-238	1.04	0.72U	36 (≤50)	-	-

Isotope	Activity (pCi/L)		RPD (Limits)	Flag	A or P
	OU2-1-SU005-01	OU2-1-SU005-01-DUP			
Actinium-228	0.49	0.70	35 (≤50)	-	-
Bismuth-212	0.40U	0.66	49 (≤50)	-	-
Bismuth-214	0.63	0.79	23 (≤50)	-	-
Potassium-40	9.1	9.7	6 (≤50)	-	-
Lead-212	0.76	0.93	20 (≤50)	-	-
Lead-214	0.66	0.91	32 (≤50)	-	-
Radium-223	0.24U	0.28	15 (≤50)	-	-
Radium-226	0.99U	1.53	43 (≤50)	-	-
Radium-228	0.49	0.70	35 (≤50)	-	-
Thallium-208	0.253	0.240	5 (≤50)	-	-
Uranium-238	1.00	0.86U	15 (≤50)	-	-

X. Minimum Detectable Concentrations

All minimum detectable concentrations (MDC) met reporting limits (RL) with the following exceptions:

Sample	Isotope	MDC	RL
OU2-1-SS008	Bismuth-214 Lead-214	0.24 pci/g 0.23 pci/g	0.2 pci/g 0.2 pci/g

Sample	Isotope	MDC	RL
OU2-1-SU006-10	Bismuth-214	0.41 pci/g	0.2 pci/g
OU2-1-SU006-13	Bismuth-214	0.29 pci/g	0.2 pci/g
OU2-1-SU008-03	Bismuth-214	0.32 pci/g	0.2 pci/g
OU2-1-SU007-08DUP	Bismuth-214	0.27 pci/g	0.2 pci/g

The MDC was greater than the RL as listed above.

XI. Sample Result Verification

All sample result verification met validation criteria with the following exceptions:

Sample	Isotope	Finding	Flag	A or P
OU2-1-SE002 REF-1-SE001 OU2-1-SS006 OU2-1-SS002 OU2-1-SS008 OU2-1-SU004-10 OU2-1-SU004-16 OU2-1-SU005-14 OU2-1-SU006-10 OU2-1-SU006-13 OU2-1-SU008-03 OU2-1-SU003-09 OU2-1-SU007-08	All isotopes	The sample density is greater than ±15% the density of the calibration standard samples are less dense.	J+ (all detects)	A
OU1-1-SE005 OU2-1-SS007 OU2-1-SS001	All isotopes	The sample density is greater than ±15% the density of the calibration standard samples are more dense.	J- (all detects) UJ (all non-detects)	A

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to field duplicates RPD and sample density, data were qualified as estimated in seventeen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Gamma Spectroscopy - Data Qualification Summary - SDG 1810627

Sample	Isotope	Flag	A or P	Reason
OU2-1-SS005 OU2-1-SS005-DUP	Bismuth-212	J (all detects)	A	Field duplicates (RPD)
OU2-1-SE002 REF-1-SE001 OU2-1-SS006 OU2-1-SS002 OU2-1-SS008 OU2-1-SU004-10 OU2-1-SU004-16 OU2-1-SU005-14 OU2-1-SU006-10 OU2-1-SU006-13 OU2-1-SU008-03 OU2-1-SU003-09 OU2-1-SU007-08	All isotopes	J+ (all detects)	A	Sample result verification (sample density)
OU1-1-SE005 OU2-1-SS007 OU2-1-SS001	All isotopes	J- (all detects) UJ (all non-detects)	A	Sample result verification (sample density)

Phase 1 RI OU2 Great Kills Park
Gamma Spectroscopy - Laboratory Blank Data Qualification Summary - SDG 1810627

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Gamma Spectroscopy - Field Blank Data Qualification Summary - SDG 1810627

No Sample Data Qualified in this SDG

LDC #: 44135A35 **VALIDATION COMPLETENESS WORKSHEET** Date: 1-24-19
SDG #: 1810627 Level IV Page: 1 of 2
Laboratory: ALS Environmental Reviewer: MG
2nd Reviewer:

METHOD: Gamma Spectroscopy (PAI 713 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.	Sample receipt/Technical holding times	A	
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	not required
VII.	Duplicates	A	DUP
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	D=3+4, D=11+12, D=21+22
X.	Minimum detectable activity (MDA)	SW	
XI.	Sample result verification	SW	
XII.	Overall assessment of data	A	

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; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	OU2-1-SE001	1810627-1	Sediment	10/22/18
2	OU2-1-SE002	1810627-2	Sediment	10/22/18
3	OU2-1-SE004	1810627-3	Sediment	10/22/18
4	OU2-1-SE004-DUP	1810627-4	Sediment	10/22/18
5	OU2-1-SE003	1810627-5	Sediment	10/22/18
6	OU1-1-SE005	1810627-6	Sediment	10/23/18
7	REF-1-SE001	1810627-7	Sediment	10/23/18
8	OU2-1-SS007	1810627-8	Soil	10/23/18
9	OU2-1-SS003	1810627-9	Soil	10/23/18
10	OU2-1-SS001	1810627-10	Soil	10/23/18
11	OU2-1-SS005	1810627-11	Soil	10/23/18
12	OU2-1-SS005-DUP	1810627-12	Soil	10/23/18
13	OU2-1-SS004	1810627-13	Soil	10/24/18
14	OU2-1-SS006	1810627-14	Soil	10/24/18
15	OU2-1-SS002	1810627-15	Soil	10/24/18
16	OU2-1-SS008	1810627-16	Soil	10/24/18
17	OU2-1-SU002-07	1810627-17	Soil	10/25/18

LDC #: 44135A35 **VALIDATION COMPLETENESS WORKSHEET** Date: 1-24-19
SDG #: 1810627 Level IV Page: 2 of 2
Laboratory: ALS Environmental Reviewer: MG
2nd Reviewer:

METHOD: Gamma Spectroscopy (PAI 713 Rev 14)

	Client ID	Lab ID	Matrix	Date
18 1	OU2-1-SU004-10	1810627-18	Soil	10/25/18
19 1	OU2-1-SU004-16	1810627-19	Soil	10/25/18
20 1	OU2-1-SU004-29	1810627-20	Soil	10/25/18
21 2	OU2-1-SU005-01	1810627-21	Soil	10/26/18
22 2	OU2-1-SU005-01-DUP	1810627-22	Soil	10/26/18
23 2	OU2-1-SU005-14	1810627-23	Soil	10/26/18
24 2	OU2-1-SU006-10	1810627-24	Soil	10/26/18
25 2	OU2-1-SU006-13	1810627-25	Soil	10/26/18
26 2	OU2-1-SU008-03	1810627-26	Soil	10/26/18
27 2	OU2-1-SU001-08	1810627-27	Soil	10/29/18
28 2	OU2-1-SU003-09	1810627-28	Soil	10/29/18
29 2	OU2-1-SU007-08	1810627-29	Soil	10/29/18
30 1	OU2-1-SE004DUP	1810627-3DUP	Sediment	10/22/18
31 1	OU2-1-SS006DUP	1810627-14DUP	Soil	10/24/18
32 2	OU2-1-SU007-08DUP	1810627-29DUP	Soil	10/29/18
33				
34				
35				
36 1	PBS1			
37 2	PBS2			

Notes:

LDC #: 44135A35

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer:

PAI 713 Rev. 14

Method: Radiochemistry (~~EPA Method~~)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments and detectors calibration as required?	✓			
Were NIST traceable standards used for all calibrations?	✓			
Was the check source identified by activity and radionuclide?	✓			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	✓			
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) $\leq$1.42?.	✓			
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	✓			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?		✓		
Were tracer/carrier recoveries within the QC limits?			✓	
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) < RL?		✓		

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.	✓			
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# 44135A35

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: MG
2nd Reviewer:

Radiochemistry, Method PAI 713 Rev. 14

Isotope	Activity (pCi/g) 3	Activity (pCi/g) 4	RPD (≤50)	
Ac-228	0.39	0.31	23	
Bi-214	0.31	0.29	7	
K-40	7.8	7.9	1	
Pb-212	0.351	0.41	16	
Pb-214	0.34	0.46	30	
Ra-228	0.39	0.31	23	
Tl-208	0.138	0.164	17	

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Isotope	Activity (pCi/g) 11	Activity (pCi/g) 12	RPD (≤50)	
Ac-228	0.69	0.67	3	
Bi-212	0.37	0.63	52	
Bi-214	0.70	0.68	3	
K-40	9.5	9.5	0	
Pb-212	0.96	0.87	10	
Pb-214	0.80	0.92	14	
Ra-223	0.24U	0.22	9	NQ
Ra-226	1.44	1.35	6	
Ra-228	0.69	0.67	3	
Tl-208	0.261	0.253	3	
Tl-210	0.044	0.029U	41	NQ
U-238	1.04	0.72U	36	NQ

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Isotope	Activity (pCi/g) 21	Activity (pCi/g) 22	RPD (≤50)	
Ac-228	0.49	0.70	35	
Bi-212	0.40U	0.66	49	NQ
Bi-214	0.63	0.79	23	

LDC# 44135A35

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: MG
2nd Reviewer:

Radiochemistry, Method PAI 713 Rev. 14

Isotope	Activity (pCi/g)		RPD (≤50)	
	21	22		
K-40	9.1	9.7	6	
Pb-212	0.76	0.93	20	
Pb-214	0.66	0.91	32	
Ra-223	0.24U	0.28	15	NQ
Ra-226	0.99U	1.53	43	NQ
Ra-228	0.49	0.70	35	
Tl-208	0.253	0.240	5	
U-238	1.00	0.86U	15	NQ

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LDC #: 44135A35

VALIDATION FINDINGS WORKSHEET
Minimum Detectable Activities

Reviewer: MG
2nd Reviewer:

METHOD: Radiochemistry (Method: PAI 713 Rev. 14)

The following sample ~~MDA~~MDC s are above the RDL: — (pCi/g) —

#	Sample ID	Isotope	RDL (units)	~~MDA~~ MDC (units)	Dilution	Qualifications
1	16	Bi-214	0.2	0.24		text
	↓	Pb-214	0.2	0.23		↓
2	24	Bi-214	0.2	0.41		
3	25	Bi-214	0.2	0.29		
4	26	Bi-214	0.2	0.32		
5	32	Bi-214	0.2	0.27		

Comments: MDC = Minimum Detectable Concentration

LDC #: 44135A35

VALIDATION FINDINGS WORKSHEET
Sample Result Verification

Reviewer: MG
2nd Reviewer:

METHOD:Radiochemistry Method: PAI 713 Rev 14

#	Sample ID	Isotope	Finding	Qualifications
1	2,7,14→16, 18,19,23→26, 28,29,31,32	all	The sample density is greater than ± 15% the density of the calibration std. Samples are less dense.	J+ dets/A (dets & ND)
2	6,8,10		The sample density is greater than ± 15% the density of the calibration std. Samples are more dense.	J-/UJ/A (dets & ND)

