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Data Validation Report for CH2M Hill Plateau Remediation Company

VSR18-003
Project 100-K

Chemical and Radiochemical Validation - Level C

Validation Performed By:

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Eyda Hergenreder

Date: 12-04-2017

Technical Review By:

Ellen McEntee
Ellen McEntee

Date: 12-04-2017

Quality Review By:

Mary A. Donovan
Mary Donovan
Quality Assurance Manager

Date: 12-06-2017

TABLE OF CONTENTS

Semi-Volatile Organics

Memorandum	3
Appendix 1 – Glossary of Data Reporting Qualifiers	7
Appendix 2 – Summary of Data Qualification	9
Appendix 3 – Data Validation Supporting Documentation	11
Appendix 4 – Additional Documentation Requested By Client	18

Pesticides

Memorandum	26
Appendix 1 – Glossary of Data Reporting Qualifiers	29
Appendix 2 – Summary of Data Qualification	32
Appendix 3 – Data Validation Supporting Documentation	34
Appendix 4 – Additional Documentation Requested By Client	41

Metals

Memorandum	50
Appendix 1 – Glossary of Data Reporting Qualifiers	54
Appendix 2 – Summary of Data Qualification	56
Appendix 3 – Data Validation Supporting Documentation	58
Appendix 4 – Additional Documentation Requested By Client	65

General Chemistry

Memorandum	73
Appendix 1 – Glossary of Data Reporting Qualifiers	76
Appendix 2 – Summary of Data Qualification	78
Appendix 3 – Data Validation Supporting Documentation	80
Appendix 4 – Additional Documentation Requested By Client	86

Radiochemistry

Memorandum	90
Appendix 1 – Glossary of Data Reporting Qualifiers	94
Appendix 2 – Summary of Data Qualification	96
Appendix 3 – Data Validation Supporting Documentation	98
Appendix 4 – Additional Documentation Requested By Client	105

Date: 01 December 2017
 To: CH2M Hill (technical representative)
 From: Analytical Quality Associates, Inc.
 Project: 100-K
 Subject: Semivolatile Organics - Sample Data Group (SDG) GEL436735

INTRODUCTION

This memorandum presents the results of data validation for SDG GEL436735 prepared by GEL Laboratories LLC. A list of samples validated along with the analytical methods is provided in the following table.

Sample ID	Sample Date	Media	Validation Level	Analytical Methods
B38W38	10/30/17	Soil	C	8270D SIM PAH
B38W39	10/30/17	Soil	C	8270D SIM PAH
B38W40	10/30/17	Soil	C	8270D SIM PAH
B38W41	10/30/17	Soil	C	8270D SIM PAH
B38W42	10/30/17	Soil	C	8270D SIM PAH
B38W43	10/30/17	Soil	C	8270D SIM PAH
B38W44	10/30/17	Soil	C	8270D SIM PAH
B38W45	10/30/17	Soil	C	8270D SIM PAH
B38W46	10/30/17	Soil	C	8270D SIM PAH
B38W47	10/30/17	Soil	C	8270D SIM PAH

Data validation was conducted in accordance with the CHPRC validation statement of work and the 100 Area Remedial Action Sampling and Analysis Plan, DOE/RL-96-22, Rev. 5 (SAP). Appendices 1 through 4 provide the following information as indicated below:

- Appendix 1. Glossary of Data Reporting Qualifiers
- Appendix 2. Summary of Data Qualification
- Appendix 3. Data Validation Supporting Documentation
- Appendix 4. Additional Documentation Requested by Client

DATA QUALITY OBJECTIVES

- **Holding Times and Sample Preservation**

Holding times are calculated from Chain-of-Custody forms to determine the validity of the results. The holding time requirements for semivolatile organics in soil are extraction within 14 days of sample collection and analysis within 40 days of sample extraction. Sample preservation requires chilling to <6 degrees Celsius.

The samples were extracted and analyzed within the prescribed holding times and properly preserved.

- **Blanks**

The blank data results are reviewed to assess the extent of contamination introduced through sampling, sample preparation, and analysis.

Laboratory Blanks

All laboratory blank results were acceptable.

Trip Blanks

No trip blanks were submitted for validation.

Field Blanks

No field blanks were submitted for validation.

Equipment Blanks

No equipment blanks were submitted for validation.

- **Accuracy**

Accuracy is evaluated by reviewing surrogate results, matrix spike sample results, and laboratory control sample results. According to the SAP, the laboratory control sample accuracy limits are 50% to 150% and the matrix spike sample accuracy limits are ones specified by the DV procedure.

Surrogates

All surrogate recoveries were acceptable.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples

All MS/MSD recoveries were acceptable.

Laboratory Control Samples (LCSs)

All LCS recoveries were acceptable.

- **Precision**

Precision is evaluated by reviewing MS/MSD results, field duplicate sample results and field split sample results. These QC results provide information on the laboratory reproducibility and whether sampling activities are adequate to acquire consistent sample results. According to the SAP, the relative percent difference (RPD) limits are $\pm 30\%$.

MS/MSD Samples

All reported MS/MSD RPD values were acceptable with the following exception.

The RPD for phenanthrene was above the upper acceptance limit. All associated sample results should be qualified as estimates and flagged “UJ” for non-detects and “J” for detects. See the table in Appendix 2 for a listing of all affected sample results.

Field Duplicate Samples

No field duplicates were submitted for validation.

Field Split Samples

No field splits were submitted for validation.

- **Internal Standards**

Internal standard performance criteria ensure that GC/MS sensitivity and response are stable during each analysis. Internal standards are added to all samples, including QC samples, prior to analysis.

Internal standards data was not included in the data package. Sample results should not be qualified based on this.

- **Detection Limits**

Reported MDLs are compared against the contractually required detection limits (CRDLs) to ensure that laboratory detection limits meet the required criteria.

All reported sample MDLs were below the CRDLs.

- **Completeness**

SDG GEL436735 was submitted for validation and verified for completeness. Completeness is based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100%.

MAJOR DEFICIENCIES

None found.

MINOR DEFICIENCIES

Minor deficiencies leading to qualification of sample results as estimates were due to poor MS/MSD precision infraction. See the table in Appendix 2 for a listing of all affected sample results.

REFERENCES

GRP-GD-003, Rev. 2, Change 0, *Data Validation for Chemical Analyses*, October 2016.

DOE/RL-96-22, Rev. 5, *100 Area Remedial Action Sampling and Analysis Plan*, September 2009.

Appendix 1
Glossary of Data Reporting Qualifiers

Qualifiers that may be applied by data validators in compliance with the CHPRC statement of work are as follows:

- **U** — The constituent was analyzed for, but was not detected. The data should be considered usable for decision-making purposes.
- **UJ** — The constituent was analyzed for and was not detected. Due to a quality control deficiency identified during data validation the value reported may not accurately reflect the RL. The data should be considered usable for decision-making purposes.
- **J** — Indicates the constituent was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J+** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J-** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **N** — The analysis indicates the presence of an analyte that has been tentatively identified.
- **NJ** — The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration.
- **NJ+** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation.
- **NJ-** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation.
- **UR** — Indicates the constituent was analyzed for and not detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.
- **R** — Indicates the constituent was analyzed for and detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.

Appendix 2
Summary of Data Qualification

Semivolatile Organics Data Qualification Summary			
SDG: GEL436735	Reviewer: AQA	Project: 100-K	Page 1 of 1
Analyte(s)	Qualifier	Samples Affected	Reason
Phenanthrene	UJ	B38W38, B38W39, B38W40, B38W41, B38W42, B38W46, B38W47	Poor MS/MSD precision
Phenanthrene	J	B38W43, B38W44, B38W45,	Poor MS/MSD precision

Comments: None

Appendix 3

Data Validation Supporting Documentation

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - Chemical Data Validation Checklist

VALIDATION LEVEL:	A	B	C	D	E
PROJECT: 100-K			DATA PACKAGE: VSR18-003		
VALIDATOR: Eyda Hergenreder		LAB: GEL		DATE: 12/01/17	
			SDG: GEL436735		
ANALYSES PERFORMED					
SW-846 8260		SW-846 8260 (TCLP)	SW-846 8270 X		SW-846 8270 (TCLP)
SAMPLES/MATRIX Soil					
SDG GEL436735: B38W38, B38W39, B38W40, B38W41, B38W42, B38W43, B38W44, B38W45, B38W46, B38W47					

1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE

Technical verification documentation present?	Yes <input type="radio"/> No <input checked="" type="radio"/> N/A
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Comments:

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

2. INSTRUMENT TUNING AND CALIBRATION (Levels D and E)

GC/MS tuning/performance check acceptable?	Yes No <input type="radio"/> N/A
Initial calibrations acceptable?	Yes No <input type="radio"/> N/A
Continuing calibrations acceptable?	Yes No <input type="radio"/> N/A
Standards traceable?	Yes No <input type="radio"/> N/A
Standards expired?	Yes No <input type="radio"/> N/A
Calculation check acceptable?	Yes No <input type="radio"/> N/A

Comments:

3. BLANKS (Levels B, C, D, and E)

Calibration blanks analyzed? (Levels D, E)	Yes No <input type="radio"/> N/A
Calibration blank results acceptable? (Levels D, E)	Yes No <input type="radio"/> N/A
Laboratory blanks analyzed?	<input checked="" type="radio"/> Yes No N/A
Laboratory blank results acceptable?	<input checked="" type="radio"/> Yes No N/A
Field/trip blanks analyzed? (Levels C, D, E)	Yes <input type="radio"/> No N/A
Field/trip blank results acceptable? (Levels C, D, E)	Yes No <input type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A

Comments:

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

4. ACCURACY (Levels C, D, and E)

Surrogates/system monitoring compounds analyzed?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
Surrogate/system monitoring compound recoveries acceptable?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
Surrogates traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
Surrogates expired? (Levels D, E)	Yes No <input type="radio"/> N/A
MS/MSD samples analyzed?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
MS/MSD results acceptable?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
MS/MSD standards NIST traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
MS/MSD standards? (Levels D, E)	Yes No <input type="radio"/> N/A
LCS/BSS samples analyzed?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
LCS/BSS results acceptable?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
Standards traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
Standards expired? (Levels D, E)	Yes No <input type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A
Performance audit sample(s) analyzed?	Yes No <input type="radio"/> N/A
Performance audit sample results acceptable?	Yes No <input type="radio"/> N/A

Comments:

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

5. PRECISION (Levels C, D, and E)

MS/MSD samples analyzed?	<input checked="" type="radio"/> Yes No N/A
MS/MSD RPD values acceptable?	Yes <input type="radio"/> No N/A
MS/MSD standards NIST traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
MS/MSD standards expired? (Levels D, E)	Yes No <input type="radio"/> N/A
LCS/LCSD duplicates run due to insufficient sample material?	Yes <input type="radio"/> No N/A
Field duplicate RPD values acceptable?	Yes No <input type="radio"/> N/A
Field split RPD values acceptable?	Yes No <input type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A

Comments:

 MS/MSD RPD: phenanthrene 57%

6. SYSTEM PERFORMANCE (Levels D and E)

Internal standards analyzed?	Yes No <input type="radio"/> N/A
Internal standard areas acceptable?	Yes No <input type="radio"/> N/A
Internal standard retention times acceptable?	Yes No <input type="radio"/> N/A
Standards traceable?	Yes No <input type="radio"/> N/A
Standards expired?	Yes No <input type="radio"/> N/A
Transcription/calculation errors?	Yes No <input type="radio"/> N/A

