







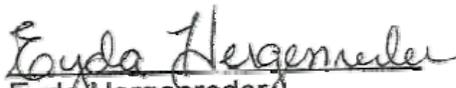
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## Data Validation Report for CH2M Hill Plateau Remediation Company

**VSR17-004**  
**Project 100-K AB**

**Chemical Validation - Level C**

Validation Performed By:

  
Eyda Hergenreder

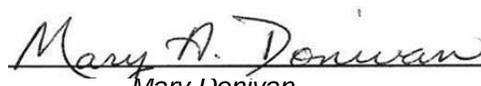
Date: 03-21-2017

Technical Review By:

  
Ellen McEntee

Date: 03-21-2017

Quality Review By:

  
Mary Donovan  
Quality Assurance Manager

Date: 03-27-2017

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Date: 21 March 2017  
 To: CH2M Hill (technical representative)  
 From: Analytical Quality Associates, Inc.  
 Project: 100-K AB  
 Subject: Semivolatile Organics - Sample Data Group (SDG) GEL417825

## **INTRODUCTION**

This memorandum presents the results of data validation for SDG GEL417825 prepared by GEL Laboratories LLC. A list of samples validated along with the analytical methods is provided in the following table.

| <b>Sample ID</b> | <b>Sample Date</b> | <b>Media</b> | <b>Validation Level</b> | <b>Analytical Methods</b> |
|------------------|--------------------|--------------|-------------------------|---------------------------|
| B394H1           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394H2           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394H3           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394H4           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394H5           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394H6           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394H7           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394H8           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394H9           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394J0           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394J1           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394J2           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394J3           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |
| B394J4           | 3/02/17            | Solid        | C                       | 8270D, WTPH D             |

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 methods 8270D and WTPH D 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**

All equipment blank results were acceptable with the following exception.

The WTPH D result for equipment blank sample B394J0 was 3420 µg/kg.

- **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. The limits for reported analytes not listed in the SAP are 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, 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 limits for reported analytes not listed in the SAP are specified by the DV procedure. When duplicate RPDs exceed the limits and have associated results  $< 5X$  the SAP required detection limits (or  $< 5X$  the laboratory reporting limits for analytes not listed in the SAP) with differences  $< 2X$  the required detection limits no precision infraction occurred.

### **MS/MSD Samples**

All MS/MSD relative percent difference values were acceptable.

### **Field Duplicate Samples**

All field duplicate results were acceptable with the following exceptions.

For method 8270D, sample B394H4 and its duplicate B394H5 had RPDs above the upper acceptance limit for anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene and pyrene.

### **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 GEL417825 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**

| <b>Semivolatile Organics Data Qualification Summary</b> |                  |                         |               |
|---------------------------------------------------------|------------------|-------------------------|---------------|
| SDG: GEL417825                                          | Reviewer: AQA    | Project: 100-K AB       | Page 1 of 1   |
| <b>Analyte(s)</b>                                       | <b>Qualifier</b> | <b>Samples Affected</b> | <b>Reason</b> |
| 8270D, WTPH D                                           | None             | NA                      | NA            |

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                  | <input checked="" type="radio"/> C | D             | E                  |
| PROJECT: 100-K AB                                                                                                         |   |                    | DATA PACKAGE: VSR17-004            |               |                    |
| VALIDATOR: Eyda Hergenreder                                                                                               |   | LAB: GEL           |                                    | DATE: 3/21/17 |                    |
|                                                                                                                           |   |                    | SDG: GEL417825                     |               |                    |
| ANALYSES PERFORMED                                                                                                        |   |                    |                                    |               |                    |
| SW-846 8260                                                                                                               |   | SW-846 8260 (TCLP) | SW-846 8270 X                      |               | SW-846 8270 (TCLP) |
|                                                                                                                           |   |                    |                                    |               |                    |
| SAMPLES/MATRIX Soil                                                                                                       |   |                    |                                    |               |                    |
| GEL417825: B394H1, B394H2, B394H3, B394H4, B394H5, B394H6, B394H7, B394H8, B394H9, B394J0, B394J1, B394J2, B394J3, B394J4 |   |                    |                                    |               |                    |
|                                                                                                                           |   |                    |                                    |               |                    |
|                                                                                                                           |   |                    |                                    |               |                    |
|                                                                                                                           |   |                    |                                    |               |                    |

**1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE**

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

Comments:

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## 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:

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

Comments:

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## 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:

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## Data Validation for Chemical Analyses

Published Date: 10/03/16

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## 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?                                | <input checked="" type="radio"/> Yes 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 <input type="radio"/> No 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:

B394H4/B394H5: anthracene 14.0/7.91 (56%); benzo(a)anthracene 27.3/16.5 (49%);  
benzo(a)pyrene 39.2/20.1 (64%); benzo(b)fluoranthene 104/71.9 (36%); benzo(k)fluoranthene 27.0/19.1 (34%);  
chrysene 32.0/22.7 (34%); fluoranthene 56.8/40.3 (34%); indeno(1,2,3-cd)pyrene 42.4/30.6 (32%);  
phenanthrene 15.5/10.4 (>+/-PQL); pyrene 55.4/29.9 (60%)

## 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

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### 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:

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#### 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 |
| Laboratory properly identified and coded all TIC? (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:

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**Data Validation for Chemical Analyses**

Published Date: 10/03/16

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**Appendix A - (Cont.) Chemical Data Validation Checklist**

|                                                                                                                           |      |           |                                    |                |   |
|---------------------------------------------------------------------------------------------------------------------------|------|-----------|------------------------------------|----------------|---|
| VALIDATION LEVEL:                                                                                                         | A    | B         | <input checked="" type="radio"/> C | D              | E |
| PROJECT: 100-K AB                                                                                                         |      |           | DATA PACKAGE: VSR17-004            |                |   |
| VALIDATOR: Eyda Hergenreder                                                                                               |      | LAB: GEL  |                                    | DATE: 03/21/17 |   |
|                                                                                                                           |      |           | SDG:                               |                |   |
| ANALYSES PERFORMED                                                                                                        |      |           |                                    |                |   |
| 8015                                                                                                                      | 8021 | 8141      | 8151                               | 8315           |   |
|                                                                                                                           |      | WTPH-HCID | WTPH-G                             | WTPH-D X       |   |
|                                                                                                                           |      |           |                                    |                |   |
| SAMPLES/MATRIX: Soil                                                                                                      |      |           |                                    |                |   |
| GEL417825: B394H1, B394H2, B394H3, B394H4, B394H5, B394H6, B394H7, B394H8, B394H9, B394J0, B394J1, B394J2, B394J3, B394J4 |      |           |                                    |                |   |
|                                                                                                                           |      |           |                                    |                |   |
|                                                                                                                           |      |           |                                    |                |   |
|                                                                                                                           |      |           |                                    |                |   |

**1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE**

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

Comments:

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## Data Validation for Chemical Analyses

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## Appendix A - (Cont.) Chemical Data Validation Checklist

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

|                                     |                                             |
|-------------------------------------|---------------------------------------------|
| Initial calibrations acceptable?    | Yes No <input checked="" type="radio"/> N/A |
| Continuing calibrations 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:

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

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

Comments:

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Equipment blank sample B394J0 3420 ug/Kg

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## Data Validation for Chemical Analyses

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## 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 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:

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## 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?                       | <input checked="" type="radio"/> Yes No 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:

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#### 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:

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

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

Comments:

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**8. SAMPLE CLEANUP (Levels D and E)**

|                                                     |                                  |
|-----------------------------------------------------|----------------------------------|
| Fluorisil ® (or other absorbent) cleanup performed? | Yes No <input type="radio"/> N/A |
| Lot check performed?                                | Yes No <input type="radio"/> N/A |
| Check recoveries acceptable?                        | Yes No <input type="radio"/> N/A |
| Check materials traceable?                          | Yes No <input type="radio"/> N/A |
| Check materials Expired?                            | Yes No <input type="radio"/> N/A |
| Analytical batch QC given similar cleanup?          | Yes No <input type="radio"/> N/A |
| Transcription/Calculation Errors?                   | Yes No <input type="radio"/> N/A |

Comments (attach additional sheets as necessary):

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## **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: March 14, 2017