Comments:

LDC #: 44135A35

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer:

METHOD: Radiochemistry (Method: PAI 713 Rev 14)

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

%R = Found x 100 / True

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 = |S-D| x 100 / (S+D)/2

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

Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	Recalculated %R or RPD	Reported %R or RPD	Acceptable (Y/N)
LCS	Laboratory control sample	Am-241	471 (pCi/g)	469.1 (pCi/g)	100	100	Y
—	Matrix spike sample	—	—	—	—	—	—
30	Duplicate RPD	Pb-212	0.351 (pCi/g) ± 0.098	0.420 (pCi/g) ± 0.12	DER 0.445	DER 0.427	Y
—	Chemical recovery	—	—	—	—	—	—

Comments: _____

LDC #: 44135A35

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: Radiochemistry (Method: PAI 713 Rev. 14)

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, K-40 reported with a positive detect were recalculated and verified using the following equation:

Concentration = $\frac{(cpm - background)}{2.22 \times E \times SA \times Vol}$

E = Counter Efficiency
SA = Self-absorbance factor
Vol = Volume of sample

Recalculation:

$$\frac{454 \text{ cts} / 155 \text{ min}}{(2.22)(0.00471)(225 \text{ g})(0.1070)} = 11.64 \text{ pCi/g}$$

#	Sample ID	Analyte	Reported Concentration (pCi/g)	Calculated Concentration (pCi/g)	Acceptable (Y/N)
1	1	K-40	11.6	11.6	Y
2	2	Bi-214	0.81	0.81	
3	3	Ac-228	0.39	0.40	
4	4	Pb-212	0.41	0.41	
5	5	Pb-214	0.56	0.56	
6	6	Ra-228	0.24	0.24	
7	7	Tl-208	0.146	0.15	
8	8	K-40	7.2	7.2	
9	9	Pb-212	0.369	0.37	
10	10	Pb-214	0.24	0.24	
11	11	Bi-212	0.37	0.37	
12	12	Ra-223	0.22	0.22	
13	13	Ra-224	0.9	0.94	
14	14	Ra-226	2.63	2.63	
15	15	U-238	1.36	1.36	
16	16	Tl-210	0.035	0.034	
17	17	Ac-228	0.85	0.85	
18	18	Bi-214	0.97	0.97	
19	19	K-40	7.7	7.6	
20	20	Pb-212	1.08	1.08	

Note:

LDC #: 44135A35

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: MG
2nd reviewer: _____

METHOD: Radiochemistry (Method: PAI 713 Rev. 14)

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 # 21, U-238 reported with a positive detect were recalculated and verified using the following equation:

Concentration = (cpm - background) / (2.22 x E x SA x Vol)

E = Counter Efficiency
SA = Self-absorbance factor
Vol = Volume of sample

Recalculation:

$$\frac{121 \text{ cts} / 120 \text{ min}}{(2.22)(0.0345)(234g)(0.0557)} = 1.010 \text{ pCi/g}$$

#	Sample ID	Analyte	Reported Concentration (pCi/g)	Calculated Concentration (pCi/g)	Acceptable (Y/N)
21	21	U-238	1.00	1.01	Y
22	22	Bi-212	0.66	0.66	
23	23	Ra-224	1.4	1.4	
24	24	K-40	5.51	5.51	
25	25	Ra-226	2.62	2.62	
26	26	Ra-228	0.85	0.85	
27	27	Pb-212	1.02	1.02	
28	28	Tl-208	0.499	0.50	
29	29	Bi-214	2.23	2.23	

Note: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 28, 2019

Parameters: Uranium

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1811039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-MW010	1811039-1	Water	10/29/18
OU2-1-MW010-F	1811039-2	Water	10/29/18
OU2-1-MW008WT	1811039-3	Water	10/31/18
OU2-1-MW008WT-DUP	1811039-4	Water	10/31/18
OU2-1-MW008WT-F	1811039-5	Water	10/31/18
OU2-1-MW008WT-F-DUP	1811039-6	Water	10/31/18
OU2-1-MW009WT	1811039-7	Water	10/31/18
OU2-1-MW009WT-F	1811039-8	Water	10/31/18
OU2-1-MW010MS	1811039-1MS	Water	10/29/18
OU2-1-MW010MSD	1811039-1MSD	Water	10/29/18

Samples appended with "F" were analyzed for dissolved Uranium

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018) and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Uranium by Environmental Protection Agency (EPA) Method 200.8

All sample results were subjected to Level IV evaluation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. ICPMS Tune

The mass calibration was within 0.1 AMU and the percent relative standard deviation (%RSD) was less than or equal to 5%.

III. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

IV. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

IX. Serial Dilution

Serial dilution analysis was performed on an associated project sample. Percent differences (%D) were within QC limits.

X. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

XI. Field Duplicates

Samples OU2-1-MW008WT and OU2-1-MW008WT-DUP and samples OU2-1-MW008WT-F and OU2-1-MW008WT-F-DUP were identified as field duplicates. No results were detected in any of the samples.

XII. Internal Standards (ICP-MS)

All internal standard percent recoveries (%R) were within QC limits.

XIII. Sample Result Verification

All sample result verifications were acceptable.

XIV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Uranium - Data Qualification Summary - SDG 1811039

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Uranium - Laboratory Blank Data Qualification Summary - SDG 1811039

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Uranium - Field Blank Data Qualification Summary - SDG 1811039

No Sample Data Qualified in this SDG

LDC #: 44135B4a
SDG #: 1811039
Laboratory: ALS Environmental

VALIDATION COMPLETENESS WORKSHEET
Level IV

Date: 1-25-19
Page: 1 of 1
Reviewer: MG
2nd Reviewer:

METHOD: Uranium (EPA Method 200.8)

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.	Sample receipt/Technical holding times	A	
II.	ICP/MS Tune	A	
III.	Instrument Calibration	A	
IV.	ICP Interference Check Sample (ICS) Analysis	A	
V.	Laboratory Blanks	A	
VI.	Field Blanks	N	
VII.	Matrix Spike/Matrix Spike Duplicates	A	MS/MSD
VIII.	Duplicate sample analysis	N	
IX.	Serial Dilution	A	SD: 1
X.	Laboratory control samples	A	LCS
XI.	Field Duplicates	ND	D = 3+4, D = 5+6
XII.	Internal Standard (ICP-MS)	A	
XIII.	Sample Result Verification	A	
XIV	Overall Assessment of Data	A	

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; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	OU2-1-MW010	1811039-1	Water	10/29/18
2	OU2-1-MW010-F	1811039-2	Water	10/29/18
3	OU2-1-MW008WT	1811039-3	Water	10/31/18
4	OU2-1-MW008WT-DUP	1811039-4	Water	10/31/18
5	OU2-1-MW008WT-F	1811039-5	Water	10/31/18
6	OU2-1-MW008WT-F-DUP	1811039-6	Water	10/31/18
7	OU2-1-MW009WT	1811039-7	Water	10/31/18
8	OU2-1-MW009WT-F	1811039-8	Water	10/31/18
9	OU2-1-MW010MS	1811039-1MS	Water	10/29/18
10	OU2-1-MW010MSD	1811039-1MSD	Water	10/29/18
11				
12				
13	PBW			

Notes:

LDC #: 44135B4a

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer:

Method: Metals (EPA SW 846 Method 6010/7000/6020)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?	✓			
Were %RSD of isotopes in the tuning solution ≤5%?	✓			
III. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury) QC limits?	✓			
Were all initial calibration correlation coefficients > 0.995?	✓			
IV. Blanks				
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.		✓		
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	✓			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	✓			
VI. Matrix spike/Matrix spike 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.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were < 5X the RL.	✓			
VII. Laboratory control samples				
Was an LCS anaylzed 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% QC limits for water samples and laboratory established QC limits for soils?	✓			

Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
Were all the percent recoveries (%R) within the 30-120% (6020)/60-125% (200.8) of the intensity of the internal standard in the associated initial calibration?	✓			
If the %Rs were outside the criteria, was a reanalysis performed?			✓	
IX. ICP Serial Dilution				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the MDL (ICP)/>100X the MDL(ICP/MS)?	✓			
Were all percent differences (%Ds) < 10%?	✓			
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.		✓		
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.		✓		
XIII. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 44135B4a

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: MG
2nd Reviewer:

METHOD: Trace metals (EPA SW 846 Method 6010/6020/7000)

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

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

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalculated %R	Reported %R	Acceptable (Y/N)
	ICP (Low Level calibration)						
	ICP/MS (Low Level calibration)						
	ICP (Initial calibration)						
07:56 ICV	ICP/MS (Initial calibration)	U	1.9042	2	95	95	Y
	CVAA (Initial calibration)						↓
	ICP (Continuing calibration)						
08:17 CCV1	ICP/MS (Continuing calibration)	U	0.9454	1	95	94	↓
	CVAA (Continuing calibration)						

ICP-MS TUNE	Calculation	Mass	Actual (Mean Counts / Axis)	Required (Counts / Axis)	Recalculated %RSD	Acceptable (Y/N)
Tune	Mass Axis	208	208.00	± 0.1 AMU	NA	Y
↓	%RSD	59	1.86	≤ 5% RSD	1.86	↓

Comments:

LDC #: 44135B4a

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer:

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

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

%R = Found / True x 100 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 = |S-D| / (S+D)/2 x 100 Where, S = Original sample concentration
D = Duplicate sample concentration

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

%D = |I-SDR| / I x 100 Where, I = Initial Sample Result (mg/L)
SDR = Serial Dilution Result (mg/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I (units)	True / D / SDR (units)	Recalculated %R / RPD / %D	Reported %R / RPD / %D	Acceptable (Y/N)
08:11 ICSAB	ICP interference check	U	0.000982 (mg/L)	0.001 (mg/L)	98	98	Y
08:29 LCS	Laboratory control sample	U	9.292 (µg/L)	10 (µg/L)	93	93	
08:40 9	Matrix spike	U	(SSR-SR) 9.739 (µg/L)	10 (µg/L)	97	97	
08:40 / 08:43 9/10	Duplicate	U	11.39 (µg/L)	11.52 (µg/L)	1.1	not reported	
08:35 / 08:37 1	ICP serial dilution	U	0.00165 ~~1.6~~ (mg/L)	0.00154 (mg/L)	7	6	

mls

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 #: 44135 B4a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

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 and within the linear range of the ICP?
(Y) N N/A Are all detection limits below the CRDL?