Comments:

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

7. HOLDING TIMES (all levels)

Samples properly preserved?	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A
Sample holding times acceptable?	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A

Comments:

8. COMPOUND IDENTIFICATION, QUANTITATION, AND DETECTION LIMITS (all levels)

Compound identification acceptable? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Compound quantitation acceptable? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Results reported for all requested analyses?	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A
Results supported in the raw data? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Samples properly prepared? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Laboratory properly identified and coded all TIC? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A
Detection limits meet RDL?	<input checked="" type="radio"/> Yes	<input type="radio"/> No	<input type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	<input type="radio"/> Yes	<input type="radio"/> No	<input checked="" type="radio"/> N/A

Comments:

Appendix 4

Additional Documentation Requested By Client

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QC Summary

Report Date: November 7, 2017

Page 1 of 6

CH2M Hill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 436735

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS											
Batch	1715120										
QC1203910371	LCS										
Acenaphthene	333			228	ug/kg		69*	(70%-130%)	JLD1	11/02/17	15:52
Acenaphthylene	333			212	ug/kg		64*	(70%-130%)			
Anthracene	333			219	ug/kg		66*	(70%-130%)			
Benzo(a)anthracene	333			232	ug/kg		70	(70%-130%)			
Benzo(a)pyrene	333			241	ug/kg		73	(70%-130%)			
Benzo(b)fluoranthene	333			260	ug/kg		78	(70%-130%)			
Benzo(ghi)perylene	333			205	ug/kg		62*	(70%-130%)			
Benzo(k)fluoranthene	333			285	ug/kg		86	(70%-130%)			
Chrysene	333			251	ug/kg		75	(70%-130%)			
Dibenzo(a,h)anthracene	333			240	ug/kg		72	(70%-130%)			
Fluoranthene	333			229	ug/kg		69*	(70%-130%)			
Fluorene	333			233	ug/kg		70	(70%-130%)			
Indeno(1,2,3-cd)pyrene	333			218	ug/kg		66*	(70%-130%)			

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QC Summary

Workorder: 436735

Page 2 of 6

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS											
Batch	1715120										
Naphthalene	333			249	ug/kg		75	(70%-130%)	JLD1	11/02/17	15:52
Phenanthrene	333			242	ug/kg		73	(70%-130%)			
Pyrene	333			229	ug/kg		69*	(70%-130%)			
**5-alpha-Androstane	166			115	ug/kg		69	(30%-118%)			
QC1203910370	MB										
Acenaphthene			U	1.67	ug/kg					11/02/17	15:20
Acenaphthylene			U	1.67	ug/kg						
Anthracene			U	1.67	ug/kg						
Benzo(a)anthracene			U	1.67	ug/kg						
Benzo(a)pyrene			U	1.67	ug/kg						
Benzo(b)fluoranthene			U	1.67	ug/kg						
Benzo(ghi)perylene			U	1.67	ug/kg						
Benzo(k)fluoranthene			U	1.67	ug/kg						
Chrysene			U	1.67	ug/kg						
Dibenzo(a,h)anthracene			U	1.67	ug/kg						
Fluoranthene			U	1.67	ug/kg						

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QC Summary

Workorder: 436735

Page 3 of 6

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS											
Batch	1715120										
Fluorene			U	1.67	ug/kg				JLD1	11/02/17	15:20
Indeno(1,2,3-cd)pyrene			U	1.67	ug/kg						
Naphthalene			U	1.00	ug/kg						
Phenanthrene			U	1.67	ug/kg						
Pyrene			U	1.67	ug/kg						
**5-alpha-Androstane	167			130	ug/kg		78	(30%-118%)			
QC1203910372 436735003 MS											
Acenaphthene	419	U	2.09	122	ug/kg		29	(18%-115%)		11/02/17	17:58
Acenaphthylene	419	U	2.09	117	ug/kg		28	(19%-116%)			
Anthracene	419	U	2.09	117	ug/kg		28	(23%-115%)			
Benzo(a)anthracene	419	J	2.51	148	ug/kg		35	(23%-124%)			
Benzo(a)pyrene	419	J	2.09	150	ug/kg		35	(20%-130%)			
Benzo(b)fluoranthene	419	J	3.76	184	ug/kg		43	(20%-134%)			
Benzo(ghi)perylene	419	U	2.09	136	ug/kg		32	(18%-118%)			
Benzo(k)fluoranthene	419	U	2.09	177	ug/kg		42	(23%-128%)			
Chrysene	419	J	2.93	155	ug/kg		36	(18%-121%)			

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QC Summary

Workorder: 436735

Page 4 of 6

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS											
Batch	1715120										
Dibenzo(a,h)anthracene	419	U	2.09	153	ug/kg		37	(12%-132%)	JLD1	11/02/17	17:58
Fluoranthene	419	J	3.76	212	ug/kg		50	(21%-124%)			
Fluorene	419	U	2.09	135	ug/kg		32	(21%-118%)			
Indeno(1,2,3-cd)pyrene	419	U	2.09	140	ug/kg		33	(11%-130%)			
Naphthalene	419	U	1.25	122	ug/kg		29	(14%-114%)			
Phenanthrene	419	U	2.09	245	ug/kg		58	(24%-106%)			
Pyrene	419	J	3.76	151	ug/kg		35	(16%-122%)			
**5-alpha-Androstane	210		106	82.6	ug/kg		39	(30%-118%)			
QC1203910373	436735003 MSD										
Acenaphthene	417	U	2.09	121	ug/kg	0	29	(0%-30%)		11/02/17	19:34
Acenaphthylene	417	U	2.09	120	ug/kg	3	29	(0%-30%)			
Anthracene	417	U	2.09	131	ug/kg	11	31	(0%-30%)			
Benzo(a)anthracene	417	J	2.51	147	ug/kg	1	35	(0%-30%)			
Benzo(a)pyrene	417	J	2.09	146	ug/kg	2	35	(0%-30%)			
Benzo(b)fluoranthene	417	J	3.76	186	ug/kg	1	44	(0%-30%)			
Benzo(ghi)perylene	417	U	2.09	120	ug/kg	12	29	(0%-30%)			

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QC Summary

Workorder: 436735

Page 5 of 6

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS											
Batch	1715120										
Benzo(k)fluoranthene	417	U	2.09	182	ug/kg	3	44	(0%-30%)	JLD1	11/02/17	19:34
Chrysene	417	J	2.93	155	ug/kg	0	36	(0%-30%)			
Dibenzo(a,h)anthracene	417	U	2.09	136	ug/kg	12	33	(0%-30%)			
Fluoranthene	417	J	3.76	220	ug/kg	4	52	(0%-30%)			
Fluorene	417	U	2.09	133	ug/kg	2	32	(0%-30%)			
Indeno(1,2,3-cd)pyrene	417	U	2.09	124	ug/kg	12	30	(0%-30%)			
Naphthalene	417	U	1.25	122	ug/kg	0	29	(0%-30%)			
Phenanthrene	417	U	2.09	137	ug/kg	57*	33	(0%-30%)			
Pyrene	417	J	3.76	143	ug/kg	5	33	(0%-30%)			
**5-alpha-Androstane	208		106	87.1	ug/kg		42	(30%-118%)			

Notes:

The Qualifiers in this report are defined as follows:

- A The TIC is a suspected aldol-condensation product
- B The analyte was detected in both the associated QC blank and in the sample.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of sample.
- E Concentration exceeds the calibration range of the instrument
- J The analyte was detected at a value less than the contract required detection limit (RDL), but greater than or equal to the IDL/MDL (as appropriate). Value is estimated
- N Spike Sample recovery is outside control limits.
- P Aroclor target analyte with greater than 25% difference between column analyses.
- T Spike and/or spike duplicate sample recovery is outside control limits.

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QC Summary

Workorder: 436735

Page 6 of 6

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
U	Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.										
X	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier										
Y	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier										
Z	Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier										
o	Analyte failed to recover within LCS limits (Organics only)										

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

~~Semi-Volatile~~
Page 25 of 107
Surrogate Recovery Report

SDG Number: GEL436735**Matrix Type: SOLID**

Sample ID	Client ID	5-alpha %REC
1203910370	MB for batch 1715115	78
1203910371	LCS for batch 1715115	69
436735001	B38W38	62
436735002	B38W39	63
436735003	B38W40	51
1203910372	B38W40MS	39
1203910373	B38W40MSD	42
436735004	B38W41	63
436735005	B38W42	64
436735006	B38W43	89
436735007	B38W44	67
436735008	B38W45	73
436735009	B38W46	73
436735010	B38W47	108

Surrogate

5-alpha- = 5-alpha-Androstane

Acceptance Limits

(30%-118%)

* Recovery outside Acceptance Limits

Column to be used to flag recovery values

D Sample Diluted

Date: 01 December 2017
 To: CH2M Hill (technical representative)
 From: Analytical Quality Associates, Inc.
 Project: 100-K
 Subject: Pesticides - Sample Data Group (SDG) GEL436735

INTRODUCTION

This memorandum presents the results of data validation for SDG GEL436735 prepared by GEL Laboratories LLC. A list of samples validated along with the analytical methods is provided in the following table.

Sample ID	Sample Date	Media	Validation Level	Analytical Method
B38W38	10/30/17	Soil	C	8081B
B38W39	10/30/17	Soil	C	8081B
B38W40	10/30/17	Soil	C	8081B
B38W41	10/30/17	Soil	C	8081B
B38W42	10/30/17	Soil	C	8081B
B38W43	10/30/17	Soil	C	8081B
B38W44	10/30/17	Soil	C	8081B
B38W45	10/30/17	Soil	C	8081B
B38W46	10/30/17	Soil	C	8081B
B38W47	10/30/17	Soil	C	8081B

Data validation was conducted in accordance with the CHPRC validation statement of work and the 100 Area Remedial Action Sampling and Analysis Plan, DOE/RL-96-22, Rev. 5 (SAP). Appendices 1 through 4 provide the following information as indicated below:

- Appendix 1. Glossary of Data Reporting Qualifiers
- Appendix 2. Summary of Data Qualification
- Appendix 3. Data Validation Supporting Documentation
- Appendix 4. Additional Documentation Requested by Client

DATA QUALITY OBJECTIVES

- **Holding Times and Sample Preservation**

Holding times are calculated from Chain-of-Custody forms to determine the validity of the results. The holding time requirements for pesticides are extraction within 14 days of sample collection and analysis within 40 days of sample extraction. Sample preservation requires chilling to <6 degrees Celsius.

The samples were extracted and analyzed within the prescribed holding times and properly preserved.

- **Blanks**

The blank data results are reviewed to assess the extent of contamination introduced through sampling, sample preparation, and analysis.

Laboratory Blanks

All laboratory blank results were acceptable.

Trip Blanks

No trip blanks were submitted for validation.

Field Blanks

No field blanks were submitted for validation.

Equipment Blanks

No equipment blanks were submitted for validation.

- **Accuracy**

Accuracy is evaluated by reviewing surrogate results, matrix spike sample results, and laboratory control sample results. According to the SAP, the laboratory control sample accuracy limits are 50% to 150% and the matrix spike sample accuracy limits are ones specified by the DV procedure.

Surrogates

All surrogate recoveries were acceptable.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples

All MS/MSD recoveries were acceptable.

It should be mentioned that MS/MSD analyses were not performed for multi-component analyte toxaphene. No sample data are qualified as a result.

Laboratory Control Samples (LCSs)

All LCS recoveries were acceptable.

It should be mentioned that LCS analysis was not performed for multi-component analyte toxaphene. No sample data are qualified as a result.