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CH2M Hill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 417825

| Parmname                   | NOM     | Sample | Qual | QC  | Units | RPD% | REC% | Range      | Anlst | Date     | Time  |
|----------------------------|---------|--------|------|-----|-------|------|------|------------|-------|----------|-------|
| <b>Semi-Volatile-GC/MS</b> |         |        |      |     |       |      |      |            |       |          |       |
| Batch                      | 1646345 |        |      |     |       |      |      |            |       |          |       |
| QC1203744745               | LCS     |        |      |     |       |      |      |            |       |          |       |
| Acenaphthene               | 333     |        |      | 266 | ug/kg |      | 80   | (70%-130%) | AGS1  | 03/13/17 | 18:22 |
| Acenaphthylene             | 333     |        |      | 271 | ug/kg |      | 81   | (70%-130%) |       |          |       |
| Anthracene                 | 333     |        |      | 272 | ug/kg |      | 82   | (70%-130%) |       |          |       |
| Benzo(a)anthracene         | 333     |        |      | 267 | ug/kg |      | 80   | (70%-130%) |       |          |       |
| Benzo(a)pyrene             | 333     |        |      | 302 | ug/kg |      | 91   | (70%-130%) |       |          |       |
| Benzo(b)fluoranthene       | 333     |        |      | 295 | ug/kg |      | 89   | (70%-130%) |       |          |       |
| Benzo(ghi)perylene         | 333     |        |      | 311 | ug/kg |      | 93   | (70%-130%) |       |          |       |
| Benzo(k)fluoranthene       | 333     |        |      | 277 | ug/kg |      | 83   | (70%-130%) |       |          |       |
| Chrysene                   | 333     |        |      | 246 | ug/kg |      | 74   | (70%-130%) |       |          |       |
| Dibenzo(a,h)anthracene     | 333     |        |      | 351 | ug/kg |      | 105  | (70%-130%) |       |          |       |
| Fluoranthene               | 333     |        |      | 276 | ug/kg |      | 83   | (70%-130%) |       |          |       |
| Fluorene                   | 333     |        |      | 288 | ug/kg |      | 86   | (70%-130%) |       |          |       |
| Indeno(1,2,3-cd)pyrene     | 333     |        |      | 366 | ug/kg |      | 110  | (70%-130%) |       |          |       |

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**QC Summary**

Workorder: 417825

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| <b>Parmname</b>            | <b>NOM</b> | <b>Sample</b> | <b>Qual</b> | <b>QC</b> | <b>Units</b> | <b>RPD%</b> | <b>REC%</b> | <b>Range</b> | <b>Anlst</b> | <b>Date</b> | <b>Time</b> |
|----------------------------|------------|---------------|-------------|-----------|--------------|-------------|-------------|--------------|--------------|-------------|-------------|
| <b>Semi-Volatile-GC/MS</b> |            |               |             |           |              |             |             |              |              |             |             |
| Batch                      | 1646345    |               |             |           |              |             |             |              |              |             |             |
| Naphthalene                | 333        |               |             | 248       | ug/kg        |             | 74          | (70%-130%)   | AGS1         | 03/13/17    | 18:22       |
| Phenanthrene               | 333        |               |             | 243       | ug/kg        |             | 73          | (70%-130%)   |              |             |             |
| Pyrene                     | 333        |               |             | 236       | ug/kg        |             | 71          | (70%-130%)   |              |             |             |
| **5-alpha-Androstane       | 167        |               |             | 156       | ug/kg        |             | 94          | (25%-129%)   |              |             |             |
| QC1203744744               | MB         |               |             |           |              |             |             |              |              |             |             |
| Acenaphthene               |            |               | U           | 1.67      | ug/kg        |             |             |              |              | 03/13/17    | 17:25       |
| 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: 417825

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| Parmname                   | NOM     | Sample | Qual | QC   | Units | RPD% | REC% | Range      | Anlst | Date     | Time  |
|----------------------------|---------|--------|------|------|-------|------|------|------------|-------|----------|-------|
| <b>Semi-Volatile-GC/MS</b> |         |        |      |      |       |      |      |            |       |          |       |
| Batch                      | 1646345 |        |      |      |       |      |      |            |       |          |       |
| Fluorene                   |         |        | U    | 1.67 | ug/kg |      |      |            | AGS1  | 03/13/17 | 17:25 |
| 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     |        |      | 168  | ug/kg |      | 101  | (25%-129%) |       |          |       |
| QC1203744746 417825005 MS  |         |        |      |      |       |      |      |            |       |          |       |
| Acenaphthene               | 360     | U      | 1.80 | 266  | ug/kg |      | 74   | (18%-115%) |       | 03/13/17 | 19:20 |
| Acenaphthylene             | 360     | U      | 1.80 | 275  | ug/kg |      | 76   | (19%-116%) |       |          |       |
| Anthracene                 | 360     |        | 7.91 | 295  | ug/kg |      | 80   | (23%-115%) |       |          |       |
| Benzo(a)anthracene         | 360     |        | 16.5 | 312  | ug/kg |      | 82   | (23%-124%) |       |          |       |
| Benzo(a)pyrene             | 360     |        | 20.1 | 344  | ug/kg |      | 90   | (20%-130%) |       |          |       |
| Benzo(b)fluoranthene       | 360     |        | 71.9 | 407  | ug/kg |      | 93   | (20%-134%) |       |          |       |
| Benzo(ghi)perylene         | 360     |        | 27.0 | 251  | ug/kg |      | 62   | (18%-118%) |       |          |       |
| Benzo(k)fluoranthene       | 360     |        | 19.1 | 330  | ug/kg |      | 86   | (23%-128%) |       |          |       |
| Chrysene                   | 360     |        | 22.7 | 297  | ug/kg |      | 76   | (18%-121%) |       |          |       |

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**QC Summary**

Workorder: 417825

Page 4 of 6

| Parmname                   | NOM     | Sample | Qual | QC  | Units | RPD% | REC% | Range      | Anlst | Date     | Time  |
|----------------------------|---------|--------|------|-----|-------|------|------|------------|-------|----------|-------|
| <b>Semi-Volatile-GC/MS</b> |         |        |      |     |       |      |      |            |       |          |       |
| Batch                      | 1646345 |        |      |     |       |      |      |            |       |          |       |
| Dibenzo(a,h)anthracene     | 360     | 5.40   |      | 304 | ug/kg |      | 83   | (12%-132%) | AGS1  | 03/13/17 | 19:20 |
| Fluoranthene               | 360     | 40.3   |      | 329 | ug/kg |      | 80   | (21%-124%) |       |          |       |
| Fluorene                   | 360     | U      | 1.80 | 291 | ug/kg |      | 81   | (21%-118%) |       |          |       |
| Indeno(1,2,3-cd)pyrene     | 360     | 30.6   |      | 324 | ug/kg |      | 82   | (11%-130%) |       |          |       |
| Naphthalene                | 360     | J      | 1.08 | 283 | ug/kg |      | 78   | (14%-114%) |       |          |       |
| Phenanthrene               | 360     | 10.4   |      | 266 | ug/kg |      | 71   | (24%-106%) |       |          |       |
| Pyrene                     | 360     | 29.9   |      | 314 | ug/kg |      | 79   | (16%-122%) |       |          |       |
| **5-alpha-Androstane       | 180     | 123    |      | 140 | ug/kg |      | 78   | (25%-129%) |       |          |       |
| QC1203744747 417825005 MSD |         |        |      |     |       |      |      |            |       |          |       |
| Acenaphthene               | 360     | U      | 1.80 | 234 | ug/kg | 13   | 65   | (0%-30%)   |       | 03/13/17 | 19:49 |
| Acenaphthylene             | 360     | U      | 1.80 | 243 | ug/kg | 13   | 67   | (0%-30%)   |       |          |       |
| Anthracene                 | 360     | 7.91   |      | 274 | ug/kg | 7    | 74   | (0%-30%)   |       |          |       |
| Benzo(a)anthracene         | 360     | 16.5   |      | 296 | ug/kg | 5    | 78   | (0%-30%)   |       |          |       |
| Benzo(a)pyrene             | 360     | 20.1   |      | 326 | ug/kg | 5    | 85   | (0%-30%)   |       |          |       |
| Benzo(b)fluoranthene       | 360     | 71.9   |      | 400 | ug/kg | 2    | 91   | (0%-30%)   |       |          |       |
| Benzo(ghi)perylene         | 360     | 27.0   |      | 225 | ug/kg | 11   | 55   | (0%-30%)   |       |          |       |

## QC Summary

Workorder: 417825

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| Parmname                   | NOM     | Sample | Qual | QC  | Units | RPD% | REC% | Range      | Anlst | Date     | Time  |
|----------------------------|---------|--------|------|-----|-------|------|------|------------|-------|----------|-------|
| <b>Semi-Volatile-GC/MS</b> |         |        |      |     |       |      |      |            |       |          |       |
| Batch                      | 1646345 |        |      |     |       |      |      |            |       |          |       |
| Benzo(k)fluoranthene       | 360     | 19.1   |      | 318 | ug/kg | 4    | 83   | (0%-30%)   | AGS1  | 03/13/17 | 19:49 |
| Chrysene                   | 360     | 22.7   |      | 283 | ug/kg | 5    | 72   | (0%-30%)   |       |          |       |
| Dibenzo(a,h)anthracene     | 360     | 5.40   |      | 278 | ug/kg | 9    | 76   | (0%-30%)   |       |          |       |
| Fluoranthene               | 360     | 40.3   |      | 307 | ug/kg | 7    | 74   | (0%-30%)   |       |          |       |
| Fluorene                   | 360     | U      | 1.80 | 260 | ug/kg | 11   | 72   | (0%-30%)   |       |          |       |
| Indeno(1,2,3-cd)pyrene     | 360     | 30.6   |      | 296 | ug/kg | 9    | 74   | (0%-30%)   |       |          |       |
| Naphthalene                | 360     | J      | 1.08 | 219 | ug/kg | 26   | 61   | (0%-30%)   |       |          |       |
| Phenanthrene               | 360     | 10.4   |      | 245 | ug/kg | 8    | 65   | (0%-30%)   |       |          |       |
| Pyrene                     | 360     | 29.9   |      | 297 | ug/kg | 5    | 74   | (0%-30%)   |       |          |       |
| **5-alpha-Androstane       | 180     | 123    |      | 121 | ug/kg |      | 67   | (25%-129%) |       |          |       |

**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.

**GEL LABORATORIES LLC**

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

**QC Summary**

Workorder: 417825

| 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.