Detected analyte results for #1, U were recalculated and verified using the following equation:

Concentration = $\frac{(RD)(FV)(Dil)}{(In.\ Vol.)}$

RD = Raw data concentration
FV = Final volume (ml)
In. Vol. = Initial volume (ml) or weight (G)
Dil = Dilution factor

Recalculation:

$$\frac{(0.1653\ mg/L)(0.050\ L)(10)}{0.050\ L} = 1.653\ mg/L$$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
1	1	U	1.6	1.7	Y
2	2	U	1.6	1.6	
3	7	U	1.1	1.1	
4	8	U	1	1.0	

Note: Samples # 3 → 6 are N.D.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 28, 2019

Parameters: Gross Alpha & Beta

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1811039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-MW010	1811039-1	Water	10/29/18
OU2-1-MW010-F	1811039-2	Water	10/29/18
OU2-1-MW008WT	1811039-3	Water	10/31/18
OU2-1-MW008WT-DUP	1811039-4	Water	10/31/18
OU2-1-MW008WT-F	1811039-5	Water	10/31/18
OU2-1-MW008WT-F-DUP	1811039-6	Water	10/31/18
OU2-1-MW009WT	1811039-7	Water	10/31/18
OU2-1-MW009WT-F	1811039-8	Water	10/31/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018), the Final Radionuclide Data Quality Evaluation Guidance (September 2008), the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Gross Alpha and Beta by PAI 724 Rev. 13

All sample results were subjected to Level IV data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

Counting and detector efficiency were determined for each detector and each radionuclide.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Laboratory blanks were analyzed as required by the method. Blank results contained less than the minimum detectable concentrations (MDC).

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples OU2-1-MW008WT and OU2-1-MW008WT-DUP and samples OU2-1-MW008WT-F and OU2-1-MW008WT-F-DUP were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Isotope	Activity (pCi/L)		RPD (Limits)	Flag	A or P
	OU2-1-MW008WT	OU2-1-MW008WT-DUP			
Gross alpha	3.3U	8.2	85 (≤20)	NQ	-
Gross beta	18.5	18.7	1 (≤20)	-	-

Isotope	Activity (pCi/L)		RPD (Limits)	Flag	A or P
	OU2-1-MW008WT-F	OU2-1-MW008WT-F-DUP			
Gross alpha	10.8	10.5	3 (≤20)	-	-
Gross beta	18.9	17.2	9 (≤20)	-	-

NQ = One or both results were less than the limit of quantitation, therefore no data were qualified.

X. Minimum Detectable Concentrations

All minimum detectable concentrations (MDC) met reporting limits (RL) with the following exceptions:

Sample	Isotope	MDC	RL
OU2-1-MW010	Gross alpha Gross beta	4.7 pCi/L 4.4 pCi/L	3 pCi/L 4 pCi/L
OU2-1-MW010-F	Gross alpha Gross beta	4.6 pCi/L 5.5 pCi/L	3 pCi/L 4 pCi/L
OU2-1-MW008WT	Gross alpha Gross beta	4.3 pCi/L 4.2 pCi/L	3 pCi/L 4 pCi/L
OU2-1-MW008WT-DUP	Gross alpha	4.3 pCi/L	3 pCi/L
OU2-1-MW008WT-F	Gross alpha	3.6 pCi/L	3 pCi/L
OU2-1-MW008WT-F-DUP	Gross alpha Gross beta	5.8 pCi/L 5.5 pCi/L	3 pCi/L 4 pCi/L

XI. Sample Result Verification

All sample result verifications were acceptable.

The results for the dissolved metals sample analysis were greater than the total metals sample analysis as follows:

Analyte	Concentration (pCi/L)	
	Dissolved	Total
Gross alpha	10.8	3.3U

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Gross Alpha & Beta - Data Qualification Summary - SDG 1811039

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Gross Alpha & Beta - Laboratory Blank Data Qualification Summary - SDG 1811039

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Gross Alpha & Beta - Field Blank Data Qualification Summary - SDG 1811039

No Sample Data Qualified in this SDG

LDC #: 44135B22
SDG #: 1811039
Laboratory: ALS Environmental

VALIDATION COMPLETENESS WORKSHEET
Level IV

Date: 1-25-19
Page: 1 of 1
Reviewer: MG
2nd Reviewer:

METHOD: Gross Alpha & Beta (PAI 724 Rev 13)

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.	Sample receipt/Technical holding times	A	
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VII.	Duplicates	N	" "
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	D=3+4, D=5+6
X.	Minimum detectable activity (MDA)	SW	
XI.	Sample result verification	SW	
XII.	Overall assessment of data	A	

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; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	OU2-1-MW010	1811039-1	Water	10/29/18
2	OU2-1-MW010-F	1811039-2	Water	10/29/18
3	OU2-1-MW008WT	1811039-3	Water	10/31/18
4	OU2-1-MW008WT-DUP	1811039-4	Water	10/31/18
5	OU2-1-MW008WT-F	1811039-5	Water	10/31/18
6	OU2-1-MW008WT-F-DUP	1811039-6	Water	10/31/18
7	OU2-1-MW009WT	1811039-7	Water	10/31/18
8	OU2-1-MW009WT-F	1811039-8	Water	10/31/18
9				
10				
11				
12				
13				
14	PBW			

Notes:

LDC #: 44135B22

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer:

PAI 724 Rev. 13
Method: Radiochemistry(~~EPA Method~~)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments and detectors calibration as required?	✓			
Were NIST traceable standards used for all calibrations?	✓			
Was the check source identified by activity and radionuclide?	✓			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	✓			
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?.			✓	
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	✓			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?		✓		
Were tracer/carrier recoveries within the QC limits?			✓	
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) < RL?		✓		

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.	✓			
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# 44135B22

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: MG
2nd Reviewer:

Radiochemistry, Method PAI 724 Rev. 13

Isotope	Activity (pCi/L)		RPD (≤20)	
	3	4		
Gross Alpha	3.3U	8.2	85	NQ
Gross Beta	18.5	18.7	1	

V:\FIELD DUPLICATES\Field Duplicates\FD_inorganic\2019\44135B22.wpd

Isotope	Activity (pCi/L)		RPD (≤20)	
	5	6		
Gross Alpha	10.8	10.5	3	
Gross Beta	18.9	17.2	9	

V:\FIELD DUPLICATES\Field Duplicates\FD_inorganic\2019\44135B22.wpd

NQ - one or both results < LOQ

LDC #: 44135B22

VALIDATION FINDINGS WORKSHEET
Minimum Detectable Activities

Reviewer: MG
2nd Reviewer:

METHOD: Radiochemistry (Method: PAI 724 Rev. 13)

The following sample ~~MDA~~MDCs are above the RDL: — (pCi/L) —

#	Sample ID	Isotope	RDL (units)	~~MDA~~ MDC (units)	Dilution	Qualifications
1	1	Gross Alpha	3	4.7		text
	↓	Gross Beta	4	4.4		↓
2	2	Gross Alpha	3	4.6		
	↓	Gross Beta	4	5.5		
3	3	Gross Alpha	3	4.3		
	↓	Gross Beta	4	4.2		
4	4	Gross Alpha	3	4.3		
5	5	Gross Alpha	3	3.6		
6	6	Gross Alpha	3	5.8		
	↓	Gross Beta	4	5.5		

Comments: MDC = Minimum Detectable Concentration

LDC #: 44135B22

VALIDATION FINDINGS WORKSHEET
Sample Result Verification

Reviewer: MG
2nd Reviewer:

METHOD:Radiochemistry Method:

— (pCi/L) —

#	Sample ID	Isotope	dissolved	total	Finding	Qualifications
1	3/5	Gross Alpha	10.8	3.3 U	dissolved > total	text

Comments:

LDC #: 44135B22

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer:

METHOD: Radiochemistry (Method: PAI 724 Rev. 13)

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 / True 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 = |S-D| / (S+D)/2 x 100 Where, S = Original sample activity
D = Duplicate sample activity

Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	Recalculated %R or RPD	Reported %R or RPD	Acceptable (Y/N)
LCS	Laboratory control sample	Gross Alpha	277 (pCi/L)	232.9 (pCi/L)	119	119	Y
-	Matrix spike sample	-	-	-	-	-	-
-	Duplicate RPD	-	-	-	-	-	-
-	Chemical recovery	-	-	-	-	-	-

Comments: _____

LDC #: 44135B22

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: Radiochemistry (Method: PAI 724 Rev. 13)

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, Gross Beta reported with a positive detect were recalculated and verified using the following equation:

Concentration = $\frac{(cpm - background)}{2.22 \times E \times SA \times Vol}$

E = Counter Efficiency
SA = Self-absorbance factor
Vol = Volume of sample

Recalculation:

$$\frac{(2.951\ cpm) - (1.664\ cpm) - (0.0179\ cpm)}{(2.22)(0.4214)(0.050\ L)(0.938)} = 28.93\ pCi/L$$

#	Sample ID	Analyte	Reported Concentration (pCi/L)	Calculated Concentration (pCi/L)	Acceptable (Y/N)
1	1	Gross Beta	28.9	28.9	Y
2	2	Gross Beta	20.6	20.6	
3	3	Gross Beta	18.5	18.5	
4	4	Gross Alpha	8.2	8.2	
5	5	Gross Alpha	10.8	10.8	
6	6	Gross Alpha	10.5	10.5	
7	7	Gross Alpha	1.9	1.9	
8	8	Gross Beta	4.8	4.8	

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 28, 2019

Parameters: Radium-226

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1811039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-MW010	1811039-1	Water	10/29/18
OU2-1-MW010-F	1811039-2	Water	10/29/18
OU2-1-MW008WT	1811039-3	Water	10/31/18
OU2-1-MW008WT-DUP	1811039-4	Water	10/31/18
OU2-1-MW008WT-F	1811039-5	Water	10/31/18
OU2-1-MW008WT-F-DUP	1811039-6	Water	10/31/18
OU2-1-MW009WT	1811039-7	Water	10/31/18
OU2-1-MW009WT-F	1811039-8	Water	10/31/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018), the Final Radionuclide Data Quality Evaluation Guidance (September 2008), the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Radium-226 by Environmental Protection Agency (EPA) Method 903.1

All sample results were subjected to Level IV data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

Counting and detector efficiency were determined for each detector and each radionuclide.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Laboratory blanks were analyzed as required by the method. Blank results contained less than the minimum detectable concentrations (MDC).

V. Field Blanks

No field duplicates were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

Samples OU2-1-MW008WT and OU2-1-MW008WT-DUP and OU2-1-MW008WT-F and OU2-1-MW008WT-F-DUP were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Isotope	Activity (pCi/L)		RPD (Limits)	Flag	A or P
	OU2-1-MW008WT	OU2-1-MW008WT-DUP			
Ra-226	3.3	3.4	3 (≤20)	-	-

Isotope	Activity (pCi/L)		RPD (Limits)	Flag	A or P
	OU2-1-MW008WT-F	OU2-1-MW008WT-F-DUP			
Ra-226	4.9	3.6	31 (≤20)	-	-

X. Minimum Detectable Concentrations

All minimum detectable concentrations (MDC) met reporting limits (RL).

XI. Sample Result Verification

All sample result verifications were acceptable.