- **Precision**

Precision is evaluated by reviewing MS/MSD results, field duplicate sample results, and field split sample results. These QC results provide information on the laboratory reproducibility and whether sampling activities are adequate to acquire consistent sample results. According to the SAP, the relative percent difference (RPD) limits are $\pm 30\%$.

MS/MSD Samples

All MS/MSD RPD values were acceptable.

Field Duplicate Samples

No field duplicates were submitted for validation.

Field Split Samples

No field splits were submitted for validation.

- **Detection Limits**

Reported MDLs are compared against the contractually required detection limits (CRDLs) to ensure that laboratory detection limits meet the required criteria.

All reported sample MDLs were below the CRDLs.

- **Completeness**

SDG GEL436735 was submitted for validation and verified for completeness. Completeness is based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100%.

MAJOR DEFICIENCIES

None found.

MINOR DEFICIENCIES

None found.

REFERENCES

GRP-GD-003, Rev. 2, Change 0, *Data Validation for Chemical Analyses*, October 2016.

DOE/RL-96-22, Rev. 5, *100 Area Remedial Action Sampling and Analysis Plan*, September 2009.

Appendix 1

Glossary of Data Reporting Qualifiers

Qualifiers that may be applied by data validators in compliance with the CHPRC statement of work are as follows:

- **U** — The constituent was analyzed for, but was not detected. The data should be considered usable for decision-making purposes.
- **UJ** — The constituent was analyzed for and was not detected. Due to a quality control deficiency identified during data validation the value reported may not accurately reflect the RL. The data should be considered usable for decision-making purposes.
- **J** — Indicates the constituent was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J+** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J-** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **N** — The analysis indicates the presence of an analyte that has been tentatively identified.
- **NJ** — The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration.
- **NJ+** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation.
- **NJ-** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation.
- **C** — This qualifier applies to pesticide and Aroclor results when the identification has been confirmed by Gas Chromatograph/Mass Spectrometer (GC/MS).
- **X** — This qualifier applies to pesticide and Aroclor results when GC/MS analysis was attempted but was unsuccessful. The data should be considered unusable for decision-making purposes.
- **UR** — Indicates the constituent was analyzed for and not detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.

- **R** — Indicates the constituent was analyzed for and detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.

Appendix 2
Summary of Data Qualification

Pesticides Data Qualification Summary			
SDG: GEL436735	Reviewer: AQA	Project: 100-K	Page 1 of 1
Analyte(s)	Qualifier	Samples Affected	Reason
Pesticides	None	N/A	N/A

Comments: None

Appendix 3

Data Validation Supporting Documentation

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

VALIDATION LEVEL:	A	B	C	D	E
PROJECT: 100-K			DATA PACKAGE: VSR18-003		
VALIDATOR: Eyda Hergenreder		LAB: GEL		DATE: 12/01/17	
			SDG: GEL436735		
ANALYSES PERFORMED					
SW-846 8081 X	SW-846 8081 (TCLP)	SW-846 8082	SW-846 8082 (TCLP)		
SAMPLES/MATRIX Soil					
GEL436735: B38W38, B38W39, B38W40, B38W41, B38W42, B38W43, B38W44, B38W45, B38W46, B38W47					

1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE

Technical verification documentation present?	Yes No N/A
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Comments:

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

2. INSTRUMENT PERFORMANCE AND CALIBRATIONS (Levels D and E)

Initial calibrations acceptable?	Yes No <input type="radio"/> N/A
Continuing calibrations acceptable?	Yes No <input type="radio"/> N/A
Standards traceable?	Yes No <input type="radio"/> N/A
Standards expired?	Yes No <input type="radio"/> N/A
Calculation check acceptable?	Yes No <input type="radio"/> N/A
DDT and endrin breakdowns acceptable?	Yes No <input type="radio"/> N/A

Comments:

3. BLANKS (Levels B, C, D, and E)

Calibration blanks analyzed? (Levels D, E)	Yes No <input type="radio"/> N/A
Calibration blank results acceptable? (Levels D, E)	Yes No <input type="radio"/> N/A
Laboratory blanks analyzed?	<input checked="" type="radio"/> Yes No N/A
Laboratory blank results acceptable?	<input checked="" type="radio"/> Yes No N/A
Field/trip blanks analyzed? (Levels C, D, E)	Yes <input type="radio"/> No N/A
Field/trip blank results acceptable? (Levels C, D, E)	Yes No <input type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A

Comments:

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

4. ACCURACY (Levels C, D, and E)

Surrogates analyzed?	<input checked="" type="radio"/> Yes No N/A
Surrogate recoveries acceptable?	<input checked="" type="radio"/> Yes No N/A
Surrogates traceable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Surrogates expired? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
MS/MSD samples analyzed?	<input checked="" type="radio"/> Yes No N/A
MS/MSD results acceptable?	<input checked="" type="radio"/> Yes No N/A
MS/MSD standards NIST traceable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
MS/MSD standards expired? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
LCS/BSS samples analyzed?	<input checked="" type="radio"/> Yes No N/A
LCS/BSS results acceptable?	<input checked="" type="radio"/> Yes No N/A
Standards traceable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Standards expired? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Performance audit sample(s) analyzed?	Yes No <input checked="" type="radio"/> N/A
Performance audit sample results acceptable?	Yes No <input checked="" type="radio"/> N/A

Comments:

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

5. PRECISION (Levels C, D, and E)

Duplicate RPD values acceptable?	<input checked="" type="radio"/> Yes No N/A
Duplicate results acceptable?	<input checked="" type="radio"/> Yes No N/A
MS/MSD standards NIST traceable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
MS/MSD standards expired? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
LCS/LCSD duplicates run due to insufficient sample material?	Yes <input checked="" type="radio"/> No N/A
Field duplicate RPD values acceptable?	Yes No <input checked="" type="radio"/> N/A
Field split RPD values acceptable?	Yes No <input checked="" type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

6. SYSTEM PERFORMANCE (Levels D and E)

Chromatographic performance acceptable?	Yes No <input checked="" type="radio"/> N/A
Positive results resolved acceptably?	Yes No <input checked="" type="radio"/> N/A

Comments:

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

7. HOLDING TIMES (all levels)

Samples properly preserved?	<input checked="" type="radio"/> Yes No N/A
Sample holding times acceptable?	<input checked="" type="radio"/> Yes No N/A

Comments:

8. COMPOUND IDENTIFICATION, QUANTITATION, AND DETECTION LIMITS (all levels)

Compound identification acceptable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Compound quantitation acceptable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Results reported for all requested analyses?	<input checked="" type="radio"/> Yes No N/A
Results supported in the raw data? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Samples properly prepared? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Detection limits meet RDL?	<input checked="" type="radio"/> Yes No N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

9. SAMPLE CLEANUP (Levels D and E)

Fluorisil ® (or other absorbent) cleanup performed?	Yes No (N/A)
Lot check performed?	Yes No (N/A)
Check recoveries acceptable?	Yes No (N/A)
GPC cleanup performed?	Yes No (N/A)
GPC check performed?	Yes No (N/A)
GPC check recoveries acceptable?	Yes No (N/A)
GPC calibration performed?	Yes No (N/A)
GPC calibration check performed?	Yes No (N/A)
GPC calibration check retention times acceptable?	Yes No (N/A)
Check/calibration materials traceable?	Yes No (N/A)
Check/calibration materials Expired?	Yes No (N/A)
Analytical batch QC given similar cleanup?	Yes No (N/A)
Transcription/Calculation Errors?	Yes No (N/A)

Comments (attach additional sheets as necessary):

Appendix 4

Additional Documentation Requested By Client

Surrogate Recovery Report

SDG Number: GEL436735

Matrix Type: SOLID

Sample ID	Client ID	4CMX 1 %REC #	4CMX 2 %REC #	DCB 1 %REC #	DCB 2 %REC #
1203910079	MB for batch 1715005	72	74	76	75
1203910080	LCS for batch 1715005	82	84	89	86
436735001	B38W38	69	71	76	77
1203910081	B38W38MS	75	79	87	86
1203910082	B38W38MSD	71	71	82	81
436735002	B38W39	84	85	91	89
436735003	B38W40	78	80	80	78
436735004	B38W41	82	83	89	86
436735005	B38W42	79	81	82	81
436735006	B38W43	80	79	81	82
436735007	B38W44	88	88	91	90
436735008	B38W45	85	85	90	117
436735009	B38W46	87	87	95	95
436735010	B38W47	52	55	84	83

Surrogate

4CMX = 4cmx

DCB = Decachlorobiphenyl

* Recovery outside Acceptance Limits

Column to be used to flag recovery values

D Sample Diluted

Acceptance Limits

(27%-121%)

(30%-136%)

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QC Summary

Report Date: November 14, 2017

Page 1 of 7

CH2M Hill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 436735

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatiles-Pesticide											
Batch	1715006										
QC1203910080	LCS										
4,4'-DDD	41.7			42.5	ug/kg		102	(70%-130%)	JXM	11/13/17	13:23
4,4'-DDE	41.7			40.7	ug/kg		98	(70%-130%)			
4,4'-DDT	41.7			43.0	ug/kg		103	(70%-130%)			
Aldrin	16.7			14.0	ug/kg		84	(70%-130%)			
Dieldrin	41.7			38.8	ug/kg		93	(70%-130%)			
Endosulfan I	16.7			12.0	ug/kg		72	(70%-130%)			
Endosulfan II	41.7			31.5	ug/kg		76	(70%-130%)			
Endosulfan sulfate	41.7			40.8	ug/kg		98	(70%-130%)			
Endrin	41.7			42.4	ug/kg		102	(70%-130%)			
Endrin aldehyde	41.7			36.3	ug/kg		87	(70%-130%)			
Endrin ketone	41.7			38.8	ug/kg		93	(70%-130%)			
Heptachlor	16.7			14.4	ug/kg		86	(70%-130%)			
Heptachlor epoxide	16.7			13.2	ug/kg		79	(70%-130%)			

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QC Summary

Workorder: 436735

Page 2 of 7

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatiles-Pesticide											
Batch	1715006										
Methoxychlor	167			165	ug/kg		99	(70%-130%)	JXM	11/13/17	13:23
alpha-BHC	16.7			14.1	ug/kg		85	(70%-130%)			
beta-BHC	16.7			13.0	ug/kg		78	(70%-130%)			
cis-Chlordane	16.7			15.4	ug/kg		93	(70%-130%)			
delta-BHC	16.7			15.1	ug/kg		91	(70%-130%)			
gamma-BHC (Lindane)	16.7			14.1	ug/kg		85	(70%-130%)			
trans-Chlordane	16.7			12.8	ug/kg		77	(70%-130%)			
**4cmx	33.3			27.4	ug/kg		82	(27%-121%)			
**Decachlorobiphenyl	33.3			28.8	ug/kg		86	(30%-136%)			
QC1203910079	MB										
4,4'-DDD			U	0.333	ug/kg					11/13/17	13:07
4,4'-DDE			U	0.333	ug/kg						
4,4'-DDT			U	0.333	ug/kg						
Aldrin			U	0.166	ug/kg						
Dieldrin			U	0.333	ug/kg						
Endosulfan I			U	0.166	ug/kg						