## Surrogate Recovery Report

SDG Number: GEL417825

Matrix Type: SOLID

| Sample ID  | Client ID             | 5-alpha<br>%REC |
|------------|-----------------------|-----------------|
| 1203744744 | MB for batch 1646344  | 101             |
| 1203744745 | LCS for batch 1646344 | 94              |
| 417825005  | B394H5                | 69              |
| 1203744746 | B394H5MS              | 78              |
| 1203744747 | B394H5MSD             | 67              |
| 417825001  | B394H1                | 75              |
| 417825002  | B394H2                | 80              |
| 417825003  | B394H3                | 69              |
| 417825004  | B394H4                | 73              |
| 417825006  | B394H6                | 72              |
| 417825007  | B394H7                | 57              |
| 417825008  | B394H8                | 71              |
| 417825009  | B394H9                | 68              |
| 417825010  | B394J0                | 56              |
| 417825011  | B394J1                | 70              |
| 417825012  | B394J2                | 75              |
| 417825013  | B394J3                | 76              |
| 417825014  | B394J4                | 44              |

**Surrogate**

5-alpha- = 5-alpha-Androstane

**Acceptance Limits**

(25%-129%)

\* Recovery outside Acceptance Limits

# Column to be used to flag recovery values

D Sample Diluted

**QC Summary**

Report Date: March 17, 2017

Page 1 of 2

**CH2M Hill Plateau Remediation Company**  
**MSIN R3-50 CHPRC**  
**PO Box 1600**  
**Richland, Washington**

**Contact: Mr. Scot Fitzgerald**

**Workorder: 417825**

| Parmname                     | NOM       | Sample | Qual | QC    | Units | RPD% | REC% | Range      | Anlst | Date     | Time  |
|------------------------------|-----------|--------|------|-------|-------|------|------|------------|-------|----------|-------|
| <b>Diesel Range Organics</b> |           |        |      |       |       |      |      |            |       |          |       |
| Batch                        | 1646468   |        |      |       |       |      |      |            |       |          |       |
| QC1203745025                 | LCS       |        |      |       |       |      |      |            |       |          |       |
| Diesel Range Organics        | 66600     |        |      | 45500 | UG/KG |      | 68*  | (70%-130%) | LXA1  | 03/16/17 | 01:04 |
| **o-Terphenyl                | 666       |        |      | 448   | UG/KG |      | 67   | (60%-140%) |       |          |       |
| QC1203745024                 | MB        |        |      |       |       |      |      |            |       |          |       |
| Diesel Range Organics        |           |        | U    | 2160  | UG/KG |      |      |            |       | 03/16/17 | 00:25 |
| **o-Terphenyl                | 666       |        |      | 447   | UG/KG |      | 67   | (60%-140%) |       |          |       |
| QC1203745026                 | 417825001 | MS     |      |       |       |      |      |            |       |          |       |
| Diesel Range Organics        | 71000     | J      | 2730 | 52900 | UG/KG |      | 71   | (70%-130%) |       | 03/16/17 | 08:14 |
| **o-Terphenyl                | 710       |        | 589  | 525   | UG/KG |      | 74   | (60%-140%) |       |          |       |
| QC1203745027                 | 417825001 | MSD    |      |       |       |      |      |            |       |          |       |
| Diesel Range Organics        | 71000     | J      | 2730 | 56100 | UG/KG | 6    | 75   | (0%-30%)   |       | 03/16/17 | 08:53 |
| **o-Terphenyl                | 710       |        | 589  | 528   | UG/KG |      | 74   | (60%-140%) |       |          |       |

**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.

**GEL LABORATORIES LLC**

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

**QC Summary**

Workorder: 417825

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| Parmname | NOM                                                                                                                              | Sample | Qual | QC | Units | RPD% | REC% | Range | Anlst | Date | Time |
|----------|----------------------------------------------------------------------------------------------------------------------------------|--------|------|----|-------|------|------|-------|-------|------|------|
| 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.

FID Diesel Range Organics  
 Surrogate Recovery Report

SDG Number: GEL417825

Matrix Type: SOLID

| Sample ID  | Client ID             | OTP<br>%REC |
|------------|-----------------------|-------------|
| 1203745024 | MB for batch 1646467  | 67          |
| 1203745025 | LCS for batch 1646467 | 67          |
| 417825001  | B394H1                | 83          |
| 1203745026 | B394H1MS              | 74          |
| 1203745027 | B394H1MSD             | 74          |
| 417825002  | B394H2                | 65          |
| 417825003  | B394H3                | 80          |
| 417825004  | B394H4                | 83          |
| 417825005  | B394H5                | 68          |
| 417825006  | B394H6                | 71          |
| 417825007  | B394H7                | 66          |
| 417825008  | B394H8                | 74          |
| 417825009  | B394H9                | 86          |
| 417825010  | B394J0                | 87          |
| 417825011  | B394J1                | 78          |
| 417825012  | B394J2                | 76          |
| 417825013  | B394J3                | 92          |
| 417825014  | B394J4                | 75          |

**Surrogate**

OTP = o-Terphenyl

**Acceptance Limits**

(60%-140%)

\* Recovery outside Acceptance Limits

# Column to be used to flag recovery values

D Sample Diluted

Date: 21 March 2017  
 To: CH2M Hill (technical representative)  
 From: Analytical Quality Associates, Inc.  
 Project: 100-K AB  
 Subject: PCBs - Sample Data Group (SDG) GEL417825

## **INTRODUCTION**

This memorandum presents the results of data validation for SDG GEL417825 prepared by GEL Laboratories LLC. A list of samples validated along with the analytical methods is provided in the following table.

| <b>Sample ID</b> | <b>Sample Date</b> | <b>Media</b> | <b>Validation Level</b> | <b>Analytical Method</b> |
|------------------|--------------------|--------------|-------------------------|--------------------------|
| B394H1           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394H2           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394H3           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394H4           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394H5           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394H6           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394H7           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394H8           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394H9           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394J0           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394J1           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394J2           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394J3           | 3/02/17            | Soil         | C                       | 8082 PCB                 |
| B394J4           | 3/02/17            | Soil         | C                       | 8082 PCB                 |

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 PCBs are extraction within one year of sample collection and analysis within one year 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**

The equipment blank results were acceptable.

- **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 and the matrix spike sample accuracy limits are 50% to 150%.

**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, 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  $\pm 30\%$ . When duplicate RPDs exceed the limits and have associated results  $< 5X$  the SAP required detection limits with differences  $< 2X$  the required detection limits no precision infraction occurred.

### **MS/MSD Samples**

All MS/MSD RPD values were acceptable.

### **Field Duplicate Samples**

All field duplicate results were acceptable.