The results for the dissolved metals sample analysis were greater than the total metals sample analysis as follows:

Analyte	Concentration (pCi/L)	
	Dissolved	Total
Radium-226	1.62	0.71
Radium-226	4.9	3.3

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Radium-226 - Data Qualification Summary - SDG 1811039

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Radium-226 - Laboratory Blank Data Qualification Summary - SDG 1811039

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Radium-226 - Field Blank Data Qualification Summary - SDG 1811039

No Sample Data Qualified in this SDG

LDC #: 44135B29a
SDG #: 1811039
Laboratory: ALS Environmental

VALIDATION COMPLETENESS WORKSHEET
Level IV

Date: 1-25-19
Page: 1 of 1
Reviewer: MG
2nd Reviewer:

METHOD: Radium 226 (EPA Method 903.1)

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.	Sample receipt/Technical holding times	A	
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VII.	Duplicates	N	" "
VIII.	Laboratory control samples	A	LCS/LCSD
IX.	Field duplicates	SW	D = 3+4, D = 5+6
X.	Carrier recovery	A	
XI.	Minimum detectable activity (MDA)	A	
XII.	Sample result verification	SW	
XIII.	Overall assessment of data	A	

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; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	OU2-1-MW010	1811039-1	Water	10/29/18
2	OU2-1-MW010-F	1811039-2	Water	10/29/18
3	OU2-1-MW008WT	1811039-3	Water	10/31/18
4	OU2-1-MW008WT-DUP	1811039-4	Water	10/31/18
5	OU2-1-MW008WT-F	1811039-5	Water	10/31/18
6	OU2-1-MW008WT-F-DUP	1811039-6	Water	10/31/18
7	OU2-1-MW009WT	1811039-7	Water	10/31/18
8	OU2-1-MW009WT-F	1811039-8	Water	10/31/18
9				
10				
11				
12				
13				
14	PBW			

Notes:

LDC #: 44135 B29a

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer:

Method: Radiochemistry (EPA Method 903.1)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments and detectors calibration as required?	✓			
Were NIST traceable standards used for all calibrations?	✓			
Was the check source identified by activity and radionuclide?	✓			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	✓			
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) $\leq$1.42?.			✓	
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	✓			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?	✓			
Were tracer/carrier recoveries within the QC limits?	✓			
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) < RL?	✓			

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.	✓			
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# 44135B29a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: MG
2nd Reviewer:

Radiochemistry, Method 903.1

Isotope	Activity (pCi/L) 3	Activity (pCi/L) 4	RPD (≤20)	
Ra-226	3.3	3.4	3	

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Isotope	Activity (pCi/L) 5	Activity (pCi/L) 6	RPD (≤20)	
Ra-226	4.9	3.6	31	

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LDC #: 44135B29a

VALIDATION FINDINGS WORKSHEET
Sample Result Verification

Page: 1 of 1
Reviewer: MG
2nd Reviewer

METHOD:Radiochemistry Method: 903.1 — (pCi/L) —

#	Sample ID	Isotope	dissolved	total	Finding	Qualifications
1	1/2	Ra-226	1.62	0.71	dissolved > total	text
2	3/5	Ra-226	4.9	3.3	↓	↓

Comments:

SRV.SW4.wpd

LDC #: 44135B29a

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer: _____

METHOD: Radiochemistry (Method: 903.1)

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

$\%R = \frac{Found}{True} \times 100$ 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 %R or RPD	Reported %R or RPD	Acceptable (Y/N)
LCS	Laboratory control sample	Ra-226	50.0 (pCi/L)	47.87 (pCi/L)	104	105	Y
–	Matrix spike sample	–	–	–	–	–	–
–	Duplicate RPD	–	–	–	–	–	–
1	Chemical recovery	Ba	16120 (µg)	18720 (µg)	86.1	86.1	Y

Comments: _____

LDC #: 44135B29a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: Radiochemistry (Method: 903.1)

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-226 reported with a positive detect were recalculated and verified using the following equation:

Concentration = $\frac{(cpm - background)}{2.22 \times E \times SA \times Vol}$

E = Counter Efficiency
SA = Self-absorbance factor
Vol = Volume of sample

Recalculation:

$$\frac{(23.000\ cts/15\ min) - (1\ cts/15\ min)}{(2.22)(1.6061)(0.876\ L)(0.861)} \times \frac{1}{0.796} \times \frac{1}{0.970} \times 1.001 = 0.707\ \frac{pCi}{L}$$

#	Sample ID	Analyte	Reported Concentration (pCi/L)	Calculated Concentration (pCi/L)	Acceptable (Y/N)
1	1	Ra-226	0.71	0.71	Y
2	2	Ra-226	1.62	1.62	
3	3	Ra-226	3.3	3.3	
4	4	Ra-226	3.4	3.4	
5	5	Ra-226	4.9	4.9	
6	6	Ra-226	3.6	3.6	
7	7	Ra-226	1.04	1.04	

Note: Sample # 8 is N.D.

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Phase 1 RI OU2 Great Kills Park

LDC Report Date: January 28, 2019

Parameters: Radium-228

Validation Level: Level IV

Laboratory: ALS Environmental

Sample Delivery Group (SDG): 1811039

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
OU2-1-MW010	1811039-1	Water	10/29/18
OU2-1-MW010-F	1811039-2	Water	10/29/18
OU2-1-MW008WT	1811039-3	Water	10/31/18
OU2-1-MW008WT-DUP	1811039-4	Water	10/31/18
OU2-1-MW008WT-F	1811039-5	Water	10/31/18
OU2-1-MW008WT-F-DUP	1811039-6	Water	10/31/18
OU2-1-MW009WT	1811039-7	Water	10/31/18
OU2-1-MW009WT-F	1811039-8	Water	10/31/18

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Sampling and Analysis Plan for the Phase 1 Remedial Investigation for Operable Unit 2, Gateway National Recreation Area, New York (September 2018), the Final Radionuclide Data Quality Evaluation Guidance (September 2008), the Multi Agency Radiological Laboratory Analytical Protocols (MARLAP) Manual (July 2004), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Methods Data Review (January 2017). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Radium-228 by PAI 724 Rev. 13

All sample results were subjected to Level IV data validation, which is comprised of the quality control (QC) summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

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.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

Counting and detector efficiency were determined for each detector and each radionuclide.

III. Continuing Calibration

Continuing calibration and background determination were performed at the required frequencies. Results were within laboratory control limits.

IV. Blanks

Laboratory blanks were analyzed as required by the method. Blank results contained less than the minimum detectable concentrations (MDC).

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

Samples OU2-1-MW008WT OU2-1-MW008WT-DUP and samples OU2-1-MW008WT-F and OU2-1-MW008WT-F-DUP were identified as field duplicates. No results were detected in any of the samples.

X. Minimum Detectable Concentrations

All minimum detectable concentrations (MDC) met reporting limits (RL).

XI. Sample Result Verification

All sample result verifications were acceptable.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Phase 1 RI OU2 Great Kills Park
Radium-228 - Data Qualification Summary - SDG 1811039

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Radium-228 - Laboratory Blank Data Qualification Summary - SDG 1811039

No Sample Data Qualified in this SDG

Phase 1 RI OU2 Great Kills Park
Radium-228 - Field Blank Data Qualification Summary - SDG 1811039

No Sample Data Qualified in this SDG

LDC #: 44135B29b
SDG #: 1811039
Laboratory: ALS Environmental

VALIDATION COMPLETENESS WORKSHEET
Level IV

Date: 1-25-19
Page: 1 of 1
Reviewer: MG
2nd Reviewer:

METHOD: Radium 228 (PAI 724 Rev 13)

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.	Sample receipt/Technical holding times	A	
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VII.	Duplicates	N	" "
VIII.	Laboratory control samples	A	LCS/LCSD
IX.	Field duplicates	ND	D= 3+4 D= 5+6
X.	Carrier recovery	A	
XI.	Minimum detectable activity (MDA)	A	
XII.	Sample result verification	A	
XIII.	Overall assessment of data	A	

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
SB=Source blank
OTHER:

	Client ID	Lab ID	Matrix	Date
1	OU2-1-MW010	1811039-1	Water	10/29/18
2	OU2-1-MW010-F	1811039-2	Water	10/29/18
3	OU2-1-MW008WT	1811039-3	Water	10/31/18
4	OU2-1-MW008WT-DUP	1811039-4	Water	10/31/18
5	OU2-1-MW008WT-F	1811039-5	Water	10/31/18
6	OU2-1-MW008WT-F-DUP	1811039-6	Water	10/31/18
7	OU2-1-MW009WT	1811039-7	Water	10/31/18
8	OU2-1-MW009WT-F	1811039-8	Water	10/31/18
9				
10				
11				
12				
13	PBW			

Notes:

LDC #: 44135B29b

VALIDATION FINDINGS CHECKLIST

Reviewer: MG
2nd Reviewer:

PAI 724 Rev. 13

Method: Radiochemistry(~~EPA Method~~)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments and detectors calibration as required?	✓			
Were NIST traceable standards used for all calibrations?	✓			
Was the check source identified by activity and radionuclide?	✓			
Were check sources including background counts analyzed at the requiried frequency and within laboratory control limits?	✓			
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?.			✓	
V. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 75-125%	✓			
VI. Sample Chemical/Carrier Recovery				
Was a tracer/carrier added to each sample?	✓			
Were tracer/carrier recoveries within the QC limits?	✓			
VII. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
VIII. Sample Result Verification				
Were activities adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were the Minimum Detectable Activities (MDA) < RL?	✓			

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.	✓			
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 #: 44135B29b

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: MG
2nd Reviewer:

METHOD: Radiochemistry (Method: PAI 724 Rev. 13)

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 / True 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 = |S-D| / (S+D)/2 x 100 Where, S = Original sample activity
D = Duplicate sample activity

Sample ID	Type of Analysis	Analyte	Found/S (units)	True/D (units)	Recalculated %R or RPD	Reported %R or RPD	Acceptable (Y/N)
LCS	Laboratory control sample	Ra-228	9.4 (pCi/L)	8.595 (pCi/L)	109	110	Y
-	Matrix spike sample	-	-	-	-	-	-
-	Duplicate RPD	-	-	-	-	-	-
1	Chemical recovery	Ba	30030 (µg)	32530 (µg)	92.3	92.3	Y

Comments: _____

LDC #: 44135B29b

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: MG
2nd reviewer: ~~X~~

METHOD: Radiochemistry (Method: PAI 724 Rev. 13)

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 all samples = N.D. ~~reported with a positive detect were recalculated and verified using the following equation:~~

Concentration = Recalculation:

$$\frac{(cpm - background)}{2.22 \times E \times SA \times Vol}$$

E = Counter Efficiency
SA = Self-absorbance factor
Vol = Volume of sample

#	Sample ID	Analyte	Reported Concentration (pCi/L)	Calculated Concentration (pCi/L)	Acceptable (Y/N)

Note: _____

LDC #: 94135

EDD POPULATION COMPLETENESS WORKSHEET

Date: 01/30/19
Page: 1 of 1
2nd Reviewer:

The LDC job number listed above was entered by 89.
Entered from Body or Summary

	EDD Process		Comments/Action
I.	EDD Completeness	-	
Ia.	- All methods present?	y	
Ib.	- All samples present/match report?	y	Extra IDW sample not validated
Ic.	- All reported analytes present?	y	
Id.	- 10% or 100% verification of EDD?	y	
II.	EDD Preparation/Entry	-	
IIa.	- Carryover U/J?	y	
IIb.	- Reason Codes used? If so, note which codes.	y	AECOM
IIc.	- Additional Information (QC Level, Validator, Validated Y/N, etc.) DATE	y	
III.	Reasonableness Checks	-	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	y	
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	y	
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	y	
IIId.	-Does the detect flag require changing for blank qualifier? If so, are all U results marked ND?	y/NA	
IIIe.	- Do blank concentrations in report match EDD where data was qualified due to blank contamination?	NA	
IIIf.	- Were multiple results reported due to dilutions/reanalysis? If so, were results qualified appropriately?	N/NA	
IIIg.	-Are there any discrepancies between the data packet and the EDD?	N	

Notes: *see discrepancy sheet

DATA VALIDATION REPORT - Level II Review

SDG No.:	**TID07**	**Analysis:**	**VOC, SVOC, PAH, Pesticides, Herbicides, Metals, PCDD/PCDF**
Laboratory:	**Eurofins Lancaster**	**Project:**	**Great Kills Park**
Reviewer:	**Devon Chicoine**	**Date:**	**November 20th, 2018**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, data review worksheets, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the specifics of the analytical method referenced and provisions of the approved project-specific work plan; and, qualified according to the *Contract Laboratory Program National Functional Guidelines*, January 2017, Modifications reflect the level of review requested, the specifications of the project-specific QAPP, and the specifics of the analytical methods employed.

Major Anomalies: None

Minor Anomalies:

VOCs - Trip blank OU2TB102218-001 displayed detections for chloromethane at 0.06 ug/L. The associated field sample results that displayed detections at levels approximate to those found in the blank were qualified U,bl and elevated to the limit of quantitation (LOQ) or the concentration in the blank, as appropriate.

SVOCs - The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
18297WAE026	Hexachlorocyclopentadiene	10-117	9

The field sample results associated with the negative biases were non-detect and were qualified UJ,l.

Field sample OU1-1SW005 displayed surrogate recoveries outside the QC limits:

Surrogate	QC Limits (%)	Recovery (%)
2-Fluorophenol	19-119	18
2,4,6-Tribromophenol	43-140	41
Nitrobenzene-d5	44-120	30

The field sample results associated with the negative biases were non-detect and were qualified UJ,s. The positive field sample results associated with a negative bias were qualified J-,s.

PAHs – The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
18297WAF026	Phenanthrene	53-115	120

The positive field sample results associated with a positive bias were qualified J+,l.

Method blank 18297WAF026 displayed detections for 1,4-dioxane at 0.2 ug/L. The associated field sample results that displayed detections at levels approximate to those found in the blank were qualified U,bl and elevated to the limit of quantitation (LOQ) or the concentration in the blank, as appropriate.

Pesticides – Field samples OU2-1-SW004 displayed surrogate percent recoveries outside the QC limits. The positive field sample results associated with a negative bias were qualified J-,s.

Method blank 182980006A displayed detections for 4,4-DDT at 0.0081 ug/l. The associated field sample results that displayed detections at levels approximate to those found in the blank were qualified U,bl and elevated to the limit of quantitation (LOQ) or the concentration in the blank, as appropriate.

The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
182980006A	Endosulfan I	62-126	56

The field sample results associated with the negative biases were qualified J- for the detects or UJ,l for the nondetects .

Herbicides - The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
182950006a	Dinoseb	19-133	17

The field sample results associated with the negative biases were non-detect and were qualified UJ,l.

PCBs - None

Metals: Method blank 182951063904A displayed detections for nickel at 0.0020 mg/l. The associated field sample results that displayed detections at levels approximate to those found in the blank were qualified U,bl and elevated to the limit of quantitation (LOQ) or the concentration in the blank, as appropriate.

Dioxin/Furan: None

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified method, with the exception of anomalies discussed previously. If a given fraction was not discussed, all quality control criteria reviewed were within acceptable limits.

DATA VALIDATION REPORT - Level II Review

SDG No.:	**TID08**	**Analysis:**	**VOC, SVOC, PAH, Pesticides, Herbicides, Metals, PCDD/PCDF**
Laboratory:	**Eurofins Lancaster**	**Project:**	**Great Kills Park**
Reviewer:	**Victoria Kirkpatrick**	**Date:**	**December 12th, 2018**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, data review worksheets, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the specifics of the analytical method referenced and provisions of the approved project-specific work plan; and, qualified according to the *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*, EPA-540-R-2017-002, January 2017, Modifications reflect the level of review requested, the specifications of the project-specific QAPP, and the specifics of the analytical methods employed.

Major Anomalies: During the herbicides analysis, the matrix spike duplicate (MSD) performed on parent sample OU002-1-SE004, performed in quality control (QC) batch 183090033A, displayed a percent recovery for dinoseb at 0%. The associated parent sample result was non-detect and was qualified R,m.

Minor Anomalies: During the volatile organic compound (VOC) analysis, trip blank OU2TB102218-001, prepared in QC batch H183041AA, displayed a detection for chloromethane greater than the detection limit (DL) at 0.06 µg/L. The associated field sample results were non-detect; no data qualifying action was required. The matrix spike pair (MS/MSD), performed on parent sample OU002-1-SE004, prepared in QC batch B182991AA, displayed percent recoveries outside the QC limits and/or relative percent differences (RPDs) greater than the upper QC limit of 20% for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)	RPD (%)
1,1,2,2-Tetrachloroethane	70-124	111	**152**	**31**
1,2,4-Trichlorobenzene	67-129	75	**51**	**39**
2-Butanone	51-148	124	**161**	**25**
Acetone	36-164	**173**	**285**	**45**
Freon-113	66-136	135	**139**	2
Styrene	76-124	99	76	**27**
Toluene	77-121	98	**222**	**69**

The field sample results associated with percent recoveries that were greater than the upper QC limits were positive and were qualified J+,m, while non-detects associated with negative biases were qualified UJ,m. The field sample results associated with the remaining percent recoveries were positive and were qualified J-,m. Field sample OU002-1-SE002 displayed a surrogate percent recovery for toluene-d_8 greater than the upper QC limit of 116% at 126% and a surrogate percent recovery for 4-bromofluorobenzene less than the lower QC limit of 79% at 69%. The field sample results associated with the positive bias were non-detect; no data qualifying action was required. The field sample results associated with the negative bias were non-detect and were qualified UJ,s.

During the semi-volatile organic compound (SVOC) analysis, the method blank prepared in batch 18302SLE026 displayed a detection for bis(2-ethylhexyl)phthalate greater than the DL at 0.010 µg/L. The associated field sample results that displayed positive results less than five times the concentration found in the blank were qualified U,bl. When appropriate, the limits of detection (LOD) and limits of quantitation were elevated to the concentration detected or the concentration detected was elevated to the LOD. The laboratory control spike (LCS) prepared in QC batch 18302SLC026 displayed a percent recovery for pyridine less than the lower QC limit of 57% at 56%. The associated field sample results were non-detect and were qualified UJ,l. The MS/MSD, performed on parent sample OU002-1-SE004, prepared in QC batch 18302SLC026, displayed percent recoveries less than the lower QC limits and/or RPDs greater than the upper QC limit of 20% for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)	RPD (%)
3,3'-Dichlorobenzidine	22-121	**11**	22	**69**
4-Chloroaniline	17-106	18	31	**54**
Aniline	44-123	**14**	**23**	**52**
Hexachlorocyclopentadiene	37-161	**35**	43	18
Pyridine	57-96	58	**52**	12

The field sample results associated with RPD anomalies were non-detect; no data qualifying action was required. The field sample results associated with the negative biases were qualified UJ,m, unless previously qualified due to a LCS percent recovery anomaly. Field sample OU002-1-SE002 exceeded the linear range of the instrument for bis(2-ethylhexyl)phthalate. The associated sample result was qualified J,q.

During the polyaromatic hydrocarbon (PAH) analysis, the LCS prepared in QC batch 18302SLE026 displayed a percent recovery for 1,4-dioxane less than the lower QC limit of 70% at 59%. The associated field sample results were positive and were qualified J,l. The MS/MSD, performed on parent sample OU002-1-SE004, prepared in QC batch 18302SLE026, displayed percent recoveries outside the QC limits and/or RPDs greater than the upper QC limit of 20% for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)	RPD (%)
1,4-Dioxane	70-130	**62**	**67**	7
Anthracene	50-114	**139**	84	**48**
Benzo(a)pyrene	50-125	115	87	**23**
Benzo(b)fluoranthene	53-128	**133**	117	10
Bis(2-ethylhexyl)phthalate	67-150	**169**	98	**40**
Chyrsene	57-118	**123**	99	18
Fluoranthene	55-119	**149**	114	**21**
Fluorene	47-114	**121**	91	**28**
Naphthalene	38-111	**199**	103	**59**
Phenanthrene	49-113	**185**	**121**	**37**
Pyrene	55-119	**135**	100	**24**

The field sample results associated with percent recoveries that were greater than the upper QC limits were positive and were qualified J+,m. The field sample results associated with RPD anomalies were positive and were qualified J,ld. The field sample results associated with the negative biases were positive and were qualified J-,m, unless previously qualified due to a method blank or LCS percent recovery anomaly.

During the herbicides analysis, the MS/MSD performed on parent sample OU002-1-SE004, prepared in QC batch 183090033AA, displayed a RPD for dalapon greater than the upper QC limit of 20% at 37%. The associated parent sample result was non-detect; no data qualifying action was required.

During the pesticides analysis, the field samples prepared in QC batch 182980035A displayed surrogate percent recoveries greater than the upper QC limit of 129% for the following:

Field Sample	Surrogate	Recovery (%)
OU002-1-SE001	Tetrachloro-m-xylene-d_1	**143**
OU002-1-SE002		**130**
OU002-1-SE003	Tetrachloro-m-xylene-d_2	**133**

The positive field sample results were qualified J+,s.