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QC Summary

Workorder: 436735

Page 3 of 7

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatiles-Pesticide											
Batch	1715006										
Endosulfan II			U	0.333	ug/kg				JXM	11/13/17	13:07
Endosulfan sulfate			U	0.333	ug/kg						
Endrin			U	0.333	ug/kg						
Endrin aldehyde			U	0.333	ug/kg						
Endrin ketone			U	0.333	ug/kg						
Heptachlor			U	0.166	ug/kg						
Heptachlor epoxide			U	0.166	ug/kg						
Methoxychlor			U	1.66	ug/kg						
Toxaphene			U	5.54	ug/kg						
alpha-BHC			U	0.166	ug/kg						
beta-BHC			U	0.166	ug/kg						
cis-Chlordane			U	0.166	ug/kg						
delta-BHC			U	0.166	ug/kg						
gamma-BHC (Lindane)			U	0.166	ug/kg						
trans-Chlordane			U	0.166	ug/kg						

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QC Summary

Workorder: 436735

Page 4 of 7

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatiles-Pesticide											
Batch	1715006										
**4cmx	33.3			23.8	ug/kg		72	(27%-121%)	JXM	11/13/17	13:07
**Decachlorobiphenyl	33.3			25.0	ug/kg		75	(30%-136%)			
QC1203910081	436735001 MS										
4,4'-DDD	45.1	U	0.362	43.2	ug/kg		96	(17%-156%)		11/13/17	13:55
4,4'-DDE	45.1	U	0.362	43.2	ug/kg		96	(15%-139%)			
4,4'-DDT	45.1	U	0.362	44.4	ug/kg		99	(11%-137%)			
Aldrin	18.0	U	0.181	14.3	ug/kg		79	(21%-119%)			
Dieldrin	45.1	U	0.362	39.8	ug/kg		88	(22%-134%)			
Endosulfan I	18.0	U	0.181	12.5	ug/kg		70	(15%-126%)			
Endosulfan II	45.1	U	0.362	31.9	ug/kg		71	(20%-132%)			
Endosulfan sulfate	45.1	U	0.362	41.4	ug/kg		92	(17%-138%)			
Endrin	45.1	U	0.362	44.0	ug/kg		98	(24%-148%)			
Endrin aldehyde	45.1	U	0.362	36.8	ug/kg		82	(18%-132%)			
Endrin ketone	45.1	U	0.362	39.3	ug/kg		87	(17%-135%)			
Heptachlor	18.0	U	0.181	14.8	ug/kg		82	(16%-128%)			
Heptachlor epoxide	18.0	U	0.181	14.6	ug/kg		81	(14%-133%)			

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QC Summary

Workorder: 436735

Page 5 of 7

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatiles-Pesticide											
Batch	1715006										
Methoxychlor	180	U	1.81	171	ug/kg		95	(15%-156%)	JXM	11/13/17	13:55
alpha-BHC	18.0	U	0.181	14.1	ug/kg		78	(14%-126%)			
beta-BHC	18.0	U	0.181	12.9	ug/kg		72	(14%-143%)			
cis-Chlordane	18.0	U	0.181	16.1	ug/kg		90	(14%-138%)			
delta-BHC	18.0	U	0.181	14.8	ug/kg		82	(17%-138%)			
gamma-BHC (Lindane)	18.0	U	0.181	14.1	ug/kg		78	(16%-126%)			
trans-Chlordane	18.0	U	0.181	13.4	ug/kg		74	(15%-137%)			
**4cmx	36.0		25.0	27.1	ug/kg		75	(27%-121%)			
**Decachlorobiphenyl	36.0		27.6	31.3	ug/kg		87	(30%-136%)			
QC1203910082 436735001 MSD											
4,4'-DDD	45.1	U	0.362	40.7	ug/kg	6	90	(0%-30%)		11/13/17	14:12
4,4'-DDE	45.1	U	0.362	40.2	ug/kg	7	89	(0%-30%)			
4,4'-DDT	45.1	U	0.362	41.0	ug/kg	8	91	(0%-30%)			
Aldrin	18.0	U	0.181	13.1	ug/kg	9	73	(0%-30%)			
Dieldrin	45.1	U	0.362	37.1	ug/kg	7	82	(0%-30%)			
Endosulfan I	18.0	U	0.181	11.7	ug/kg	7	65	(0%-30%)			

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QC Summary

Workorder: 436735

Page 6 of 7

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatiles-Pesticide											
Batch	1715006										
Endosulfan II	45.1	U	0.362	30.1	ug/kg	6	67	(0%-30%)	JXM	11/13/17	14:12
Endosulfan sulfate	45.1	U	0.362	40.8	ug/kg	2	91	(0%-30%)			
Endrin	45.1	U	0.362	40.8	ug/kg	7	91	(0%-30%)			
Endrin aldehyde	45.1	U	0.362	35.4	ug/kg	4	79	(0%-30%)			
Endrin ketone	45.1	U	0.362	38.0	ug/kg	3	84	(0%-30%)			
Heptachlor	18.0	U	0.181	13.6	ug/kg	8	76	(0%-30%)			
Heptachlor epoxide	18.0	U	0.181	13.7	ug/kg	6	76	(0%-30%)			
Methoxychlor	180	U	1.81	158	ug/kg	8	88	(0%-30%)			
alpha-BHC	18.0	U	0.181	13.1	ug/kg	7	73	(0%-30%)			
beta-BHC	18.0	U	0.181	13.0	ug/kg	1	72	(0%-30%)			
cis-Chlordane	18.0	U	0.181	15.1	ug/kg	7	84	(0%-30%)			
delta-BHC	18.0	U	0.181	15.0	ug/kg	1	83	(0%-30%)			
gamma-BHC (Lindane)	18.0	U	0.181	13.4	ug/kg	5	75	(0%-30%)			
trans-Chlordane	18.0	U	0.181	12.6	ug/kg	6	70	(0%-30%)			
**4cmx	36.0		25.0	25.6	ug/kg		71	(27%-121%)			

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QC Summary

Workorder: 436735

Page 7 of 7

Parname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Semi-Volatiles-Pesticide											
Batch	1715006										
**Decachlorobiphenyl	36.0	27.6		29.4	ug/kg		82	(30%-136%)	JXM	11/13/17	14:12

Notes:

The Qualifiers in this report are defined as follows:

- A The TIC is a suspected aldol-condensation product
- B The analyte was detected in both the associated QC blank and in the sample.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of sample.
- E Concentration exceeds the calibration range of the instrument
- J The analyte was detected at a value less than the contract required detection limit (RDL), but greater than or equal to the IDL/MDL (as appropriate). Value is estimated
- N Spike Sample recovery is outside control limits.
- P Aroclor target analyte with greater than 25% difference between column analyses.
- T Spike and/or spike duplicate sample recovery is outside control limits.
- U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Z Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
 - o Analyte failed to recover within LCS limits (Organics only)

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Date: 01 December 2017
 To: CH2M Hill (technical representative)
 From: Analytical Quality Associates, Inc.
 Project: 100-K
 Subject: Inorganics - Sample Data Group (SDG) GEL436735

INTRODUCTION

This memorandum presents the results of data validation for SDG GEL436735 prepared by GEL Laboratories LLC. A list of samples validated along with the analytical methods is provided in the following table.

Sample ID	Sample Date	Media	Validation Level	Analytical Methods
B38W38	10/30/17	Soil	C	6010D, 6020B, 7471
B38W39	10/30/17	Soil	C	6010D, 6020B, 7471
B38W40	10/30/17	Soil	C	6010D, 6020B, 7471
B38W41	10/30/17	Soil	C	6010D, 6020B, 7471
B38W42	10/30/17	Soil	C	6010D, 6020B, 7471
B38W43	10/30/17	Soil	C	6010D, 6020B, 7471
B38W44	10/30/17	Soil	C	6010D, 6020B, 7471
B38W45	10/30/17	Soil	C	6010D, 6020B, 7471
B38W46	10/30/17	Soil	C	6010D, 6020B, 7471
B38W47	10/30/17	Soil	C	6010D, 6020B, 7471

Data validation was conducted in accordance with the CHPRC validation statement of work and the 100 Area Remedial Action Sampling and Analysis Plan, DOE/RL-96-22, Rev. 5 (SAP). Appendices 1 through 4 provide the following information as indicated below:

- Appendix 1. Glossary of Data Reporting Qualifiers
- Appendix 2. Summary of Data Qualification
- Appendix 3. Data Validation Supporting Documentation
- Appendix 4. Additional Documentation Requested by Client

DATA QUALITY OBJECTIVES

- **Holding Times and Sample Preservation**

Holding times are calculated from Chain-of-Custody forms to determine the validity of the results. The holding time requirement for ICP metals are analysis within 180 days of sample collection and the holding time requirement for mercury is analysis within 28 days of sample collection. Sample preservation for soil samples require chilling to ≤ 6 degree Celsius.

The samples were analyzed within the prescribed holding times and properly preserved.

- **Blanks**

The blank data results are reviewed to assess the extent of contamination introduced through sampling, sample preparation, and analysis.

Laboratory Blanks

All laboratory blank results were acceptable with the following exception.

The Ni laboratory blank result was $>$ the method detection limit (MDL) but $<$ the practical quantitation limit (PQL). The Ni result for sample B38W47 was a detect $>$ the MDL but \leq the PQL and should be qualified as an estimate and flagged “J+.”

Trip Blanks

No trip blanks were submitted for validation.

Field Blanks

No field blanks were submitted for validation.

Equipment Blanks

No equipment blanks were submitted for validation.

- **Accuracy**

Accuracy is evaluated by reviewing matrix spike sample results, laboratory control sample results, and ICP-AES interference check sample results. According to the SAP, the matrix spike sample accuracy limits are 70% to 130% and the laboratory control sample accuracy limits are ones specified by the DV procedure. The limits for reported analytes not listed in the SAP are specified by the DV procedure. The interference check sample limits are ones specified by the DV procedure.

Matrix Spike (MS) Samples

All MS recoveries were acceptable.

Laboratory Control Samples (LCSs)

All LCS recoveries were acceptable.

ICP-AES Interference Check Samples (ICSs)

ICS data was not included in the data package. Sample results should not be qualified based on this.

- **Precision**

Precision is evaluated by reviewing laboratory duplicate sample results, field duplicate sample results, field split sample results, and ICP serial dilution results. These QC results provide information on the laboratory reproducibility and whether sampling activities are adequate to acquire consistent sample results. According to the SAP, the relative percent difference (RPD) limits are $\pm 30\%$. The limits for reported analytes not listed in the SAP are specified by the DV procedure.

Laboratory Duplicate Samples

All laboratory duplicate results were acceptable.

Field Duplicate Samples

No field duplicates were submitted for validation.

Field Split Samples

No field splits were submitted for validation.

ICP Serial Dilution Samples

ICS serial dilution data was not included in the data package. Sample results should not be qualified based on this.

- **ICP-MS Internal Standards**

The analysis of ICP-MS internal standards is used to determine the existences and magnitude of instrument drift and physical interferences. The criteria for evaluation of internal standard results apply to all samples (including QC) analyzed during the analytical run, beginning with the calibration.

ICP-MS internal standards data was not included in the data package. Sample results should not be qualified based on this.

- **Detection Limits**

Reported MDLs are compared against the contractually required detection limits (CRDLs) to ensure that laboratory detection limits meet the required criteria.

All reported sample MDLs with associated non-detected sample results were below the CRDLs with the exception of Sb for all samples except for sample B38W47.

- **Completeness**

SDG GEL436735 was submitted for validation and verified for completeness. Completeness is based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100%.

MAJOR DEFICIENCIES

None found.

MINOR DEFICIENCIES

A minor deficiency leading to qualification of Ni result for sample B38W47 was due to a laboratory blank infraction.