### **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 GEL417825 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**

| <b>PCB Data Qualification Summary</b> |                  |                         |               |
|---------------------------------------|------------------|-------------------------|---------------|
| SDG: GEL417825                        | Reviewer: AQA    | Project: 100-K AB       | Page 1 of 1   |
| <b>Analyte(s)</b>                     | <b>Qualifier</b> | <b>Samples Affected</b> | <b>Reason</b> |
| PCBs                                  | 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 AB                                                                                                         |                    |               | DATA PACKAGE: VSR17-004            |               |   |
| VALIDATOR: Eyda Hergenreder                                                                                               |                    | LAB: GEL      |                                    | DATE: 3/21/17 |   |
|                                                                                                                           |                    |               | SDG: GEL417825                     |               |   |
| ANALYSES PERFORMED                                                                                                        |                    |               |                                    |               |   |
| SW-846 8081                                                                                                               | SW-846 8081 (TCLP) | SW-846 8082 X | SW-846 8082 (TCLP)                 |               |   |
| SAMPLES/MATRIX Soil                                                                                                       |                    |               |                                    |               |   |
| GEL417825: B394H1, B394H2, B394H3, B394H4, B394H5, B394H6, B394H7, B394H8, B394H9, B394J0, B394J1, B394J2, B394J3, B394J4 |                    |               |                                    |               |   |
|                                                                                                                           |                    |               |                                    |               |   |
|                                                                                                                           |                    |               |                                    |               |   |

**1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE**

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

Comments:

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## 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:

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

Comments:

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

Comments:

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## 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 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?                       | <input checked="" type="radio"/> Yes No 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:

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#### 6. SYSTEM PERFORMANCE (Levels D and E)

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

Comments:

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## 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:

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#### 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 |
| 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:

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**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):

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## **Appendix 4**

### **Additional Documentation Requested By Client**

**PCB**  
**Surrogate Recovery Report**

SDG Number: GEL417825

Matrix Type: SOLID

| Sample ID  | Client ID             | 4CMX 1<br>%REC # | 4CMX 2<br>%REC # | DCB 1<br>%REC # | DCB 2<br>%REC # |
|------------|-----------------------|------------------|------------------|-----------------|-----------------|
| 1203746089 | MB for batch 1646879  | 62               | 69               | 58              | 58              |
| 1203746090 | LCS for batch 1646879 | 66               | 74               | 57              | 61              |
| 417825001  | B394H1                | 66               | 75               | 64              | 66              |
| 417825002  | B394H2                | 57               | 65               | 55              | 57              |
| 417825003  | B394H3                | 65               | 74               | 59              | 63              |
| 1203746091 | B394H3MS              | 59               | 67               | 60              | 61              |
| 1203746092 | B394H3MSD             | 57               | 65               | 61              | 58              |
| 417825004  | B394H4                | 52               | 59               | 58              | 56              |
| 417825005  | B394H5                | 53               | 59               | 61              | 58              |
| 417825006  | B394H6                | 47               | 53               | 48              | 48              |
| 417825007  | B394H7                | 50               | 56               | 58              | 54              |
| 417825008  | B394H8                | 53               | 60               | 59              | 54              |
| 417825009  | B394H9                | 53               | 60               | 61              | 54              |
| 417825010  | B394J0                | 59               | 66               | 65              | 53              |
| 417825011  | B394J1                | 51               | 58               | 63              | 50              |
| 417825012  | B394J2                | 48               | 55               | 66              | 53              |
| 417825013  | B394J3                | 53               | 60               | 64              | 53              |
| 417825014  | B394J4                | 50               | 57               | 57              | 53              |

**Surrogate**

4CMX = 4cmx

DCB = Decachlorobiphenyl

**Acceptance Limits**

(30%-120%)

(32%-139%)

\* Recovery outside Acceptance Limits

# Column to be used to flag recovery values

D Sample Diluted

**GEL LABORATORIES LLC**

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

**QC Summary**

Report Date: March 16, 2017

Page 1 of 3

CH2M Hill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 417825

| Parmname                  | NOM     | Sample | Qual | QC   | Units | RPD% | REC% | Range      | Anlst | Date     | Time  |
|---------------------------|---------|--------|------|------|-------|------|------|------------|-------|----------|-------|
| <b>Semi-Volatiles-PCB</b> |         |        |      |      |       |      |      |            |       |          |       |
| Batch                     | 1646880 |        |      |      |       |      |      |            |       |          |       |
| QC1203746090              | LCS     |        |      |      |       |      |      |            |       |          |       |
| Aroclor-1016              | 33.3    |        |      | 23.9 | ug/kg |      | 72   | (70%-130%) | YS1   | 03/15/17 | 14:49 |
| Aroclor-1260              | 33.3    |        |      | 25.9 | ug/kg |      | 78   | (70%-130%) |       |          |       |
| **4cmx                    | 6.66    |        |      | 4.42 | ug/kg |      | 66   | (30%-120%) |       |          |       |
| **Decachlorobiphenyl      | 6.66    |        |      | 3.79 | ug/kg |      | 57   | (32%-139%) |       |          |       |
| QC1203746089              | MB      |        |      |      |       |      |      |            |       |          |       |
| Aroclor-1016              |         |        | U    | 1.11 | ug/kg |      |      |            |       | 03/15/17 | 14:37 |
| Aroclor-1221              |         |        | U    | 1.11 | ug/kg |      |      |            |       |          |       |
| Aroclor-1232              |         |        | U    | 1.11 | ug/kg |      |      |            |       |          |       |
| Aroclor-1242              |         |        | U    | 1.11 | ug/kg |      |      |            |       |          |       |
| Aroclor-1248              |         |        | U    | 1.11 | ug/kg |      |      |            |       |          |       |
| Aroclor-1254              |         |        | U    | 1.11 | ug/kg |      |      |            |       |          |       |
| Aroclor-1260              |         |        | U    | 1.11 | ug/kg |      |      |            |       |          |       |
| **4cmx                    | 6.67    |        |      | 4.12 | ug/kg |      | 62   | (30%-120%) |       |          |       |
| **Decachlorobiphenyl      | 6.67    |        |      | 3.85 | ug/kg |      | 58   | (32%-139%) |       |          |       |

Date: 21 March 2017  
 To: CH2M Hill (technical representative)  
 From: Analytical Quality Associates, Inc.  
 Project: 100-K AB  
 Subject: Inorganics - Sample Data Groups (SDG) GEL417825

## **INTRODUCTION**

This memorandum presents the results of data validation for SDG GEL417825 prepared by GEL Laboratories LLC. A list of samples validated along with the analytical methods is provided in the following table.

| <b>Sample ID</b> | <b>Sample Date</b> | <b>Media</b> | <b>Validation Level</b> | <b>Analytical Methods</b> |
|------------------|--------------------|--------------|-------------------------|---------------------------|
| B394H1           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394H2           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394H3           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394H4           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394H5           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394H6           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394H7           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394H8           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394H9           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394J0           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394J1           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394J2           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394J3           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |
| B394J4           | 03/02/17           | Soil         | C                       | 6010D & 7471B             |

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 is 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 ICP metals requires chilling to <6 degrees Celsius and no specific preservation is required for mercury analysis.

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 exceptions.

The Se and Hg laboratory blank results were detects > MDLs but < the PQLs. The Se results for samples B394H1 and B394J0 were detects > the MDL but ≤ the PQL and should be qualified as estimates and flagged “J+.” The Hg result for samples B394H3, B394H4, B394H5, B394H6, B394H7, B394H8, B394H9, B394J0, B394J2, B394J3, and B394J4 were detects > the MDL and ≤20X the blank value; therefore should be qualified as estimates and would be flagged J+, but were further flagged “J” due to other QC infractions.

**Trip Blanks**

No trip blanks were submitted for validation.

**Field Blanks**

No field blanks were submitted for validation.

**Equipment Blanks**

All equipment blank results were acceptable with the following exceptions. Sb, Ba, Cr, Mn, Hg, Se, V and Zn were detected in equipment blank sample B394J0. The Se sample result was flagged “J+” due to laboratory blank contamination and the Hg result was flagged “J” due to other QC infractions.

- **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.

## QC Summary

Workorder: 417825

Page 2 of 3

| Parmname                  | NOM       | Sample | Qual | QC   | Units | RPD% | REC% | Range      | Anlst | Date     | Time  |
|---------------------------|-----------|--------|------|------|-------|------|------|------------|-------|----------|-------|
| <b>Semi-Volatiles-PCB</b> |           |        |      |      |       |      |      |            |       |          |       |
| Batch                     | 1646880   |        |      |      |       |      |      |            |       |          |       |
| QC1203746091              | 417825003 | MS     |      |      |       |      |      |            |       |          |       |
| Aroclor-1016              | 35.3      | U      | 1.18 | 23.8 | ug/kg |      | 67   | (23%-121%) | YS1   | 03/15/17 | 15:48 |
| Aroclor-1260              | 35.3      | U      | 1.18 | 27.6 | ug/kg |      | 78   | (35%-135%) |       |          |       |
| **4cmx                    | 7.06      |        | 4.59 | 4.14 | ug/kg |      | 59   | (30%-120%) |       |          |       |
| **Decachlorobiphenyl      | 7.06      |        | 4.19 | 4.25 | ug/kg |      | 60   | (32%-139%) |       |          |       |
| QC1203746092              | 417825003 | MSD    |      |      |       |      |      |            |       |          |       |
| Aroclor-1016              | 35.2      | U      | 1.18 | 23.5 | ug/kg | 2    | 67   | (0%-30%)   |       | 03/15/17 | 16:04 |
| Aroclor-1260              | 35.2      | U      | 1.18 | 27.2 | ug/kg | 1    | 77   | (0%-30%)   |       |          |       |
| **4cmx                    | 7.04      |        | 4.59 | 4.00 | ug/kg |      | 57   | (30%-120%) |       |          |       |
| **Decachlorobiphenyl      | 7.04      |        | 4.19 | 4.31 | ug/kg |      | 61   | (32%-139%) |       |          |       |

**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

### **Matrix Spike (MS) Samples**

All MS recoveries were acceptable with the following exceptions.