During the metals analysis, the following MS/MSDs performed on parent sample OU002-1-SE004 displayed percent recoveries outside the QC limits and/or RPDs greater than the upper QC limit of 20% for the following:

QC Batch	Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)	RPD (%)
182931063702	Thorium	75-125	113	110	**25**
182971063702A	Aluminum	78-124	**383***	**131***	15
	Antimony	72-124	**53**	92	**44**
	Arsenic	82-118	**81**	**121**	**32**
	Beryllium	80-120	97	102	**26**
	Cadmium	84-116	96	**120**	**31**
	Chromium	83-119	**120**	**150**	**25**
	Cobalt	84-115	101	96	**22**
	Copper	84-119	**-30***	**235**	**56**
	Iron	81-124	**-48***	**375***	11
	Lead	84-118	**-211***	**426***	**55***
	Magnesium	80-123	**134***	105	1
	Manganese	85-116	92*	**129***	11
	Nickel	84-119	108	**130**	16
	Silver	83-118	101	101	**27**
	Sodium	79-125	110	116	**33**
	Thallium	83-118	92	109	**36**
	Uranium	75-125	103	99	**22**
	Vanadium	82-116	93	**141**	**26**
	Zinc	82-119	**160**	**246**	**34**
182971063702B	Calcium	86-118	**125**	**136**	**21**
	Selenium	80-119	97	106	**33**
182971063702D	Barium	86-116	**63***	**179**	**29**

*The unspiked parent sample result was more than four times the spike added; no data qualifying action was required

The field sample results associated with percent recoveries that were greater than the upper QC limits were positive and were qualified J+,m. The field sample results associated with the remaining percent recoveries were positive and were qualified J-,m. The positive field sample results associated with RPD anomalies were qualified J,ld. The field duplicate pair performed on field sample OU002-1-SE004 displayed a RPD for lead

greater than the upper QC limit of 50% at 64.8%. The positive associated field sample result was qualified J,fd. The laboratory duplicate performed on parent sample OU002-1-SE004 displayed RPDs greater than the upper QC limit for the following:

QC Batch	Analyte	RPD (%)
182971063702A	Chromium	21
	Lead	70
	Vanadium	27
	Zinc	53
182971063702D	Barium	27

The positive associated field sample results were previously qualified due to MS/MSD percent recovery or RPD anomalies; no data qualifying action was required. The field duplicate pair performed on field sample OU002-1-SE004 displayed a delta for silver greater than two times the LOQ. The positive associated field sample results were qualified J,fd.

During the dioxin and furan analysis, the method blank prepared in QC batch 18297009 displayed detections greater than the DL for the following:

Analyte	Concentration (mg/kg)
123478-HxCDD	0.000000258
123678-HxCDD	0.000000286
1234678-HpCDD	0.000000276
12378-PeCDF	0.000000350
23478-PeCDF	0.000000291
123478-HxCDF	0.000000300
123789-HxCDF	0.000000395
234678-HxCDF	0.000000279
1234678-HpCDF	0.000000263
1234789-HpCDF	0.000000335
OCDF	0.000000591

The positive associated field sample results that were less than ten times the concentrations found in the blanks were qualified U,bl, and elevated to the LOD. The field duplicate pair performed on field sample OU002-1-SE004 displayed a RPD for OCDD greater than the upper QC limit of 50% at 52.7%. The positive associated field sample results were qualified J,fd.

Correctable Anomalies: None.

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified method, with the exception of anomalies discussed previously. If a given fraction was not discussed, all quality control criteria reviewed were within acceptable limits. Except for those flagged "R", all data are usable, as qualified, for their intended purpose based on the data reviewed.

Signed: Victoria Kirkpatrick

DATA VALIDATION REPORT - Level II Review

SDG No.:	**TID09**	**Analysis:**	**VOC, SVOC, PAH, Pesticides, Herbicides, Metals, PCDD/PCDF**
Laboratory:	**Eurofins Lancaster**	**Project:**	**Great Kills Park**
Reviewer:	**Devon Chicoine**	**Date:**	**November 19th, 2018**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, data review worksheets, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the specifics of the analytical method referenced and provisions of the approved project-specific work plan; and, qualified according to the *Contract Laboratory Program National Functional Guidelines*, January 2017, Modifications reflect the level of review requested, the specifications of the project-specific QAPP, and the specifics of the analytical methods employed.

Major Anomalies: None

Minor Anomalies:

VOCs - The LCS/LCSD analyzed in QC batch B183022AA displayed a relative percent difference greater than the QC limit of 20% for 1,2-dibromo-3-chloropropane and 2-hexanone at 23% and 1,2-4-trichlorobenzene at 22%. The positive associated field sample result was qualified J,ld.

SVOCs - The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
18302SLC026	2,2'-oxybis(1-chloropropane	68-112	65
	Pyridine	57-96	56

The field sample results associated with the negative biases were non-detect and were qualified UJ,l.

PAHs – The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
18302SLE026	1,4-Dioxane	70-130	59

The field sample results associated with the negative biases were non-detect and were qualified UJ,l. The positive field sample results associated with a negative bias were qualified J-,l.

Method blank 18302SLE026 displayed detections for bis(2-ethylhexyl)phthalate at 0.010 ug/Kg. The associated field sample results that displayed detections at levels

approximate to those found in the blank were qualified U,bl and elevated to the limit of quantitation (LOQ) or the concentration in the blank, as appropriate.

Pesticides – Field samples OU2-1-SS003, OU2-1-SS005, and OU2-1SS005-DUP displayed surrogate percent recoveries outside the QC limits. The positive field sample results associated with a positive bias were qualified J+,s.

The field duplicate pair performed on field sample OU2-1-SS005 displayed several RPD greater than the QC limit of 50% (4,4'-DDT, beta-BHC, alpha-BHC, and endosulfan I). The positive field sample results were qualified J,fd.

PCBs - Field samples OU2-1-SS003, OU2-1-SS005, and OU2-1SS005-DUP displayed surrogate percent recoveries outside the QC limits. The positive field sample results associated with a positive bias were qualified J+,s.

Metals: Thorium CCV RSDs were > 5%. The acceptance limits: < 5%. The positive field sample results associated with positive biases were qualified J,c.

The field duplicate pair performed on field sample OU2-1-SS005 displayed several RPD greater than the QC limit of 50% (manganese, chromium, lead, thallium, and iron). The positive field sample results were qualified J,fd.

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified method, with the exception of anomalies discussed previously. If a given fraction was not discussed, all quality control criteria reviewed were within acceptable limits.

DATA VALIDATION REPORT - Level II Review

SDG No.:	**TID10**	**Analysis:**	**VOC, SVOC, PAH, Pesticides, Herbicides, Metals, PCDD/PCDF**
Laboratory:	**Eurofins Lancaster**	**Project:**	**Great Kills Park**
Reviewer:	**Devon Chicoine**	**Date:**	**December 10th, 2018**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, data review worksheets, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the specifics of the analytical method referenced and provisions of the approved project-specific work plan; and, qualified according to the *Contract Laboratory Program National Functional Guidelines*, January 2017, Modifications reflect the level of review requested, the specifications of the project-specific QAPP, and the specifics of the analytical methods employed.

Major Anomalies:

SVOCs- The MS/MSD performed on field sample OU002-2-SS006 displayed recoveries outside the QC limits and/or relative percent differences (RPDs) greater than 20% for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)	RPD (%)
Aniline	44-113	**0**	**0**	0
2-Chloronaphthalene	41-114	75	102	**32**
3,3'-Dichlorobenzidine	22-121	**0**	**0**	0
Hexachlorocylcopentadiene	37-161	**0**	**0**	0
Hexachloroethane	28-117	**18**	46	**88**
2-Nitroaniline	44-127	**64**	81	**24**
3-Nitroaniline	33-119	**0**	**0**	0
4-Nitroaniline	54-103	**0**	**0**	0
Pyridine	57-96	**48**	47	4

The field sample results associated with the 0% recoveries were non-detect and were qualified R,m. The parent sample results associated with the high biases were qualified J+,m. The parent sample result associated with one high bias and one low bias and was qualified J,m. The parent sample results associated with the low biases were qualified J-,m. The parent sample results associated with the high RPDs (2-chloronaphthalene) were qualified J,ld.

Herbicides- The MS/MSD performed on field sample OU002-2-SS006 displayed recoveries outside the QC limits and/or relative percent differences (RPDs) greater than 20% for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)	RPD (%)
Dalapon	15-115	**0**	**0**	0
Dicamba	38-132	**0**	**0**	0
Dinoseb	10-115	**0**	**0**	0

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)	RPD (%)
MCPA	28-135	**0**	**0**	0
MCPP	35-143	**0**	**0**	0

The field sample results associated with the 0% recoveries were non-detect and were qualified R,m.

Minor

Anomalies: **VOCs** – Field sample OU2-1-SS002 and OU2-1-SS004 recovery for the internal standard was outside the QC acceptance limits. The samples were re-analyzed and the QC was again outside the acceptance limits, indicating a matrix effect. The data was reported from the initial trial.

Field sample OU2-1-SS004, OU2-1-SS006, OU2-1-SS002, and OU2-1-SS008 displayed surrogate percent recoveries for toluene-D8 greater than the QC limits. The positive associated field sample result was qualified J+,s.

The MS/MSD performed on field sample OU002-2-SS006 displayed recoveries outside the QC limits and/or relative percent differences (RPDs) greater than 20% for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)	RPD (%)
Acetone	36-164	**457**	**228**	**67**
Bromoform	67-132	**48**	**60**	19
2-Butanone	51-148	**184**	118	**46**
Chlorobenzene	79-120	**72**	79	6
1,2-Dibromo-3-chloropropane	61-132	**53**	86	**44**
1,2-Dibromoethane	78-122	**76**	89	13
1,2-Dichlorobenzene	78-121	**64**	**76**	14
1,3-Dichlorobenzene	77-121	**69**	77	8
1,4-Dichlorobenzene	75-120	**68**	76	8
cis-1,3-Dichloropropene	74-126	**41**	**59**	**32**
Trans-1,3-Dichloropropene	71-130	**54**	**68**	20
Freon 113	66-136	**138**	**142**	0
2-Hexanone	53-145	**39**	69	**52**
2-methyl-2-pentanone	65-135	**57**	69	**52**
Methylcyclohexane	66-133	**63**	72	11
Styrene	76-124	**47**	**53**	8
1,1,2,2-Tetrachloroethane	70-124	**125**	**153**	17
1,2,4-Trichlorobenzene	67-129	**0**	**30**	**200**
Trichloroethene	77-123	**74**	81	7
Xylene (total)	78-124	**76**	84	7

The parent sample results associated with the high biases were qualified J+,m. The parent sample result associated with one high bias and one low bias and was qualified J,m. The parent sample result associated with the remaining percent recoveries were non-detect and were qualified UJ,m.

SVOCs - Method blank 18302SLI026 displayed detections for 2-methylnaphthalene at 0.012 mg/Kg. The sample was re-extracted outside method holding time and the QC was compliant. The data was reported from the initial trial (OU2-1-SS002, OU2-1-SS004, OU2-1-SS006, and OU2-1-SS008) except for 2-methylnaphthalene which was used from the reanalysis trial.

PAHs – Method blank 18302SLH026 displayed detections for acenapthene (0.002 mg/Kg), for anthracene (0.0007 mg/Kg), fluorene (0.002 mg/Kg), naphthalene (0.031 mg/Kg), and phenanthrene (0.003 mg/Kg) The samples (OU2-1-SS002, OU2-1-SS004) were re-extracted outside method holding time and the QC was compliant. The associated field sample results that displayed detections at levels approximate to those found in the blank were qualified U,bl and elevated to the limit of quantitation (LOQ) or the concentration in the blank, as appropriate. The initial results were reported except for the analytes that displayed blank contamination. Those analytes were qualified J,h.