REFERENCES

GRP-GD-003, Rev. 2, Change 0, *Data Validation for Chemical Analyses*, October 2016.

DOE/RL-96-22, Rev. 5, *100 Area Remedial Action Sampling and Analysis Plan*, September 2009.

Appendix 1

Glossary of Data Reporting Qualifiers

Qualifiers that may be applied by data validators in compliance with the CHPRC statement of work are as follows:

- **U** — The constituent was analyzed for, but was not detected. The data should be considered usable for decision-making purposes.
- **UJ** — The constituent was analyzed for and was not detected. Due to a quality control deficiency identified during data validation the value reported may not accurately reflect the RL. The data should be considered usable for decision-making purposes.
- **J** — Indicates the constituent was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J+** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J-** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **N** — The analysis indicates the presence of an analyte that has been tentatively identified.
- **NJ** — The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration.
- **NJ+** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation.
- **NJ-** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation.
- **UR** — Indicates the constituent was analyzed for and not detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.
- **R** — Indicates the constituent was analyzed for and detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.

Appendix 2
Summary of Data Qualification

Inorganic Data Qualification Summary			
SDG: GEL436735	Reviewer: AQA	Project: 100-K	Page 1 of 1
Analyte(s)	Qualifier	Samples Affected	Reason
Ni	J+	B38W47	Laboratory blank contamination

Comments: None

Appendix 3

Data Validation Supporting Documentation

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

VALIDATION LEVEL:	A	B	C	D	E
PROJECT: 100-K			DATA PACKAGE: VSR18-003		
VALIDATOR: Eyda Hergenreder		LAB: GEL		DATE: 12/01/2017	
			SDG: GEL436735		
ANALYSES PERFORMED					
SW-846/ICP X	SW-846/GFAA	SW-846/Hg X	SW-846 Cyanide	SW-846/ICPMS X	
SAMPLES/MATRIX Soil					
GEL436735: B38W38, B38W39, B38W40, B38W41, B38W42, B38W43, B38W44, B38W45, B38W46, B38W47					

1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE

Technical verification documentation present?	Yes No N/A
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Comments:

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

2. INSTRUMENT PERFORMANCE AND CALIBRATIONS (Levels D and E)

Initial calibrations performed on all instruments?	Yes No <input checked="" type="radio"/> N/A
Initial calibrations acceptable?	Yes No <input checked="" type="radio"/> N/A
ICP interference checks acceptable?	Yes No <input checked="" type="radio"/> N/A
ICV and CCV checks performed on all instruments?	Yes No <input checked="" type="radio"/> N/A
ICV and CCV checks acceptable?	Yes No <input checked="" type="radio"/> N/A
Standards traceable?	Yes No <input checked="" type="radio"/> N/A
Standards expired?	Yes No <input checked="" type="radio"/> N/A
Calculation check acceptable?	Yes No <input checked="" type="radio"/> N/A

Comments:

3. BLANKS (Levels B, C, D, and E)

ICB and CCB checks performed for all applicable analyses? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
ICB and CCB results acceptable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Laboratory blanks analyzed?	<input checked="" type="radio"/> Yes No N/A
Laboratory blank results acceptable?	Yes <input checked="" type="radio"/> No N/A
Field blanks analyzed? (Levels C, D, E)	Yes <input checked="" type="radio"/> No N/A
Field blank results acceptable? (Levels C, D, E)	Yes No <input checked="" type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

Laboratory blank Ni 158 ug/kg

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

4. ACCURACY (Levels C, D, and E)

MS/MSD samples analyzed?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
MS/MSD results acceptable?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
MS/MSD standards NIST traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
MS/MSD standards expired? (Levels D, E)	Yes No <input type="radio"/> N/A
LCS/BSS samples analyzed?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
LCS/BSS results acceptable?	<input checked="" type="radio"/> Yes No <input type="radio"/> N/A
Standards traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
Standards expired? (Levels D, E)	Yes No <input type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A
Performance audit sample(s) analyzed?	Yes No <input type="radio"/> N/A
Performance audit sample results acceptable?	Yes No <input type="radio"/> N/A

Comments:

Parent sample results for Ba and Mn were >4X spike concentration.

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

6. ICP QUALITY CONTROL (Levels D and E)

ICP serial dilution samples analyzed?	Yes No <input checked="" type="radio"/> N/A
ICP serial dilution %D values acceptable?	Yes No <input checked="" type="radio"/> N/A
ICP post digestion spike required?	Yes No <input checked="" type="radio"/> N/A
ICP post digestion spike values acceptable?	Yes No <input checked="" type="radio"/> N/A
Standards traceable?	Yes No <input checked="" type="radio"/> N/A
Standards expired?	Yes No <input checked="" type="radio"/> N/A
Transcription/calculation errors?	Yes No <input checked="" type="radio"/> N/A

Comments:

7. HOLDING TIMES (all levels)

Samples properly preserved?	<input checked="" type="radio"/> Yes No N/A
Sample holding times acceptable?	<input checked="" type="radio"/> Yes No N/A

Comments:

Appendix 4

Additional Documentation Requested By Client

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: November 15, 2017

Page 1 of 8

CH2MHill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 436735

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis - ICPMS											
Batch	1714821										
QC1203909682	436735001	DUP									
Barium	D	67800	D	75400	ug/kg	10.6		(0%-35%)	PRB	11/02/17	23:38
Cadmium	BD	95.1	BD	86.0	ug/kg	10.1	^	(+/-200)			
Chromium	D	9890	D	9500	ug/kg	3.96		(0%-35%)			
Selenium	D	1830	D	2150	ug/kg	16.2	^	(+/-1000)			
QC1203909681	LCS										
Barium	4790		D	5340	ug/kg		112	(80%-120%)		11/02/17	23:32
Cadmium	4790		D	4710	ug/kg		98.3	(80%-120%)			
Chromium	4790		D	5210	ug/kg		109	(80%-120%)			
Selenium	4790		D	4110	ug/kg		85.8	(80%-120%)			
QC1203909680	MB										
Barium			DU	93.8	ug/kg					11/02/17	23:28
Cadmium			DU	18.8	ug/kg						
Chromium			DU	188	ug/kg						
Selenium			DU	338	ug/kg						

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QC Summary

Workorder: 436735

Page 2 of 8

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis - ICPMS											
Batch 1714821											
QC1203909683 436735001 MS											
Barium	4980	D	67800	D	76900	ug/kg	N/A	(75%-125%)	PRB	11/02/17	23:41
Cadmium	4980	BD	95.1	D	4300	ug/kg	84.5	(75%-125%)			
Chromium	4980	D	9890	D	14500	ug/kg	92.6	(75%-125%)			
Selenium	4980	D	1830	D	5710	ug/kg	77.8	(75%-125%)			
QC1203909684 436735001 SDILT											
Barium		D	317	D	61.3	ug/L	3.18	(0%-10%)		11/02/17	23:48
Cadmium		BD	0.444	BD	0.105	ug/L	18.2	(0%-10%)			
Chromium		D	46.2	D	9.43	ug/L	2.12	(0%-10%)			
Selenium		D	8.55	DU	1930	ug/L	N/A	(0%-10%)			
Metals Analysis-ICP											
Batch 1714818											
QC1203909674 436735001 DUP											
Antimony		DNU	1710	DU	1640	ug/kg	N/A		HSC	11/13/17	19:08
Arsenic		B	2570	B	2520	ug/kg	2.06	^ (+/-2990)		11/07/17	17:46
Beryllium			1030		978	ug/kg	5.41	^ (+/-498)			
Boron		B	-1830	B	-1120	ug/kg	48.2	^ (+/-4980)			
Cobalt		D	10800	D	9790	ug/kg	9.53	^ (+/-2490)		11/13/17	19:08
Copper			16600		15700	ug/kg	5.22	(0%-35%)		11/07/17	17:46

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QC Summary

Workorder: 436735

Page 3 of 8

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis-ICP											
Batch	1714818										
Lead	B	824	B	879	ug/kg	6.49	^	(+/-996)	HSC	11/07/17	17:46
Manganese		318000		300000	ug/kg	5.82		(0%-35%)			
Molybdenum	B	347	B	365	ug/kg	5.03	^	(+/-996)			
Nickel		9300		9360	ug/kg	0.663		(0%-35%)			
Silver	B	-142	B	-118	ug/kg	18	^	(+/-498)			
Vanadium	D	67900	D	62300	ug/kg	8.65		(0%-35%)		11/13/17	19:08
Zinc	D	43400	D	43700	ug/kg	0.803		(0%-35%)		11/14/17	15:59
QC1203909673	LCS										
Antimony		47800		45200	ug/kg			94.7	(80%-120%)	11/13/17	18:58
Arsenic		47800		45100	ug/kg			94.4	(80%-120%)	11/07/17	17:40
Beryllium		47800		46300	ug/kg			96.8	(80%-120%)		
Boron		47800		47200	ug/kg			98.7	(80%-120%)		
Cobalt		47800		48300	ug/kg			101	(80%-120%)	11/13/17	18:58
Copper		47800		43700	ug/kg			91.5	(80%-120%)	11/07/17	17:40
Lead		47800		46400	ug/kg			97	(80%-120%)		
Manganese		47800		44400	ug/kg			92.9	(80%-120%)		

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QC Summary

Workorder: 436735

Page 4 of 8

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis-ICP											
Batch	1714818										
Molybdenum	47800			43500	ug/kg		90.9	(80%-120%)	HSC	11/07/17	17:40
Nickel	47800			41900	ug/kg		87.7	(80%-120%)			
Silver	47800			44400	ug/kg		92.8	(80%-120%)			
Vanadium	47800			45300	ug/kg		94.8	(80%-120%)		11/13/17	18:58
Zinc	47800			44000	ug/kg		92.1	(80%-120%)		11/14/17	15:52
QC1203909672 MB											
Antimony			U	300	ug/kg					11/13/17	18:55
Arsenic			U	455	ug/kg					11/07/17	17:37
Beryllium			U	90.9	ug/kg						
Boron			U	909	ug/kg						
Cobalt			U	136	ug/kg					11/13/17	18:55
Copper			U	273	ug/kg					11/07/17	17:37
Lead			U	300	ug/kg						
Manganese			U	182	ug/kg						
Molybdenum			U	182	ug/kg						
Nickel			B	158	ug/kg						

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QC Summary

Workorder: 436735

Page 5 of 8

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis-ICP											
Batch	1714818										
Silver			U	90.9	ug/kg				HSC	11/07/17	17:37
Vanadium			U	90.9	ug/kg					11/13/17	18:55
Zinc			U	364	ug/kg					11/14/17	15:49
QC1203909675 436735001 MS											
Antimony	51800	DNU	1710	DN	38400	ug/kg	74.1 *	(75%-125%)		11/13/17	19:11
Arsenic	51800	B	2570		47700	ug/kg	87.2	(75%-125%)		11/07/17	17:50
Beryllium	51800		1030		46600	ug/kg	87.9	(75%-125%)			
Boron	51800	B	-1830		44900	ug/kg	86.6	(75%-125%)			
Cobalt	51800	D	10800	D	57400	ug/kg	89.9	(75%-125%)		11/13/17	19:11
Copper	51800		16600		66100	ug/kg	95.6	(75%-125%)		11/07/17	17:50
Lead	51800	B	824		46500	ug/kg	88.2	(75%-125%)			
Manganese	51800		318000		367000	ug/kg	N/A	(75%-125%)			
Molybdenum	51800	B	347		45100	ug/kg	86.3	(75%-125%)			
Nickel	51800		9300		53300	ug/kg	84.9	(75%-125%)			
Silver	51800	B	-142		44500	ug/kg	85.9	(75%-125%)			
Vanadium	51800	D	67900	D	112000	ug/kg	84.5	(75%-125%)		11/13/17	19:11