The MS recovery for Hg was  $<$  the lower acceptance limit but  $\geq 10\%$ . All sample results were detects and should be qualified as estimates and would be flagged J-, but were further flagged "J" due to other QC infractions. See the table in Appendix 2 for a listing of all affected sample results.

### **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. When duplicate RPDs exceed the limits and have associated results  $< 5X$  the SAP required detection limits (or  $< 5X$  the laboratory reporting limits for analytes not listed in the SAP) with differences  $< 2X$  the required detection limits, no precision infraction occurred. The serial dilution limits are ones specified by the DV procedure.

### **Laboratory Duplicate Samples**

All laboratory duplicate results were acceptable with the following exception.

The laboratory duplicate RPDs for B and Hg were above the acceptance limit. The B result for sample B394J0 was non-detect and should be qualified as estimate and flagged "UJ." All other B sample results and all Hg sample results were detects and should be qualified as estimates and flagged "J" due to poor precision. See the table in Appendix 2 for a listing of all affected sample results.

### **Field Duplicate Samples**

All field duplicate results were acceptable.

### **Field Split Samples**

No field splits were submitted for validation.

### **ICP Serial Dilution Samples**

ICP 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 existence 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 were below the CRDLs.

- **Completeness**

SDG GEL417825 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 a laboratory blank infraction, low matrix spike recovery, and poor duplicate precision. 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**

| <b>Inorganic Data Qualification Summary</b> |                  |                                                                                                        |                                                                                        |
|---------------------------------------------|------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| SDG: GEL417825                              | Reviewer: AQA    | Project: 100-K AB                                                                                      | Page 1 of 1                                                                            |
| <b>Analyte(s)</b>                           | <b>Qualifier</b> | <b>Samples Affected</b>                                                                                | <b>Reason</b>                                                                          |
| Se                                          | J+               | B394H1, B394J0                                                                                         | Laboratory blank contamination                                                         |
| Hg                                          | J                | B394H3, B394H4, B394H5, B394H6, B394H7, B394H8, B394H9, B394J0, B394J2, B394J3, B394J4                 | Laboratory blank contamination, low matrix spike recovery and poor duplicate precision |
| Hg                                          | J                | B394H1, B394H2, B394J1,                                                                                | Low matrix spike recovery and poor duplicate precision                                 |
| B                                           | UJ               | B394J0                                                                                                 | Poor duplicate precision                                                               |
| B                                           | J                | B394H1, B394H2, B394H3, B394H4, B394H5, B394H6, B394H7, B394H8, B394H9, B394J1, B394J2, B394J3, B394J4 | Poor duplicate 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 - (Cont.) Chemical Data Validation Checklist**

|                                                                                                                           |             |                |                                    |               |   |
|---------------------------------------------------------------------------------------------------------------------------|-------------|----------------|------------------------------------|---------------|---|
| VALIDATION LEVEL:                                                                                                         | A           | B              | <input checked="" type="radio"/> C | D             | E |
| PROJECT: 100-K AB                                                                                                         |             |                | DATA PACKAGE: VSR17-004            |               |   |
| VALIDATOR: Eyda Hergenreder                                                                                               |             | LAB: GEL       |                                    | DATE: 3/21/17 |   |
|                                                                                                                           |             |                | SDG: GEL417825                     |               |   |
| ANALYSES PERFORMED                                                                                                        |             |                |                                    |               |   |
| SW-846/ICP<br>X                                                                                                           | SW-846/GFAA | SW-846/Hg<br>X | SW-846<br>Cyanide                  |               |   |
|                                                                                                                           |             |                |                                    |               |   |
| SAMPLES/MATRIX Soil                                                                                                       |             |                |                                    |               |   |
| GEL417825: B394H1, B394H2, B394H3, B394H4, B394H5, B394H6, B394H7, B394H8, B394H9, B394J0, B394J1, B394J2, B394J3, B394J4 |             |                |                                    |               |   |
|                                                                                                                           |             |                |                                    |               |   |
|                                                                                                                           |             |                |                                    |               |   |
|                                                                                                                           |             |                |                                    |               |   |

**1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE**

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

Comments:

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## 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:

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

Comments:

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MB: Se 767 ug/kg; Hg 4.42 ug/kg

Equipment blank sample B394J0: Sb 478 ug/kg; Ba 317 ug/kg; Cr 166 ug/kg, Mn 305 ug/kg; Hg 4.87 ug/kg  
Se 463 ug/kg; V 92.3 ug/kg, Zn 747 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

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:

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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:

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## **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: March 17, 2017

Page 1 of 8

CH2M Hill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 417825

| Parmname                   | NOM       | Sample | Qual | QC     | Units | RPD/D% | REC% | Range     | Anlst | Date     | Time  |
|----------------------------|-----------|--------|------|--------|-------|--------|------|-----------|-------|----------|-------|
| <b>Metals Analysis-ICP</b> |           |        |      |        |       |        |      |           |       |          |       |
| Batch                      | 1644693   |        |      |        |       |        |      |           |       |          |       |
| QC1203740783               | 417825001 | DUP    |      |        |       |        |      |           |       |          |       |
| Antimony                   | BD        | 4450   | BD   | 3070   | ug/kg | 36.7   | ^    | (+/-5080) | HSC   | 03/16/17 | 07:50 |
| Arsenic                    | B         | 1880   | B    | 1670   | ug/kg | 12.1   | ^    | (+/-3050) |       | 03/15/17 | 09:46 |
| Barium                     |           | 65000  |      | 63000  | ug/kg | 3.14   |      | (0%-20%)  |       |          |       |
| Beryllium                  |           | 935    |      | 881    | ug/kg | 5.98   | ^    | (+/-508)  |       |          |       |
| Boron                      |           | 5410   | B    | 2710   | ug/kg | 66.4   | ^    | (+/-5080) |       |          |       |
| Cadmium                    | BD        | 560    | BD   | 562    | ug/kg | 0.46   | ^    | (+/-2540) |       | 03/16/17 | 07:50 |
| Chromium                   |           | 8900   |      | 8460   | ug/kg | 4.98   |      | (0%-20%)  |       | 03/15/17 | 09:46 |
| Cobalt                     | D         | 9780   | D    | 9090   | ug/kg | 7.28   | ^    | (+/-2540) |       | 03/16/17 | 07:50 |
| Copper                     |           | 17000  |      | 16600  | ug/kg | 2.6    |      | (0%-20%)  |       | 03/15/17 | 09:46 |
| Lead                       |           | 5510   |      | 5510   | ug/kg | 0.0699 |      | (0%-20%)  |       |          |       |
| Manganese                  |           | 356000 |      | 370000 | ug/kg | 3.95   |      | (0%-20%)  |       |          |       |
| Molybdenum                 |           | 1350   |      | 1030   | ug/kg | 26.8   | ^    | (+/-1020) |       |          |       |
| Nickel                     |           | 9080   |      | 9970   | ug/kg | 9.35   |      | (0%-20%)  |       |          |       |

**GEL LABORATORIES LLC**

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

**QC Summary**

Workorder: 417825

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| Parmname                   | NOM     | Sample | Qual | QC    | Units | RPD/D%  | REC% | Range      | Anlst | Date     | Time  |
|----------------------------|---------|--------|------|-------|-------|---------|------|------------|-------|----------|-------|
| <b>Metals Analysis-ICP</b> |         |        |      |       |       |         |      |            |       |          |       |
| Batch                      | 1644693 |        |      |       |       |         |      |            |       |          |       |
| Selenium                   | BC      | 549    | B    | -532  | ug/kg | 13100 ^ |      | (+/-3050)  | HSC   | 03/15/17 | 09:46 |
| Silver                     | U       | 106    | U    | 102   | ug/kg | N/A     |      |            |       |          |       |
| Vanadium                   | D       | 75700  | D    | 71500 | ug/kg | 5.73    |      | (0%-20%)   |       | 03/16/17 | 07:50 |
| Zinc                       |         | 45100  |      | 43900 | ug/kg | 2.65    |      | (0%-20%)   |       | 03/15/17 | 10:50 |
| QC1203740782               | LCS     |        |      |       |       |         |      |            |       |          |       |
| Antimony                   | 46100   |        |      | 45400 | ug/kg |         | 98.5 | (80%-120%) |       | 03/15/17 | 09:39 |
| Arsenic                    | 46100   |        |      | 46600 | ug/kg |         | 101  | (80%-120%) |       |          |       |
| Barium                     | 46100   |        |      | 45600 | ug/kg |         | 98.8 | (80%-120%) |       |          |       |
| Beryllium                  | 46100   |        |      | 46300 | ug/kg |         | 100  | (80%-120%) |       |          |       |
| Boron                      | 46100   |        |      | 47400 | ug/kg |         | 103  | (80%-120%) |       |          |       |
| Cadmium                    | 46100   |        |      | 46500 | ug/kg |         | 101  | (80%-120%) |       |          |       |
| Chromium                   | 46100   |        |      | 44600 | ug/kg |         | 96.7 | (80%-120%) |       |          |       |
| Cobalt                     | 46100   |        |      | 45200 | ug/kg |         | 98   | (80%-120%) |       |          |       |
| Copper                     | 46100   |        |      | 45200 | ug/kg |         | 98.1 | (80%-120%) |       |          |       |
| Lead                       | 46100   |        |      | 46000 | ug/kg |         | 99.7 | (80%-120%) |       |          |       |
| Manganese                  | 46100   |        |      | 45200 | ug/kg |         | 97.9 | (80%-120%) |       |          |       |