The laboratory control spike (LCS) 18302SLH026 displayed percent recoveries less than the lower QC limit for 1,4-dioxane (69%). The associated field sample results were non-detect and were qualified UJ,l.

The MS/MSD performed on field sample OU002-2-SS006 displayed recoveries outside the QC limits and/or relative percent differences (RPDs) greater than 20% for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)	RPD (%)
Anthracene	50-114	**162**	**131**	**53**
Benzo(a)anthracene	54-122	**38**	**211**	**32**
Benzo(a)pyrene	50-125	**13**	**153**	**25**
Benzo(g,h,i)perylene	49-127	**-2**	**47**	20
Benzo(k)fluoranthene	56-123	86	**294**	**31**
Chrysene	57-118	**49**	74	**43**
Dibenz(a,h)anthracene	50-129	**44**	62	14
Fluoranthene	55-119	**395**	**593**	**60**
Indeno(1,2,3-cd)pyrene	49-130	**5**	74	**26**
Naphthalene	38-111	98	**510**	**45**
Phenanthrene	49-113	**258**	**582**	**79**
Pyrene	55-117	**-48**	**379**	**45**

The parent sample results associated with one high and one low percent recovery were positive and were qualified J,m. The positive parent sample results associated with positive biases were qualified J+,m. The positive parent sample result associated with the negative bias for was qualified J-,m.

Herbicides- Field samples OU2-1-SS008 displayed a surrogate percent recovery greater than the upper QC limit. The positive associated field sample result was qualified J+,s.

Pesticides – Field samples OU2-1-SS004, OU2-1-SS006, OU2-1-SS002, and OU2-1-SS008 displayed a surrogate percent recovery greater than the upper QC limit for dechlorobiphenyl. The positive associated field sample result was qualified J+,s.

The MS/MSD performed on field sample OU002-2-SS006 displayed recoveries outside the QC limits and/or relative percent differences (RPDs) greater than 20% for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)	RPD (%)
Beta-BHC	50-136	**255**	**170**	**40**
4,4-DDD	56-139	**53**	**48**	0
4,4-DDT	50-141	**-56**	**29**	**35**
Dieldrin	56-136	98	66	**39**
Endosulfan II	53-134	**0**	**0**	0
Endrin aldehyde	35-137	99	60	**50**

The field sample results associated with the 0% recoveries were non-detect and were qualified R,m. The positive parent sample result associated with the negative bias was qualified J-,m. The parent sample result associated with the high RPD for was positive and was qualified J,ld.

PCBs- Field samples OU2-1-SS004, OU2-1-SS006, OU2-1-SS002, and OU2-1-SS008 displayed a surrogate percent recovery greater than the upper QC limit for dechlorobiphenyl. The positive associated field sample result was qualified J+,s.

Metals: The following MS/MSDs displayed percent recoveries outside the QC limits for the following:

Parent Sample	Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)
OU002-2-SS006	Aluminum	78-124	**3131**	**231**
	Antimony	72-124	**-31**	**-29**
	Arsenic	82-118	90	**148**
	Barium	86-116	**-1843**	**-2633**
	Cadmium	84-116	**61**	**19**
	Calcium	86-118	**-20**	**81**
	Chromium	83-119	**75**	**63**
	Copper	84-119	**7400**	**-668**
	Iron	81-124	**-1863**	**6147**
	Lead	84-118	**-1050**	**-2072**
	Magnesium	80-123	107	**217**
	Manganese	85-116	**58**	**4813**
	Nickel	84-119	**67**	**44**
	Thallium	83-118	**74**	**65**
	Vanadium	82-116	**78**	87
	Zinc	82-119	**45**	**80**

The parent sample results associated with one high and one low percent recovery were positive and were qualified J,m. The positive field sample results associated with positive biases were qualified J+,m. The positive field sample results associated with negative biases were qualified J-,m, while non-detects were qualified UJ,m.

Dioxin/Furan:

The following MS/MSDs displayed percent recoveries outside the QC limits:

Parent Sample	Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)
OU002-2-SS006	1,2,3,4,6,7,8-HpCDD	76-125	**153**	**127**
	OCDD	73-135	**1600**	**1742**

The positive field sample results associated with positive biases were qualified J+,m.

The result for 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)in field sample OU2-1-SS006 and the result for 2,3,7,8-TCDD in field sample OU2-1-SS002 was reported as the estimated maximum possible concentration of the analyte due to a signal to noise ratio anomaly. The associated field sample result was qualified J,q.

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified method, with the exception of anomalies discussed previously. If a given fraction was not discussed, all quality control criteria reviewed were within acceptable limits. Except for those flagged "R," all data are usable, as qualified, for their intended purpose based on the data reviewed.

DATA VALIDATION REPORT - Level II Review

SDG No.:	**TID11**	**Analysis:**	**VOC, SVOC, PAH, Pesticides, Herbicides, Metals, PCDD/PCDF**
Laboratory:	**Eurofins Lancaster**	**Project:**	**Great Kills Park**
Reviewer:	**Devon Chicoine**	**Date:**	**November 28th, 2018**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, data review worksheets, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the specifics of the analytical method referenced and provisions of the approved project-specific work plan; and, qualified according to the *Contract Laboratory Program National Functional Guidelines*, January 2017, Modifications reflect the level of review requested, the specifications of the project-specific QAPP, and the specifics of the analytical methods employed.

Major Anomalies: None

Minor Anomalies:

VOCs - The LCS/LCSD analyzed in QC batch B183101AA displayed a relative percent difference greater than the QC limit of 20% for 4-methyl-2-pentanone at 21%. The positive associated field sample result was qualified J,ld.

Field sample OU2-1-SU004-22 displayed surrogate percent recoveries for 1,2-dichloroethane-d4 (68%) and 4-bromofluorobenzene (56%) less than the lower QC limits. The associated field sample results were either qualified J-,s for the detects and non-detects and were qualified UJ,s.

SVOCs - The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
18302SLC026	2,2'-oxybis(1-chloropropane	68-112	65
	Pyridine	57-96	56

The field sample results associated with the negative biases were non-detect and were qualified UJ,l.

PAHs – The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
18302SLE026	1,4-Dioxane	70-130	59

The field sample results associated with the negative biases were non-detect and were qualified UJ,l. The positive field sample results associated with a negative bias were qualified J-,l.

Field samples OU2-1-SU004-09 displayed a surrogate percent recovery greater than the upper QC limit. The positive associated field sample result was qualified J+,s.

Pesticides – Field samples OU2-1-SU002-04, OU2-1-SU004-09, OU2-1-SU004-14, and OU2-1-SU004-22 displayed surrogate percent recoveries outside the QC limits. The positive field sample results associated with a positive bias were qualified J+,s.

Herbicides – Field samples OU2-1-SU004-14 and OU2-1-SU004-22 displayed surrogate percent recoveries outside the QC limits. The positive field sample results associated with a positive bias were qualified J+,s.

PCBs - Field samples OU2-1-SU002-04 and OU2-1-SU004-22 displayed surrogate percent recoveries outside the QC limits. The positive field sample results associated with a positive bias were qualified J+,s.

Metals: Thorium CCV RSDs were > 5%. The acceptance limits: < 5%. The positive field sample results associated with positive biases were qualified J,c.

Dioxin/Furan: Field sample OU2-1-SU004-09, OU2-1-SU004-14, and OU2-1-SU004-22 displayed surrogate percent recoveries less than the lower QC limits. The associated field sample results were either qualified J-,s for the detects and non-detects and were qualified UJ,s.

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified method, with the exception of anomalies discussed previously. If a given fraction was not discussed, all quality control criteria reviewed were within acceptable limits.

DATA VALIDATION REPORT - Level II Review

SDG No.:	**TID12**	**Analysis:**	**VOC, SVOC, PAH, Pesticides, Herbicides, Metals, PCDD/PCDF**
Laboratory:	**Eurofins Lancaster**	**Project:**	**Great Kills Park**
Reviewer:	**Devon Chicoine**	**Date:**	**November 29th, 2018**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, data review worksheets, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the specifics of the analytical method referenced and provisions of the approved project-specific work plan; and, qualified according to the *Contract Laboratory Program National Functional Guidelines*, January 2017, Modifications reflect the level of review requested, the specifications of the project-specific QAPP, and the specifics of the analytical methods employed.

Major Anomalies: None

Minor Anomalies:

VOCs - Field sample OU2-1-SU005-06, OU2-1-SU005-06DUP, OU2-1-SU005-16, OU2-1-SU006-05, and OU2-1-SU006-14 displayed surrogate percent recoveries for less than the lower QC limits. The associated field sample results were either qualified J-,s for the detects and non-detects and were qualified UJ,s. Field sample OU2-1-SU008-02 displayed surrogate percent recoveries for greater than the QC limits. The associated field sample results were either qualified J+,s for the detects.

SVOCs - The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
18303SLC026	2,2'-oxybis(1-chloropropane)	68-112	65
	Pyridine	57-96	55

The field sample results associated with the negative biases were non-detect and were qualified UJ,l.

PAHs – The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
18305SLE026	1,4-Dioxane	70-130	59

The field sample results associated with the negative biases were non-detect and were qualified UJ,l. The positive field sample results associated with a negative bias were qualified J-,l.

The following method blank displayed detections greater than the DL:

Method Blank	Analyte	Concentration (mg/Kg)
18302SLE026	Bis(2-ethylhexyl)phthalate	0.010

The associated field sample results that displayed detections at levels approximate to those found in the blank were qualified U,bl and elevated to the LOQ or the concentration in the blank, as appropriate.

Pesticides – Field samples OU2-1-SU005-06, OU2-1-SU005-06DUP, OU2-1-SU005-16 displayed surrogate percent recoveries outside the QC limits. The positive field sample results associated with a positive bias were qualified J+,s.

Herbicides – Field samples OU2-1-SU005-06, OU2-1-SU005-06DUP, OU2-1-SU005-16 displayed surrogate percent recoveries outside the QC limits. The positive field sample results associated with a positive bias were qualified J+,s.

PCBs - Field samples OU2-1-SU005-16 and OU2-1-SU006-14 displayed (positive biases) surrogate percent recoveries outside the QC limits. The positive field sample results associated with a positive bias were qualified J+,s.

Metals: Thorium CCV RSDs were > 5%. The acceptance limits: < 5%. The positive field sample results associated with positive biases were qualified J,c.

Dioxin/Furan: The result for 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD) and 2,3,7,8-TCDD in field sample OU2-1-SU005-06 and OU2-1-SU008-02 was reported as the estimated maximum possible concentration of the analyte due to a signal to noise ratio anomaly. The associated field sample result was qualified J,q.