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QC Summary

Workorder: 436735

Page 6 of 8

Parname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis-ICP											
Batch	1714818										
Zinc	51800	D	43400	D	93400	ug/kg	96.6	(75%-125%)	HSC	11/14/17	16:02
QC1203918622	436735001	PS									
Antimony	500	DNU	-3.2	D	471	ug/L	94.3	(75%-125%)		11/13/17	19:14
QC1203909676	436735001	SDILT									
Antimony		DNU	-3.2	DU	8530	ug/L	N/A	(0%-10%)		11/13/17	19:18
Arsenic		B	24.8	DU	2590	ug/L	N/A	(0%-10%)		11/07/17	17:53
Beryllium			9.98	BD	2.32	ug/L	16.1	(0%-10%)			
Boron		B	-17.7	DU	5170	ug/L	N/A	(0%-10%)			
Cobalt		D	20.8	BD	4.79	ug/L	14.9	(0%-10%)		11/13/17	19:18
Copper			160	D	30.3	ug/L	5.31	(0%-10%)		11/07/17	17:53
Lead		B	7.96	DU	1710	ug/L	N/A	(0%-10%)			
Manganese			3080	D	664	ug/L	7.79	(0%-10%)			
Molybdenum		B	3.36	DU	1030	ug/L	N/A	(0%-10%)			
Nickel			89.9	D	19.8	ug/L	10.2	(0%-10%)			
Silver		B	-1.37	DU	517	ug/L	N/A	(0%-10%)			
Vanadium		D	131	D	27.3	ug/L	3.84	(0%-10%)		11/13/17	19:18

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QC Summary

Workorder: 436735

Page 7 of 8

Parname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Metals Analysis-ICP											
Batch	1714818										
Zinc	D	83.8	D	30.1	ug/L	79.8		(0%-10%)	HSC	11/14/17	16:05
Metals Analysis-Mercury											
Batch	1716417										
QC1203913576	436735001	DUP									
Mercury	B	11.1	B	10.7	ug/kg	3.22 ^		(+/-12.8)	MTM1	11/08/17	11:34
QC1203913572	LCS										
Mercury	109			111	ug/kg		101	(80%-120%)		11/08/17	11:05
QC1203913571	MB										
Mercury			U	3.73	ug/kg					11/08/17	11:00
QC1203913577	436735001	MS									
Mercury	121	B	11.1	134	ug/kg		102	(75%-125%)		11/08/17	11:35
QC1203913578	436735001	SDILT									
Mercury	B	0.183	BD	0.109	ug/L	198		(0%-10%)		11/08/17	11:37

Notes:

The Qualifiers in this report are defined as follows:

- * Duplicate analysis not within control limits
- + Correlation coefficient for Method of Standard Additions (MSA) is < 0.995
- B The analyte was detected at a value less than the contract required detection limit (RDL), but greater than or equal to the IDL/MDL (as appropriate).
- C Target analyte was detected in the sample and the associated blank. The associated blank concentration is \geq EQL or is $>$ 5% of the measured concentration and/or decision level for associated samples.
- D Results are reported from a diluted aliquot of sample.
- E Reported value is estimated due to interferences. See comment in narrative.
- M Duplicate precision not met.
- N Spike Sample recovery is outside control limits.
- S Reported value determined by the Method of Standard Additions (MSA)
- U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.
- W Post-digestion spike recovery for GFAA out of control limit. Sample absorbency < 50% of spike absorbency.
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier

Date: 01 December 2017
 To: CH2M Hill (technical representative)
 From: Analytical Quality Associates, Inc.
 Project: 100-K
 Subject: General Chemistry - Sample Data Group (SDG) GEL436735

INTRODUCTION

This memorandum presents the results of data validation for SDG GEL436735 prepared by GEL Laboratories LLC. A list of samples validated along with the analytical methods is provided in the following table.

Sample ID	Sample Date	Media	Validation Level	Analytical Methods
B38W38	10/30/17	Soil	C	9056, 7196
B38W39	10/30/17	Soil	C	9056, 7196
B38W40	10/30/17	Soil	C	9056, 7196
B38W41	10/30/17	Soil	C	9056, 7196
B38W42	10/30/17	Soil	C	9056, 7196
B38W43	10/30/17	Soil	C	9056, 7196
B38W44	10/30/17	Soil	C	9056, 7196
B38W45	10/30/17	Soil	C	9056, 7196
B38W46	10/30/17	Soil	C	9056, 7196
B38W47	10/30/17	Soil	C	9056, 7196

Data validation was conducted in accordance with the CHPRC validation statement of work and the 100 Area Remedial Action Sampling and Analysis Plan, DOE/RL-96-22, Rev. 5 (SAP). Appendices 1 through 4 provide the following information as indicated below:

- Appendix 1. Glossary of Data Reporting Qualifiers
- Appendix 2. Summary of Data Qualification
- Appendix 3. Data Validation Supporting Documentation
- Appendix 4. Additional Documentation Requested by Client

DATA QUALITY OBJECTIVES

• Holding Times and Sample Preservation

Holding times are calculated from Chain-of-Custody forms to determine the validity of the results. The holding time requirements are as follows:

- Chloride, fluoride, sulfate – analysis within 28 days of sample collection
- Nitrate and nitrite – extraction within 28 days of sample collection and analysis within 48 hours of extraction
- Hexavalent chromium – extraction within 30 days of sample collection and analysis within seven days of extraction

Sample preservation requires chilling to ≤ 6 degrees Celsius.

The samples were extracted and analyzed within the prescribed holding times and properly preserved.

- **Blanks**

The blank data results are reviewed to assess the extent of contamination introduced through sampling, sample preparation, and analysis.

Laboratory Blanks

All laboratory blank results were acceptable.

Trip Blanks

No trip blanks were submitted for validation.

Field Blanks

No field blanks were submitted for validation.

Equipment Blanks

No equipment blanks were submitted for validation.

- **Accuracy**

Accuracy is evaluated by reviewing matrix spike sample results and laboratory control sample results. According to the SAP, the matrix spike sample accuracy limits are 70% to 130% and the laboratory control sample accuracy limits are ones specified by the DV procedure. The limits for reported analytes not listed in the SAP are specified by the DV procedure.

Matrix Spike (MS) Samples

All MS recoveries were acceptable.

Laboratory Control Samples (LCSs)

All LCS recoveries were acceptable.

- **Precision**

Precision is evaluated by reviewing laboratory duplicate sample results, field duplicate sample results, and field split sample results. These QC results provide information on the laboratory reproducibility and whether sampling activities are adequate to acquire consistent sample results.

According to the SAP, the relative percent difference (RPD) limits are $\pm 30\%$. The RPD limits for reported analytes not listed in the SAP are specified by the DV procedure.

Laboratory Duplicate Samples

All laboratory duplicate RPDs were acceptable.

Field Duplicate Samples

No field duplicates were submitted for validation.

Field Split Samples

No field splits were submitted for validation.

• Detection Limits

Reported MDLs are compared against the contractually required detection limits (CRDLs) to ensure that laboratory detection limits meet the required criteria.

All reported sample MDLs were below the CRDLs.

• Completeness

SDG GEL436735 was submitted for validation and verified for completeness. Completeness is based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100%.

MAJOR DEFICIENCIES

None found.

MINOR DEFICIENCIES

None found.

REFERENCES

GRP-GD-003, Rev. 2, Change 0, *Data Validation for Chemical Analyses*, October 2016.

DOE/RL-96-22, Rev. 5, *100 Area Remedial Action Sampling and Analysis Plan*, September 2009.

Appendix 1

Glossary of Data Reporting Qualifiers

Qualifiers that may be applied by data validators in compliance with the CHPRC statement of work are as follows:

- **U** — The constituent was analyzed for, but was not detected. The data should be considered usable for decision-making purposes.
- **UJ** — The constituent was analyzed for and was not detected. Due to a quality control deficiency identified during data validation the value reported may not accurately reflect the RL. The data should be considered usable for decision-making purposes.
- **J** — Indicates the constituent was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J+** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J-** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **N** — The analysis indicates the presence of an analyte that has been tentatively identified.
- **NJ** — The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration.
- **NJ+** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation.
- **NJ-** — The analysis indicates the presence of an analyte that has been tentatively identified. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation.
- **UR** — Indicates the constituent was analyzed for and not detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.
- **R** — Indicates the constituent was analyzed for and detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.

Appendix 2
Summary of Data Qualification

General Chemistry Data Qualification Summary			
SDG: GEL436735	Reviewer: AQA	Project: 100-K	Page 1 of 1
Analyte(s)	Qualifier	Samples Affected	Reason
Cr(VI), Anions	None	N/A	N/A

Comments: None

Appendix 3

Data Validation Supporting Documentation

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

VALIDATION LEVEL:	A	B	<input checked="" type="radio"/> C	D	E
PROJECT: 100-K			DATA PACKAGE: VSR18-003		
VALIDATOR: Eyda Hergenreder		LAB: GEL		DATE: 12/01/17	
			SDG: GEL436735		
ANALYSES PERFORMED					
Anions/IC X	TOC	TOX	TPH-418.1	Oil and Grease	Alkalinity
Ammonia	BOD/COD	Chloride	Chromium-VI X	pH	NO ₃ /NO ₂
Sulfate	TDS	TKN	Phosphate		
SAMPLES/MATRIX Soil					
SDG GEL436735: B38W38, B38W39, B38W40, B38W41, B38W42, B38W43, B38W44, B38W45 B38W46, B38W47					

1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE

Technical verification documentation present?	Yes <input type="radio"/> No <input checked="" type="radio"/> N/A
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Comments:

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

2. INSTRUMENT PERFORMANCE AND CALIBRATIONS (Levels D and E)

Initial calibrations performed on all instruments?	Yes No <input type="radio"/> N/A
Initial calibrations acceptable?	Yes No <input type="radio"/> N/A
ICV and CCV checks performed on all instruments?	Yes No <input type="radio"/> N/A
ICV and CCV checks acceptable?	Yes No <input type="radio"/> N/A
Standards traceable?	Yes No <input type="radio"/> N/A
Standards expired?	Yes No <input type="radio"/> N/A
Calculation check acceptable?	Yes No <input type="radio"/> N/A

Comments:

3. BLANKS (Levels B, C, D, and E)

ICB and CCB checks performed for all applicable analyses? (Levels D, E)	Yes No <input type="radio"/> N/A
ICB and CCB results acceptable? (Levels D, E)	Yes No <input type="radio"/> N/A
Laboratory blanks analyzed?	<input checked="" type="radio"/> Yes No N/A
Laboratory blank results acceptable?	<input checked="" type="radio"/> Yes No N/A
Field blanks analyzed? (Levels C, D, E)	Yes <input type="radio"/> No N/A
Field blank results acceptable? (Levels C, D, E)	Yes No <input type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A

Comments:

Data Validation for Chemical Analyses

Published Date: 10/03/16

SGRP-GD-SMP-50117

Effective Date: 10/03/16

Appendix A - (Cont.) Chemical Data Validation Checklist

5. PRECISION (Levels C, D, and E)

Duplicate RPD values acceptable?	<input checked="" type="radio"/> Yes No N/A
Duplicate results acceptable?	<input checked="" type="radio"/> Yes No N/A
MS/MSD standards NIST traceable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
MS/MSD standards expired? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
LCS/LCSD duplicates run due to insufficient sample material?	Yes <input checked="" type="radio"/> No N/A
Field duplicate RPD values acceptable?	Yes No <input checked="" type="radio"/> N/A
Field split RPD values acceptable?	Yes No <input checked="" type="radio"/> N/A
Transcription/calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