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**QC Summary**

Workorder: 417825

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| Parmname                   | NOM     | Sample | Qual | QC    | Units | RPD/D% | REC% | Range      | Anlst | Date     | Time  |
|----------------------------|---------|--------|------|-------|-------|--------|------|------------|-------|----------|-------|
| <b>Metals Analysis-ICP</b> |         |        |      |       |       |        |      |            |       |          |       |
| Batch                      | 1644693 |        |      |       |       |        |      |            |       |          |       |
| Molybdenum                 | 46100   |        |      | 44900 | ug/kg |        | 97.3 | (80%-120%) | HSC   | 03/15/17 | 09:39 |
| Nickel                     | 46100   |        |      | 45100 | ug/kg |        | 97.7 | (80%-120%) |       |          |       |
| Selenium                   | 46100   |        |      | 47000 | ug/kg |        | 102  | (80%-120%) |       |          |       |
| Silver                     | 46100   |        |      | 44900 | ug/kg |        | 97.4 | (80%-120%) |       |          |       |
| Vanadium                   | 46100   |        |      | 44900 | ug/kg |        | 97.4 | (80%-120%) |       |          |       |
| Zinc                       | 46100   |        |      | 43700 | ug/kg |        | 94.7 | (80%-120%) |       | 03/15/17 | 10:45 |
| QC1203740781               | MB      |        |      |       |       |        |      |            |       |          |       |
| Antimony                   |         |        | U    | 322   | ug/kg |        |      |            |       | 03/15/17 | 09:36 |
| Arsenic                    |         |        | U    | 487   | ug/kg |        |      |            |       |          |       |
| Barium                     |         |        | U    | 97.5  | ug/kg |        |      |            |       |          |       |
| Beryllium                  |         |        | U    | 97.5  | ug/kg |        |      |            |       |          |       |
| Boron                      |         |        | U    | 975   | ug/kg |        |      |            |       |          |       |
| Cadmium                    |         |        | U    | 97.5  | ug/kg |        |      |            |       |          |       |
| Chromium                   |         |        | U    | 146   | ug/kg |        |      |            |       |          |       |
| Cobalt                     |         |        | U    | 146   | ug/kg |        |      |            |       |          |       |
| Copper                     |         |        | U    | 292   | ug/kg |        |      |            |       |          |       |

**GEL LABORATORIES LLC**

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

**QC Summary**

Workorder: 417825

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| Parmname                   | NOM     | Sample | Qual  | QC   | Units  | RPD/D% | REC% | Range      | Anlst | Date     | Time  |
|----------------------------|---------|--------|-------|------|--------|--------|------|------------|-------|----------|-------|
| <b>Metals Analysis-ICP</b> |         |        |       |      |        |        |      |            |       |          |       |
| Batch                      | 1644693 |        |       |      |        |        |      |            |       |          |       |
| Lead                       |         |        | U     | 322  | ug/kg  |        |      |            | HSC   | 03/15/17 | 09:36 |
| Manganese                  |         |        | U     | 195  | ug/kg  |        |      |            |       |          |       |
| Molybdenum                 |         |        | U     | 195  | ug/kg  |        |      |            |       |          |       |
| Nickel                     |         |        | U     | 146  | ug/kg  |        |      |            |       |          |       |
| Selenium                   |         |        | B     | 767  | ug/kg  |        |      |            |       |          |       |
| Silver                     |         |        | U     | 97.5 | ug/kg  |        |      |            |       |          |       |
| Vanadium                   |         |        | U     | 97.5 | ug/kg  |        |      |            |       |          |       |
| Zinc                       |         |        | U     | 390  | ug/kg  |        |      |            |       | 03/15/17 | 10:41 |
| QC1203740784 417825001 MS  |         |        |       |      |        |        |      |            |       |          |       |
| Antimony                   | 50600   | BD     | 4450  | D    | 49300  | ug/kg  | 88.7 | (75%-125%) |       | 03/16/17 | 07:53 |
| Arsenic                    | 50600   | B      | 1880  |      | 48900  | ug/kg  | 93   | (75%-125%) |       | 03/15/17 | 09:49 |
| Barium                     | 50600   |        | 65000 |      | 110000 | ug/kg  | 89.1 | (75%-125%) |       |          |       |
| Beryllium                  | 50600   |        | 935   |      | 47400  | ug/kg  | 92   | (75%-125%) |       |          |       |
| Boron                      | 50600   |        | 5410  |      | 52700  | ug/kg  | 93.5 | (75%-125%) |       |          |       |
| Cadmium                    | 50600   | BD     | 560   | D    | 51600  | ug/kg  | 101  | (75%-125%) |       | 03/16/17 | 07:53 |
| Chromium                   | 50600   |        | 8900  |      | 54900  | ug/kg  | 91   | (75%-125%) |       | 03/15/17 | 09:49 |

**GEL LABORATORIES LLC**

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**QC Summary**

Workorder: 417825

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| Parmname                     | NOM     | Sample | Qual   | QC | Units  | RPD/D% | REC% | Range      | Anlst | Date     | Time  |
|------------------------------|---------|--------|--------|----|--------|--------|------|------------|-------|----------|-------|
| <b>Metals Analysis-ICP</b>   |         |        |        |    |        |        |      |            |       |          |       |
| Batch                        | 1644693 |        |        |    |        |        |      |            |       |          |       |
| Cobalt                       | 50600   | D      | 9780   | D  | 59500  | ug/kg  | 98.3 | (75%-125%) | HSC   | 03/16/17 | 07:53 |
| Copper                       | 50600   |        | 17000  |    | 65800  | ug/kg  | 96.5 | (75%-125%) |       | 03/15/17 | 09:49 |
| Lead                         | 50600   |        | 5510   |    | 51700  | ug/kg  | 91.4 | (75%-125%) |       |          |       |
| Manganese                    | 50600   |        | 356000 |    | 396000 | ug/kg  | N/A  | (75%-125%) |       |          |       |
| Molybdenum                   | 50600   |        | 1350   |    | 46500  | ug/kg  | 89.3 | (75%-125%) |       |          |       |
| Nickel                       | 50600   |        | 9080   |    | 53000  | ug/kg  | 86.9 | (75%-125%) |       |          |       |
| Selenium                     | 50600   | BC     | 549    |    | 45700  | ug/kg  | 89.4 | (75%-125%) |       |          |       |
| Silver                       | 50600   | U      | 106    |    | 46800  | ug/kg  | 92.4 | (75%-125%) |       |          |       |
| Vanadium                     | 50600   | D      | 75700  | D  | 132000 | ug/kg  | 111  | (75%-125%) |       | 03/16/17 | 07:53 |
| Zinc                         | 50600   |        | 45100  |    | 89500  | ug/kg  | 87.7 | (75%-125%) |       | 03/15/17 | 10:52 |
| QC1203740785 417825001 SDILT |         |        |        |    |        |        |      |            |       |          |       |
| Antimony                     |         | BD     | 8.44   | BD | 7.17   | ug/L   | 325  | (0%-20%)   |       | 03/16/17 | 07:57 |
| Arsenic                      |         | B      | 17.9   | DU | 2640   | ug/L   | N/A  | (0%-20%)   |       | 03/15/17 | 09:52 |
| Barium                       |         |        | 616    | D  | 130    | ug/L   | 5.21 | (0%-20%)   |       |          |       |
| Beryllium                    |         |        | 8.86   | BD | 1.92   | ug/L   | 8.3  | (0%-20%)   |       |          |       |
| Boron                        |         |        | 51.3   | BD | 12.3   | ug/L   | 20.1 | (0%-20%)   |       |          |       |