Field sample OU2-1-SU005-06, OU2-1-SU005-06DUP, OU2-1-SU005-16, OU2-1-SU006-05, and OU2-1-SU006-14 displayed surrogate percent recoveries for less than the lower QC limits. The associated field sample results were either qualified J-,s for the detects and non-detects and were qualified UJ,s.

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified method, with the exception of anomalies discussed previously. If a given fraction was not discussed, all quality control criteria reviewed were within acceptable limits.

DATA VALIDATION REPORT - Level II Review

SDG No.:	**TID13**	**Analysis:**	**VOC, SVOC, PAH, Pesticides, Herbicides, Metals, PCDD/PCDF**
Laboratory:	**Eurofins Lancaster**	**Project:**	**Great Kills Park**
Reviewer:	**Devon Chicoine**	**Date:**	**November 28th, 2018**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, data review worksheets, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the specifics of the analytical method referenced and provisions of the approved project-specific work plan; and, qualified according to the *Contract Laboratory Program National Functional Guidelines*, January 2017, Modifications reflect the level of review requested, the specifications of the project-specific QAPP, and the specifics of the analytical methods employed.

Major Anomalies: None

Minor Anomalies:

VOCs - Field sample OU2-1-SU003-08 and OU2-1-SU007-10 displayed surrogate percent recoveries for less than the lower QC limits. The associated field sample results were either qualified J-,s for the detects and non-detects and were qualified UJ,s.

SVOCs - The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
18305SLE026	Pyridine	57-96	55

The field sample results associated with the negative biases were non-detect and were qualified UJ,l.

PAHs – The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
18305SLD026	1,4-Dioxane	70-130	68

The field sample results associated with the negative biases were non-detect and were qualified UJ,l. The positive field sample results associated with a negative bias were qualified J-,l.

Field sample OU2-1-SU001-10 displayed surrogate percent recoveries for less than the lower QC limits. The associated field sample results were either qualified J-,s for the detects and non-detects and were qualified UJ,s.

Method blank 18305SLD026 displayed detections for anthracene at 0.0008 mg/kg, naphthalene at 0.004 mg/Kg and phenanthrene at 0.0008 mg/kg. The associated field sample results that displayed detections at levels approximate to those found in the blank

were qualified U,bl and elevated to the limit of quantitation (LOQ) or the concentration in the blank, as appropriate.

Pesticides – Field samples OU2-1-SU003-08 and OU2-1-SU007-10 displayed surrogate percent recoveries greater than the QC limits. The positive field sample results associated with a positive bias were qualified J+,s.

Herbicides – Field samples OU2-1-SU003-08, OU2-1-SU003-08, and OU2-1-SU007-10 displayed surrogate percent recoveries outside the QC limits. The positive field sample results associated with a positive bias were qualified J+,s.

PCBs - Field samples OU2-1-SU003-08 and OU2-1-SU007-10 displayed surrogate percent recoveries greater than the QC limits. The positive field sample results associated with a positive bias were qualified J+,s.

Metals: Thorium CCV RSDs were > 5%. The acceptance limits: < 5%. The positive field sample results associated with positive biases were qualified J,c.

Dioxin/Furan: The result for 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)in field sample OU2-1-SU007-10 and OU2-1-SU003-08 was reported as the estimated maximum possible concentration of the analyte due to a signal to noise ratio anomaly. The associated field sample result was qualified J,q.

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified method, with the exception of anomalies discussed previously. If a given fraction was not discussed, all quality control criteria reviewed were within acceptable limits.

DATA VALIDATION REPORT - Level II Review

SDG No.:	**TID14**	**Analysis:**	**VOC, SVOC, PAH, Pesticides, Herbicides, Metals, PCDD/PCDF**
Laboratory:	**TestAmerica St. Louis**	**Project:**	**Great Kills Park**
Reviewer:	**Devon Chicoine**	**Date:**	**December 12th, 2018**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, data review worksheets, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the specifics of the analytical method referenced and provisions of the approved project-specific work plan; and, qualified according to the *Contract Laboratory Program National Functional Guidelines*, January 2017, Modifications reflect the level of review requested, the specifications of the project-specific QAPP, and the specifics of the analytical methods employed.

Major Anomalies: None.

Minor

Anomalies: **VOCs-** Equipment blank OU2EB103018-001 displayed detection above the detection (DL) acetone at 3.8 ug/L, chloroform at 0.1 ug/L, methylene chloride at 0.07 ug/L, and carbon disulfide at 0.2 ug/L. The associated field sample result that displayed a detection approximate to that found in the blank was qualified U,bl and elevated to the limit of quantitation (LOQ).

SVOCs - Field sample OU2-1-MW008I displayed a surrogate percent recovery lower than the QC limit for 2,4,6-tribromophenol at 32%, phenol-d6 at 5%, and 2-fluorophenol at 4%. The positive associated field sample result was qualified J-,s and the nondetects were qualified UJ,s.

The matrix spike pair (MS/MSD) performed on parent sample OU2-1-MW008I displayed percent recoveries less than the lower quality control (QC) limit for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)
2,4-Dichlorophenol	47-121	55	**42**
Phenol	23-82	30	**19**

The associated parent sample result were non-detect and qualified UJ,m.

PAHs – Field sample OU2-1-MW010, OU2-1-MW008I displayed a LCS recovery for bis(2-chloroethyl)ether greater than the upper QC limit of 116% at 123%. The positive associated field sample results were qualified J,l.

Method blank 18305WAN026 displayed a detection above the detection limit (DL) for bis(2-ethylhexyl)phthalate at 0.3 ug/L, di-n-butyl phthalate at 0.08 ug/L, benzo(g,h,i)perylene at 0.01 ug/L, and indeno(1,2,3-cd)pyrene at 0.01 ug/L. The associated field sample result that displayed a detection approximate to that found in the blank was qualified U,bl and elevated to the limit of quantitation (LOQ).

The MS/MSD performed on parent sample sample OU2-1-MW008I displayed percent recoveries not within QC limits for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)
Bis(2-ethylhexyl)phthalate	55-173	**46**	114

The parent sample result associated with one high bias and one low bias and was qualified J,m.

PCBs – Field sample OU2-1-MW010 displayed high surrogate recovery (140%). The positive associated field sample results were qualified J+,s.

Herbicides- The MS/MSD performed on field sample OU2-1-MW008I displayed recoveries outside the QC limits and/or relative percent differences (RPDs) greater than 20% for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)	RPD (%)
Dicamba	50-141	**0**	**0**	0
MCPA	35-144	**27**	**21**	0
MCPP	33-157	**0**	**0**	0
2,4,5-T	42-147	**0**	**0**	0
2,4,5-TP	51-134	**0**	**0**	0

The field sample results associated with the 0% recoveries were non-detect and were qualified R,m.

Pesticides- Field sample OU2-1-MW010 displayed a surrogate percent recovery lower than the QC limit for decachlorobiphenyl at 23% and tetrachloro-m-xylene at 31%. The positive associated field sample result was qualified J-,s and the nondetects were qualified UJ,s. The following laboratory control spikes (LCS) displayed percent recoveries outside the QC limits:

Analysis Batch	Analyte	QC Limits (%)	LCS Recovery (%)
183050009A	Aldrin	45-134	39
	Alpha Chlordane	60-129	59
	Endosulfan I	62-126	59
	Endosulfan sulfate	62-133	61
	Heptachlor	54-130	53
	Heptachlor epoxide	61-133	60

The field sample results associated with the negative biases were non-detect and were qualified UJ,l.

Metals:

The MS/MSD performed on parent sample OU2-1-MW008I displayed percent recoveries not within QC limits for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)
Magnesium	83-118	**171**	**154**
Calcium	87-118	**151**	**75**
Sodium	85-117	**121**	111
Nickel	85-117	**67**	**68**
Chromium	85-116	**16**	**17**

The parent sample results associated with the high biases were qualified J+,m. The parent sample result associated with one high bias and one low bias and was qualified J,m. The parent sample results associated with the low biases were qualified J-,m.

The MS/MSD performed on parent sample OU2-1-MW008I-F displayed percent recoveries not within QC limits for the following:

Analyte	QC Limits (%)	MS Recovery (%)	MSD Recovery (%)
Magnesium	87-115	**157**	**135**
Barium	86-114	**125**	**157**
Calcium	87-118	**131**	**85**
Sodium	85-117	**228**	**251**
Nickel	85-116	**82**	**83**

The parent sample results associated with the high biases were qualified J+,m. The parent sample result associated with one high bias and one low bias and was qualified J,m. The parent sample results associated with the low biases were qualified J-,m.

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified method, with the exception of anomalies discussed previously. If a given fraction was not discussed, all quality control criteria reviewed were within acceptable limits.

DATA VALIDATION REPORT - Level II Review

SDG No.:	**TID15**	**Analysis:**	**VOC, SVOC, PAH, Pesticides, Herbicides, Metals, PCDD/PCDF**
Laboratory:	**Eurofins**	**Project:**	**Great Kills Park**
Reviewer:	**Devon Chicoine**	**Date:**	**December 14th, 2018**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, data review worksheets, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the specifics of the analytical method referenced and provisions of the approved project-specific work plan; and, qualified according to the *Contract Laboratory Program National Functional Guidelines*, January 2017, Modifications reflect the level of review requested, the specifications of the project-specific QAPP, and the specifics of the analytical methods employed.

Major Anomalies: None.

Minor Anomalies:

VOCs- Trip blank OU2TB103118-001 displayed a detection above the detection limit (DL) for methylene chloride at 0.07 ug/L. The associated field sample result that displayed a detection approximate to that found in the blank was qualified U,bl and elevated to the limit of quantitation (LOQ).

PAHs – Method blank 160-275374/1-A displayed a detection above the detection limit (DL) for di-n-butylphthalate at 0.1 ug/L and bis(2-ethylhexyl)phthalate at 0.3 ug/L. The associated field sample result that displayed a detection approximate to that found in the blank was qualified U,bl and elevated to the limit of quantitation (LOQ).

The field duplicate pair performed on field sample OU002-1-MW008WT displayed several RPD greater than the QC limit of 25% (benzo(b)fluoranthene, chrysene, benzo(a)anthracene). The positive field sample results were qualified J,fd.

Pesticides- Field sample OU2-1-MW008WT, OU2-1-MW008WTDUP, OU2-1-MW009WT displayed a surrogate percent recovery less than the lower QC limit. The associated field sample results that were detected were qualified J- and non-detect were qualified UJ,s.

Metals: The ICV, CCV RSD is greater than 5% for Thorium. The acceptance limits: < 5%. The positive field sample results associated with positive biases were qualified J,c.

The field duplicate pair performed on field sample OU002-1-MW008WT displayed several RPD greater than the QC limit of 25% (nickel). The positive field sample results were qualified J,fd.

Comments: On the basis of this evaluation, the laboratory appears to have followed the specified method, with the exception of anomalies discussed previously. If a given fraction was not discussed, all quality control criteria reviewed were within acceptable limits. All data are usable, as qualified, for their intended purpose based on the data reviewed.