6. HOLDING TIMES (all levels)

Samples properly preserved?	<input checked="" type="radio"/> Yes No N/A
Sample holding times acceptable?	<input checked="" type="radio"/> Yes No N/A

Comments:

Appendix 4

Additional Documentation Requested By Client

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: November 13, 2017

Page 1 of 4

CH2M Hill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 436735

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Ion Chromatography											
Batch	1715523										
QC1203911269 436735009 DUP											
Chloride	B	1660	B	1610	ug/Kg	3	^	(+/-2040)	MXL2	11/03/17	05:11
Fluoride	B	988	B	941	ug/Kg	4.84	^	(+/-1020)			
Nitrate-N		1360		1320	ug/Kg	2.73	^	(+/-1020)			
Nitrite-N	U	336	U	337	ug/Kg	N/A					
Sulfate		6850		6560	ug/Kg	4.32	^	(+/-4090)			
QC1203911270 436735010 DUP											
Chloride		3600		3640	ug/Kg	1.23	^	(+/-1930)		11/03/17	06:38
Fluoride	B	390	B	377	ug/Kg	3.53	^	(+/-966)			
Nitrate-N	B	515	B	506	ug/Kg	1.65	^	(+/-966)			
Nitrite-N	U	318	U	319	ug/Kg	N/A					
Sulfate	B	2790	B	2530	ug/Kg	9.66	^	(+/-3870)			
QC1203911268 LCS											
Chloride		49900		47500	ug/Kg			95.3	(80%-120%)	11/02/17	22:27
Fluoride		24900		23700	ug/Kg			95	(80%-120%)		
Nitrate-N		24900		24000	ug/Kg			96.1	(80%-120%)		

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Workorder: 436735

Page 2 of 4

Parmname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Ion Chromatography											
Batch	1715523										
Nitrite-N	24900			24500	ug/Kg		98.4	(80%-120%)	MXL2	11/02/17	22:27
Sulfate	99800			100000	ug/Kg		100	(80%-120%)			
QC1203911267	MB										
Chloride			U	716	ug/Kg					11/02/17	21:58
Fluoride			U	338	ug/Kg						
Nitrate-N			U	328	ug/Kg						
Nitrite-N			U	328	ug/Kg						
Sulfate			U	1320	ug/Kg						
QC1203911271	436735009 MS										
Chloride	51200	B	1660	49000	ug/Kg		92.6	(75%-125%)		11/03/17	05:40
Fluoride	25600	B	988	23400	ug/Kg		87.5	(75%-125%)			
Nitrate-N	25600		1360	25500	ug/Kg		94.5	(75%-125%)			
Nitrite-N	25600	U	336	25100	ug/Kg		98.2	(75%-125%)			
Sulfate	102000		6850	108000	ug/Kg		98.9	(75%-125%)			
QC1203911272	436735010 MS										
Chloride	48300		3600	47500	ug/Kg		90.9	(75%-125%)		11/03/17	07:07
Fluoride	24200	B	390	22700	ug/Kg		92.2	(75%-125%)			
Nitrate-N	24200	B	515	22900	ug/Kg		92.8	(75%-125%)			

GEL LABORATORIES LLC

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Workorder: 436735

Page 3 of 4

Parname	NOM	Sample	Qual	QC	Units	RPD%	REC%	Range	Anlst	Date	Time
Ion Chromatography											
Batch	1715523										
Nitrite-N	24200	U	318	23500	ug/Kg		97.2	(75%-125%)	MXL2	11/03/17	07:07
Sulfate	96600	B	2790	97200	ug/Kg		97.7	(75%-125%)			
Spectrometric Analysis											
Batch	1715592										
QC1203911481	436735010	DUP									
Hexavalent Chromium		U	103	U	103	ug/Kg	N/A		VH1	11/10/17	10:30
QC1203911480	ILCS										
Hexavalent Chromium	7850				7610	ug/Kg	96.9	(80%-120%)		11/10/17	10:20
QC1203911479	LCS										
Hexavalent Chromium	3830				3910	ug/Kg	102	(80%-120%)		11/10/17	10:19
QC1203911478	MB										
Hexavalent Chromium			U		150	ug/Kg				11/10/17	10:19
QC1203911483	436735010	MS									
Hexavalent Chromium	3390	U	103		2860	ug/Kg	83.6	(75%-125%)		11/10/17	10:31

Notes:

The Qualifiers in this report are defined as follows:

- < Sample is below the EPA guidance level for Reactive Releasable Cyanide and/or Reactive Releasable Sulfide
- > Result greater than quantifiable range or greater than upper limit of the analysis range
- B The analyte was detected at a value less than the contract required detection limit (RDL), but greater than or equal to the IDL/MDL (as appropriate).
- C Target analyte was detected in the sample and the associated blank. The associated blank concentration is \geq EQL or is $>$ 5% of the measured concentration and/or decision level for associated samples.
- D Results are reported from a diluted aliquot of sample.
- N Spike Sample recovery is outside control limits.
- U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Z Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier

Date: 01 December 2017
 To: CH2M Hill (technical representative)
 From: Analytical Quality Associates, Inc.
 Project: 100-K
 Subject: Radiochemical - Sample Data Group (SDG) GEL436735

INTRODUCTION

This memorandum presents the results of data validation for SDG GEL436735 prepared by GEL Laboratories LLC. A list of samples validated along with the analytical methods is provided in the following table.

Sample ID	Sample Date	Media	Validation Level	Analytical Methods
B38W38	10/30/17	Soil	C	Gamma
B38W39	10/30/17	Soil	C	Gamma
B38W40	10/30/17	Soil	C	Gamma
B38W41	10/30/17	Soil	C	Gamma
B38W42	10/30/17	Soil	C	Gamma
B38W43	10/30/17	Soil	C	Gamma
B38W44	10/30/17	Soil	C	Gamma
B38W45	10/30/17	Soil	C	Gamma
B38W46	10/30/17	Soil	C	Gamma
B38W47	10/30/17	Soil	C	Gamma

Data validation was conducted in accordance with the CHPRC validation statement of work and the 100 Area Remedial Action Sampling and Analysis Plan, DOE/RL-96-22, Rev. 5 (SAP). Appendices 1 through 4 provide the following information as indicated below:

- Appendix 1. Glossary of Data Reporting Qualifiers
- Appendix 2. Summary of Data Qualification
- Appendix 3. Data Validation Supporting Documentation
- Appendix 4. Additional Documentation Requested by Client

DATA QUALITY OBJECTIVES

- **Holding Times and Sample Preservation**

Holding times are calculated from Chain-of-Custody forms to determine the validity of the results. The maximum holding time for radiochemical analysis is 180 days. There are no specific preservation requirements for radiochemical soil/solid analysis.

The samples were analyzed within the prescribed holding time.

- **Blanks**

The blank data results are reviewed to assess the extent of contamination introduced through sampling, sample preparation, and analysis.

Laboratory Blanks

All laboratory blank results were acceptable.

Trip Blanks

No trip blanks were submitted for validation.

Field Blanks

No field blanks were submitted for validation.

Equipment Blanks

No equipment blanks were submitted for validation.

- **Accuracy**

Accuracy is evaluated by reviewing matrix spike sample results, laboratory control sample results, and chemical recovery factors. Chemical recovery factors are determined through use of a carrier or tracer and provide assessment of the chemical separation process that is affected by the laboratory procedure, sample matrix, and/or interference. Chemical recovery factors are used to correct sample concentration, uncertainty, and MDC results. According to the SAP, the laboratory control sample accuracy limits are 70% to 130%. The matrix spike sample accuracy limits are ones specified by the DV procedure.

Matrix Spike (MS) Samples

MS analyses are not required for gamma spectrometry analysis.

Laboratory Control Samples (LCSs)

All LCS recoveries were acceptable.

Carrier/Tracer Recovery Factors

Carrier/tracer analyses are not required for gamma spectrometry analysis.

- **Precision**

Precision is evaluated by reviewing laboratory duplicate, field duplicate, and field split sample results. These QC results provide information on the laboratory reproducibility and whether sampling activities are adequate to acquire consistent sample results. According to the SAP, the relative percent difference (RPD) limits are $\pm 30\%$.

Laboratory Duplicate Samples

All laboratory duplicate RPDs were acceptable.

Field Duplicate Samples

No field duplicates were submitted for validation.

Field Split Samples

No field splits were submitted for validation.

- **Detection Limits**

Reported MDCs are compared against the contractually required detection limits (CRDLs) to ensure that laboratory detection limits meet the required criteria.

All reported sample MDCs with associated non-detected sample results were below the CRDLs with exceptions of Eu-152, Eu-154 and Eu-155 for all samples, Cs-137 for all samples except for samples B38W43 and B38W47 and Co-60 for all samples except for samples B38W42 and B38W44.

- **Completeness**

SDG GEL436735 was submitted for validation and verified for completeness. Completeness is based on the percentage of data determined to be valid (i.e., not rejected). The completion percentage was 100%.

MAJOR DEFICIENCIES

None found.

MINOR DEFICIENCIES

None found.

REFERENCES

GRP-GD-002, Rev. 2, Change 0, *Data Validation for Radiochemical Analyses*, September 2016.

DOE/RL-96-22, Rev. 5, *100 Area Remedial Action Sampling and Analysis Plan*, September 2009.

Appendix 1

Glossary of Data Reporting Qualifiers

Qualifiers that may be applied by data validators in compliance with the CHPRC statement of work are as follows:

- **U** — The constituent was analyzed for and was not detected. The data should be considered usable for decision-making purposes.
- **UJ** — The constituent was analyzed for and was not detected. Due to a quality control deficiency identified during data validation the value reported may not accurately reflect the MDC. The data should be considered usable for decision-making purposes.
- **J** — Indicates the constituent was analyzed for and detected. The associated value is estimated due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J+** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected positive bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **J-** — Indicates the constituent was analyzed for and detected. The associated value is estimated with a suspected negative bias due to a quality control deficiency identified during data validation. The data should be considered usable for decision-making purposes.
- **UR** — Indicates the constituent was analyzed for and not detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.
- **R** — Indicates the constituent was analyzed for and detected; however, due to an identified quality control deficiency the data should be considered unusable for decision-making purposes.