## QC Summary

Workorder: 417825

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| Parmname                       | NOM           | Sample | Qual | QC   | Units | RPD/D% | REC% | Range      | Anlst | Date     | Time  |
|--------------------------------|---------------|--------|------|------|-------|--------|------|------------|-------|----------|-------|
| <b>Metals Analysis-ICP</b>     |               |        |      |      |       |        |      |            |       |          |       |
| Batch                          | 1644693       |        |      |      |       |        |      |            |       |          |       |
| Cadmium                        | BD            | 1.06   | DU   | 2640 | ug/L  | N/A    |      | (0%-20%)   | HSC   | 03/16/17 | 07:57 |
| Chromium                       |               | 84.3   | D    | 17.4 | ug/L  | 3.06   |      | (0%-20%)   |       | 03/15/17 | 09:52 |
| Cobalt                         | D             | 18.5   | BD   | 3.92 | ug/L  | 5.73   |      | (0%-20%)   |       | 03/16/17 | 07:57 |
| Copper                         |               | 161    | D    | 31.7 | ug/L  | 1.61   |      | (0%-20%)   |       | 03/15/17 | 09:52 |
| Lead                           |               | 52.2   | BD   | 8.20 | ug/L  | 21.4   |      | (0%-20%)   |       |          |       |
| Manganese                      |               | 3370   | D    | 727  | ug/L  | 7.8    |      | (0%-20%)   |       |          |       |
| Molybdenum                     |               | 12.8   | BD   | 3.10 | ug/L  | 21.5   |      | (0%-20%)   |       |          |       |
| Nickel                         |               | 86.1   | D    | 18.3 | ug/L  | 6.15   |      | (0%-20%)   |       |          |       |
| Selenium                       | BC            | 5.20   | DU   | 2640 | ug/L  | N/A    |      | (0%-20%)   |       |          |       |
| Silver                         | U             | 0.641  | DU   | 528  | ug/L  | N/A    |      | (0%-20%)   |       |          |       |
| Vanadium                       | D             | 143    | D    | 28.6 | ug/L  | .185   |      | (0%-20%)   |       | 03/16/17 | 07:57 |
| Zinc                           |               | 428    | D    | 96.1 | ug/L  | 12.3   |      | (0%-20%)   |       | 03/15/17 | 10:56 |
| <b>Metals Analysis-Mercury</b> |               |        |      |      |       |        |      |            |       |          |       |
| Batch                          | 1644774       |        |      |      |       |        |      |            |       |          |       |
| QC1203740965                   | 417825001 DUP |        |      |      |       |        |      |            |       |          |       |
| Mercury                        | *MN           | 145    | *    | 81.3 | ug/kg | 56.3*  |      | (0%-20%)   | AXS5  | 03/13/17 | 12:35 |
| QC1203740964                   | LCS           |        |      |      |       |        |      |            |       |          |       |
| Mercury                        | 111           |        |      | 116  | ug/kg |        | 104  | (80%-120%) |       | 03/13/17 | 12:31 |

## QC Summary

Workorder: 417825

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| Parmname                       | NOM       | Sample | Qual | QC   | Units | RPD/D% | REC%  | Range      | Anlst | Date     | Time  |
|--------------------------------|-----------|--------|------|------|-------|--------|-------|------------|-------|----------|-------|
| <b>Metals Analysis-Mercury</b> |           |        |      |      |       |        |       |            |       |          |       |
| Batch                          | 1644774   |        |      |      |       |        |       |            |       |          |       |
| QC1203740963                   | MB        |        |      |      |       |        |       |            |       |          |       |
| Mercury                        |           |        | B    | 4.42 | ug/kg |        |       |            | AXS5  | 03/13/17 | 12:30 |
| QC1203740966                   | 417825001 | MS     |      |      |       |        |       |            |       |          |       |
| Mercury                        | 124       | *MN    | 145  | N    | 216   | ug/kg  | 56.8* | (80%-120%) |       | 03/13/17 | 12:36 |
| QC1203745723                   | 417825001 | PS     |      |      |       |        |       |            |       |          |       |
| Mercury                        | 2.00      | *MN    | 2.43 |      | 4.33  | ug/L   | 95.2  | (80%-120%) |       | 03/13/17 | 12:40 |
| QC1203740967                   | 417825001 | SDILT  |      |      |       |        |       |            |       |          |       |
| Mercury                        |           | *MN    | 2.43 | DM   | 0.537 | ug/L   | 10.7* | (0%-10%)   |       | 03/13/17 | 12:38 |

**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 >= 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
- 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: 21 March 2017  
 To: CH2M Hill (technical representative)  
 From: Analytical Quality Associates, Inc.  
 Project: 100-K AB  
 Subject: General Chemistry - Sample Data Group (SDG) GEL417825

## **INTRODUCTION**

This memorandum presents the results of data validation for SDG GEL417825 prepared by GEL Laboratories LLC. A list of samples validated along with the analytical methods is provided in the following table.

| <b>Sample ID</b> | <b>Sample Date</b> | <b>Media</b> | <b>Validation Level</b> | <b>Analytical Methods</b> |
|------------------|--------------------|--------------|-------------------------|---------------------------|
| B394H1           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394H2           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394H3           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394H4           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394H5           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394H6           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394H7           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394H8           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394H9           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394J0           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394J1           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394J2           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394J3           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |
| B394J4           | 03/02/17           | Soil         | C                       | 9056A & 7196A             |

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:

- All anions – extraction within 28 days of sample collection and analysis within 48 hours of extraction

- Hexavalent chromium – analysis within 30 days of sample collection

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**

The equipment blank results were acceptable with the following exceptions. Chloride, nitrate-N and sulfate were detected in equipment blank sample B394J0.

- **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/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, 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. When duplicate RPDs exceed the limits and have associated results  $< 5X$  the reporting limits with difference  $< 2X$  the required detection limits no precision infraction occurred

**MS/MSD Samples**

The MS/MSD RPD value was acceptable.

**Laboratory Duplicate Samples**

All laboratory duplicate results were acceptable.

**Field Duplicate Samples**

All field duplicate results were acceptable.

**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 GEL417825 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**

| <b>General Chemistry Data Qualification Summary</b> |                  |                         |               |
|-----------------------------------------------------|------------------|-------------------------|---------------|
| SDG: GEL417825                                      | Reviewer: AQA    | Project: 100-K AB       | Page 1 of 1   |
| <b>Analyte(s)</b>                                   | <b>Qualifier</b> | <b>Samples Affected</b> | <b>Reason</b> |
| 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 AB                                                                                                         |         |          | DATA PACKAGE: VSR17-004            |                |                                  |
| VALIDATOR: Eyda Hergenreder                                                                                               |         | LAB: GEL |                                    | DATE: 3/21/17  |                                  |
|                                                                                                                           |         |          | SDG: GEL417825                     |                |                                  |
| ANALYSES PERFORMED                                                                                                        |         |          |                                    |                |                                  |
| Anions/IC<br>X                                                                                                            | TOC     | TOX      | TPH-418.1                          | Oil and Grease | Alkalinity                       |
| Ammonia                                                                                                                   | BOD/COD | Chloride | Chromium-VI<br>X                   | pH             | NO <sub>3</sub> /NO <sub>2</sub> |
| Sulfate                                                                                                                   | TDS     | TKN      | Phosphate                          |                |                                  |
|                                                                                                                           |         |          |                                    |                |                                  |
| SAMPLES/MATRIX Soil                                                                                                       |         |          |                                    |                |                                  |
| GEL417825: B394H1, B394H2, B394H3, B394H4, B394H5, B394H6, B394H7, B394H8, B394H9, B394J0, B394J1, B394J2, B394J3, B394J4 |         |          |                                    |                |                                  |
|                                                                                                                           |         |          |                                    |                |                                  |
|                                                                                                                           |         |          |                                    |                |                                  |
|                                                                                                                           |         |          |                                    |                |                                  |

**1. DATA PACKAGE COMPLETENESS AND CASE NARRATIVE**

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

Comments:

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## 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:

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

Comments:

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Equipment blank sample B394J0: Cl 2900 ug/Kg, NO3 373 ug/Kg, Sulfate 3240 ug/Kg

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## 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?                       | <input checked="" type="radio"/> Yes No 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:

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#### 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:

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## **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: March 16, 2017