Appendix 2
Summary of Data Qualification

Radiochemical Data Qualification Summary			
SDGs: GEL436735	Reviewer: AQA	Project: 100-K	Page 1 of 1
Analyte(s)	Qualifier	Samples Affected	Reason
Radiochemical	None	N/A	N/A

Comments: None

Appendix 3

Data Validation Supporting Documentation

Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

Appendix B - Radiochemical Data Validation Checklist

Validation Level:	A	B	C	D	E
Project: 100-K			Data Package: VSR18-003		
Validator: Eyda Hergenreder		Lab: GEL		Date: 12/01/17	
			SDG: GEL436735		
Analyses Performed					
<input type="checkbox"/> Gross Alpha/Beta	<input type="checkbox"/> Strontium-90	<input type="checkbox"/> Technetium-99	<input type="checkbox"/> Alpha Spectroscopy	<input checked="" type="checkbox"/> Gamma Spectroscopy	<input type="checkbox"/> Tritium
<input type="checkbox"/> Total Uranium	<input type="checkbox"/> Radium-22				
Samples/Matrix Soil					
SDG436735: B38W38, B38W39, B38W40, B38W41, B38W42, B38W43, B38W44, B38W45, B38W46, B38W47					

1. Completeness and Case Narrative	<input type="checkbox"/> N/A
Technical verification forms present?	Yes <input checked="" type="radio"/> No <input type="radio"/> N/A

Comments:

2. Initial Calibration (Levels D, E)	<input checked="" type="checkbox"/> N/A
Instruments/detectors calibrated?	Yes No <input checked="" type="radio"/> N/A
Initial calibration acceptable?	Yes No <input checked="" type="radio"/> N/A
Standards NIST traceable?	Yes No <input checked="" type="radio"/> N/A
Standards expired?	Yes No <input checked="" type="radio"/> N/A
Calculation check acceptable?	Yes No <input checked="" type="radio"/> N/A

Comments:

Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

Appendix B - (Cont.) Radiochemical Data Validation Checklist

3. Continuing Calibration (Levels D, E)	<input checked="" type="checkbox"/> N/A
Calibration checked within required frequency?	Yes No <input type="radio"/> N/A
Calibration check acceptable?	Yes No <input type="radio"/> N/A
Calibration check standards traceable?	Yes No <input type="radio"/> N/A
Calibration check standards expired?	Yes No <input type="radio"/> N/A
Calculation check acceptable?	Yes No <input type="radio"/> N/A
Comments:	

4. Background Counts (Levels D, E)	<input checked="" type="checkbox"/> N/A
Background counts checked within required frequency?	Yes No <input type="radio"/> N/A
Background counts acceptable?	Yes No <input type="radio"/> N/A
Calculation check acceptable?	Yes No <input type="radio"/> N/A
Comments:	

Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

Appendix B - (Cont.) Radiochemical Data Validation Checklist

5. Blanks (Levels B, C, D, E)	<input type="checkbox"/> N/A
Method blank analyzed within required frequency?	(Yes) No N/A
Method blank results acceptable?	(Yes) No N/A
Analytes detected in method blank?	Yes (No) N/A
Field blank(s) analyzed?	Yes (No) N/A
Field blank results acceptable?	Yes No (N/A)
Analytes detected in field blank(s)?	Yes No (N/A)
Transcription/Calculation Errors? (Levels D, E)	Yes No (N/A)

Comments:

6. Laboratory Control Samples or Blank Spike Samples (Levels C, D, E)	<input type="checkbox"/> N/A
LCS /BSS analyzed within required frequency?	(Yes) No N/A
LCS/BSS recoveries acceptable?	(Yes) No N/A
LCS/BSS traceable? (Levels D,E)	Yes No (N/A)
LCS/BSS expired? (Levels D,E)	Yes No (N/A)
LCS/BSS levels correct? (Levels D,E)	Yes No (N/A)
Transcription/Calculation errors? (Levels D, E)	Yes No (N/A)

Comments:

Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

Appendix B - (Cont.) Radiochemical Data Validation Checklist

7. Chemical Carrier Recovery (Levels C, D, E)	<input checked="" type="checkbox"/> N/A
Chemical carrier added?	Yes No <input type="radio"/> N/A
Chemical recovery acceptable?	Yes No <input type="radio"/> N/A
Chemical carrier traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
Chemical carrier expired? (Levels D, E)	Yes No <input type="radio"/> N/A
Transcription/Calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A

Comments:

Chemical carrier not required for requested method

8. Tracer Recovery (Levels C, D, E)	<input checked="" type="checkbox"/> N/A
Tracer added?	Yes No <input type="radio"/> N/A
Tracer recovery acceptable?	Yes No <input type="radio"/> N/A
Tracer traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
Tracer expired? (Levels D, E)	Yes No <input type="radio"/> N/A
Transcription/Calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A

Comments:

Tracer not required for requested method

Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

Appendix B - (Cont.) Radiochemical Data Validation Checklist

9. Matrix Spikes (Levels C, D, E)	<input checked="" type="checkbox"/> N/A
Matrix spike analyzed?	Yes No <input type="radio"/> N/A
Spike recoveries acceptable?	Yes No <input type="radio"/> N/A
Spike source traceable? (Levels D, E)	Yes No <input type="radio"/> N/A
Spike source expired? (Levels D, E)	Yes No <input type="radio"/> N/A
Transcription/Calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A

Comments:

MS not required for the requested method

10. Duplicates (Levels C, D, E)	<input type="checkbox"/> N/A
Duplicates analyzed at required frequency?	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A
RPD values acceptable?	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A
Transcription/Calculation errors? (Levels D, E)	Yes No <input type="radio"/> N/A

Comments:

Data Validation for Radiochemical Analyses

Published Date: 09/13/16

SGRP-GD-SMP-50116

Effective Date: 09/13/16

Appendix B - (Cont.) Radiochemical Data Validation Checklist

11. Field QC Samples (Levels C, D, E)	<input type="checkbox"/> N/A
Field duplicate sample(s) analyzed?	Yes <input checked="" type="radio"/> No N/A
Field duplicate RPD values acceptable?	Yes No <input checked="" type="radio"/> N/A
Field split sample(s) analyzed?	Yes <input checked="" type="radio"/> No N/A
Field split RPD values acceptable?	Yes No <input checked="" type="radio"/> N/A
Performance audit sample(s) analyzed?	Yes No <input checked="" type="radio"/> N/A
Performance audit sample results acceptable?	Yes No <input checked="" type="radio"/> N/A

Comments:

12. Holding Times (All levels)	<input type="checkbox"/> N/A
Are sample holding times acceptable?	<input checked="" type="radio"/> Yes No N/A

Comments:

13. Results and MDCs (All Levels)	<input type="checkbox"/> N/A
Results reported for all required sample analyses?	<input checked="" type="radio"/> Yes No N/A
Results supported in raw data?(Levels D, E)	Yes No <input checked="" type="radio"/> N/A
Results acceptable? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A
MDC's meet required reporting limits?	Yes <input checked="" type="radio"/> No N/A
Transcription/Calculation errors? (Levels D, E)	Yes No <input checked="" type="radio"/> N/A

Comments:

MDCs > CRDL: Eu-152, Eu-154, Eu-155 for all samples; Cs-137 for all samples except samples B38W43 and B38W47; Co-60 for all samples except samples B38W42 and B38W44

Appendix 4

Additional Documentation Requested By Client

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Report Date: November 24, 2017

Page 1 of 3

Client : CH2MHill Plateau Remediation Company
 MSIN R3-50 CHPRC
 PO Box 1600
 Richland, Washington 99352
 Contact: Mr. Scot Fitzgerald
 Workorder: 436735

Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date Time
Rad Gamma Spec									
Batch	1714961								
QC1203909969	MB								
Cesium-137			U	0.00859	pCi/g			MXR1	11/02/1713:56
				Uncert: +/-0.0207					
				TPU: +/-0.0211					
Cobalt-60			U	-0.00904	pCi/g				
				Uncert: +/-0.0214					
				TPU: +/-0.0218					
Europium-152			U	0.0136	pCi/g				
				Uncert: +/-0.0516					
				TPU: +/-0.0519					
Europium-154			U	0.0226	pCi/g				
				Uncert: +/-0.0667					
				TPU: +/-0.0675					
Europium-155			U	0.000534	pCi/g				
				Uncert: +/-0.0484					
				TPU: +/-0.0484					
QC1203909970	436690001	DUP							
Cesium-137		U	-0.0144	0.0378	pCi/g				11/02/1715:46
				Uncert: +/-0.0232		RPD: 13	(0% - 100%)		
				TPU: +/-0.0241		RER: 0.944	(0-2)		
Cobalt-60		U	-0.00984	0.000355	pCi/g				
				Uncert: +/-0.0232		RPD: 0	N/A		
				TPU: +/-0.0237		RER: 1.79	(0-2)		
Europium-152		U	0.0259	-0.00215	pCi/g				
				Uncert: +/-0.0481		RPD: 0	N/A		
				TPU: +/-0.0496		RER: 0.702	(0-2)		
Europium-154		U	0.0398	-0.0265	pCi/g				
				Uncert: +/-0.0621		RPD: 0	N/A		
				TPU: +/-0.0648		RER: 1.88	(0-2)		
Europium-155		U	0.0568	0.0343	pCi/g				
				Uncert: +/-0.0877		RPD: 0	N/A		
				TPU: +/-0.0878		RER: 0.135	(0-2)		
QC1203909971	LCS								
Americium-241	488			554	pCi/g	REC: 113	(80%-120%)		11/02/1713:56
				Uncert: +/-14.5					
				TPU: +/-62.8					
Cesium-137	175			172	pCi/g	REC: 99	(80%-120%)		
				Uncert: +/-3.32					
				TPU: +/-14.4					
Cobalt-60	139			135	pCi/g	REC: 97	(80%-120%)		
				Uncert: +/-3.58					
				TPU: +/-13.6					
Europium-152			U	-0.15	pCi/g				
				Uncert: +/-1.47					
				TPU: +/-1.47					

GEL LABORATORIES LLC

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

QC Summary

Workorder: 436735

Page 2 of 3

Parmname	NOM	Sample	Qual	QC	Units	QC Criteria	Range	Analyst	Date	Time
Rad Gamma Spec										
Batch	1714961									
Europium-154			U	0.0644	pCi/g					
	Uncert:			+/-0.942						
	TPU:			+/-0.943						
Europium-155			U	0.138	pCi/g					
	Uncert:			+/-1.37						
	TPU:			+/-1.37						

Notes:

TPU and Counting Uncertainty are calculated at the 95% confidence level (1.96-sigma).

The Qualifiers in this report are defined as follows:

- * Duplicate analysis not within control limits
- + Correlation coefficient for Method of Standard Additions (MSA) is < 0.995
- < Sample is below the EPA guidance level for Reactive Releasable Cyanide and/or Reactive Releasable Sulfide
- > Result greater than quantifiable range or greater than upper limit of the analysis range
- A The TIC is a suspected aldol-condensation product
- B The analyte was detected at a value less than the contract required detection limit (RDL), but greater than or equal to the IDL/MDL (as appropriate).
- B The analyte was detected in both the associated QC blank and in the sample.
- B The associated QC sample blank has a result $\geq 2X$ the MDA and, after corrections, result is \geq MDA for this sample
- C Analyte has been confirmed by GC/MS analysis
- C Target analyte was detected in the sample and the associated blank. The associated blank concentration is \geq EQL or is > 5% of the measured concentration and/or decision level for associated samples.
- D Results are reported from a diluted aliquot of sample.
- E Concentration exceeds the calibration range of the instrument
- E Reported value is estimated due to interferences. See comment in narrative.
- J The analyte was detected at a value less than the contract required detection limit (RDL), but greater than or equal to the IDL/MDL (as appropriate). Value is estimated
- M Duplicate precision not met.
- N Spike Sample recovery is outside control limits.
- P Aroclor target analyte with greater than 25% difference between column analyses.
- S Reported value determined by the Method of Standard Additions (MSA)
- T Spike and/or spike duplicate sample recovery is outside control limits.
- U Analyzed for but not detected above limiting criteria. Includes MDL, MDA, PQL, zero, counting error, and total analytical error.
- UX Gamma Spectroscopy--Uncertain identification
- W Post-digestion spike recovery for GFAA out of control limit. Sample absorbency < 50% of spike absorbency.
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Z Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- o Analyte failed to recover within LCS limits (Organics only)