Page 1 of 4

CH2M Hill Plateau Remediation Company

MSIN R3-50 CHPRC

PO Box 1600

Richland, Washington

Contact: Mr. Scot Fitzgerald

Workorder: 417825

| Parmname                  | NOM       | Sample | Qual | QC    | Units | RPD% | REC% | Range           | Anlst | Date     | Time  |
|---------------------------|-----------|--------|------|-------|-------|------|------|-----------------|-------|----------|-------|
| <b>Ion Chromatography</b> |           |        |      |       |       |      |      |                 |       |          |       |
| Batch                     | 1645114   |        |      |       |       |      |      |                 |       |          |       |
| QC1203741898              | 417825001 | DUP    |      |       |       |      |      |                 |       |          |       |
| Chloride                  | B         | 913    | B    | 840   | ug/Kg | 8.39 | ^    | (+/-2130)       | MAR1  | 03/15/17 | 03:10 |
| Fluoride                  | B         | 1040   | B    | 1030  | ug/Kg | 1.03 | ^    | (+/-1070)       |       |          |       |
| Nitrate-N                 | U         | 352    | U    | 352   | ug/Kg | N/A  |      |                 |       |          |       |
| Nitrite-N                 | U         | 352    | U    | 352   | ug/Kg | N/A  |      |                 |       |          |       |
| Sulfate                   | B         | 2890   | B    | 2280  | ug/Kg | 23.7 | ^    | (+/-4260)       |       |          |       |
| QC1203741899              | 417825014 | DUP    |      |       |       |      |      |                 |       |          |       |
| Chloride                  | B         | 2010   | B    | 1900  | ug/Kg | 6.03 | ^    | (+/-2140)       |       | 03/15/17 | 12:11 |
| Fluoride                  | B         | 844    | B    | 858   | ug/Kg | 1.75 | ^    | (+/-1070)       |       |          |       |
| Nitrate-N                 | B         | 668    | B    | 675   | ug/Kg | 1.04 | ^    | (+/-1070)       |       |          |       |
| Nitrite-N                 | U         | 351    | U    | 352   | ug/Kg | N/A  |      |                 |       |          |       |
| Sulfate                   | B         | 3560   | B    | 3030  | ug/Kg | 16.2 | ^    | (+/-4270)       |       |          |       |
| QC1203741897              | LCS       |        |      |       |       |      |      |                 |       |          |       |
| Chloride                  |           | 50000  |      | 47600 | ug/Kg |      |      | 95.3 (80%-120%) |       | 03/15/17 | 02:06 |
| Fluoride                  |           | 25000  |      | 25200 | ug/Kg |      |      | 101 (80%-120%)  |       |          |       |
| Nitrate-N                 |           | 25000  |      | 24400 | ug/Kg |      |      | 97.4 (80%-120%) |       |          |       |

**GEL LABORATORIES LLC**

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

**QC Summary**

Workorder: 417825

Page 2 of 4

| Parmname                  | NOM          | Sample | Qual | QC     | Units | RPD%  | REC% | Range      | Anlst | Date     | Time  |
|---------------------------|--------------|--------|------|--------|-------|-------|------|------------|-------|----------|-------|
| <b>Ion Chromatography</b> |              |        |      |        |       |       |      |            |       |          |       |
| Batch                     | 1645114      |        |      |        |       |       |      |            |       |          |       |
| Nitrite-N                 | 25000        |        |      | 24700  | ug/Kg |       | 98.7 | (80%-120%) | MAR1  | 03/15/17 | 02:06 |
| Sulfate                   | 100000       |        |      | 97900  | ug/Kg |       | 97.9 | (80%-120%) |       |          |       |
| QC1203741896              | MB           |        |      |        |       |       |      |            |       |          |       |
| Chloride                  |              |        | U    | 720    | ug/Kg |       |      |            |       | 03/15/17 | 01:34 |
| Fluoride                  |              |        | U    | 340    | ug/Kg |       |      |            |       |          |       |
| Nitrate-N                 |              |        | U    | 330    | ug/Kg |       |      |            |       |          |       |
| Nitrite-N                 |              |        | U    | 330    | ug/Kg |       |      |            |       |          |       |
| Sulfate                   |              |        | U    | 1330   | ug/Kg |       |      |            |       |          |       |
| QC1203741900              | 417825001 MS |        |      |        |       |       |      |            |       |          |       |
| Chloride                  | 53000        | B      | 913  | 50400  | ug/Kg |       | 93.4 | (48%-145%) |       | 03/15/17 | 03:42 |
| Fluoride                  | 26500        | B      | 1040 | 26100  | ug/Kg |       | 94.7 | (30%-135%) |       |          |       |
| Nitrate-N                 | 26500        | U      | 352  | 25300  | ug/Kg |       | 95.6 | (70%-125%) |       |          |       |
| Nitrite-N                 | 26500        | U      | 352  | 25900  | ug/Kg |       | 97.7 | (70%-120%) |       |          |       |
| Sulfate                   | 106000       | B      | 2890 | 106000 | ug/Kg |       | 96.9 | (45%-162%) |       |          |       |
| QC1203741901              | 417825014 MS |        |      |        |       |       |      |            |       |          |       |
| Chloride                  | 53300        | B      | 2010 | 50300  | ug/Kg |       | 90.7 | (48%-145%) |       | 03/16/17 | 11:15 |
| Fluoride                  | 26600        | B      | 844  | 26600  | ug/Kg |       | 96.5 | (30%-135%) |       |          |       |
| Nitrate-N                 | 26600        | B      | 668  | X      | 25100 | ug/Kg | 91.9 | (70%-125%) |       |          |       |

## QC Summary

Workorder: 417825

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| Parmname                      | NOM       | Sample | Qual | QC | Units  | RPD%  | REC%   | Range      | Anlst    | Date     | Time  |
|-------------------------------|-----------|--------|------|----|--------|-------|--------|------------|----------|----------|-------|
| <b>Ion Chromatography</b>     |           |        |      |    |        |       |        |            |          |          |       |
| Batch                         | 1645114   |        |      |    |        |       |        |            |          |          |       |
| Nitrite-N                     | 26600     | U      | 351  | X  | 25300  | ug/Kg | 94.9   | (70%-120%) | MAR1     | 03/16/17 | 11:15 |
| Sulfate                       | 107000    | B      | 3560 |    | 105000 | ug/Kg | 94.8   | (45%-162%) |          |          |       |
| <b>Spectrometric Analysis</b> |           |        |      |    |        |       |        |            |          |          |       |
| Batch                         | 1645255   |        |      |    |        |       |        |            |          |          |       |
| QC1203742239                  | 417707001 | DUP    |      |    |        |       |        |            |          |          |       |
| Hexavalent Chromium           |           | U      | 153  | U  | 153    | ug/Kg | N/A    |            | RXB5     | 03/15/17 | 18:04 |
| QC1203742238                  | ILCS      |        |      |    |        |       |        |            |          |          |       |
| Hexavalent Chromium           | 7790      |        |      |    | 7400   | ug/Kg | 95     | (80%-120%) |          | 03/15/17 | 18:01 |
| QC1203742237                  | LCS       |        |      |    |        |       |        |            |          |          |       |
| Hexavalent Chromium           | 3780      |        |      |    | 3630   | ug/Kg | 96.1   | (80%-120%) |          | 03/15/17 | 18:00 |
| QC1203742236                  | MB        |        |      |    |        |       |        |            |          |          |       |
| Hexavalent Chromium           |           |        | U    |    | 146    | ug/Kg |        |            |          | 03/15/17 | 17:59 |
| QC1203742242                  | 417707001 | MS     |      |    |        |       |        |            |          |          |       |
| Hexavalent Chromium           | 3800      | U      | 153  |    | 3080   | ug/Kg | 81.2   | (75%-125%) |          | 03/15/17 | 18:09 |
| QC1203742246                  | 417707001 | MSD    |      |    |        |       |        |            |          |          |       |
| Hexavalent Chromium           | 3720      | U      | 153  |    | 3260   | ug/Kg | 5.7    | 87.8       | (0%-35%) | 03/15/17 | 18:11 |
| Batch                         | 1645476   |        |      |    |        |       |        |            |          |          |       |
| QC1203742811                  | 417825006 | DUP    |      |    |        |       |        |            |          |          |       |
| Hexavalent Chromium           |           | B      | 170  | U  | 136    | ug/Kg | 23.4 ^ | (+/-340)   | VH1      | 03/13/17 | 15:14 |
| QC1203742810                  | ILCS      |        |      |    |        |       |        |            |          |          |       |
| Hexavalent Chromium           | 8150      |        |      |    | 7860   | ug/Kg | 96.4   | (80%-120%) |          | 03/13/17 | 15:13 |
| QC1203742809                  | LCS       |        |      |    |        |       |        |            |          |          |       |
| Hexavalent Chromium           | 4000      |        |      |    | 3850   | ug/Kg | 96.2   | (80%-120%) |          | 03/13/17 | 15:13 |

## QC Summary

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| Parmname                      | NOM       | Sample | Qual | QC   | Units | RPD% | REC% | Range      | Anlst | Date     | Time  |
|-------------------------------|-----------|--------|------|------|-------|------|------|------------|-------|----------|-------|
| <b>Spectrometric Analysis</b> |           |        |      |      |       |      |      |            |       |          |       |
| Batch                         | 1645476   |        |      |      |       |      |      |            |       |          |       |
| QC1203742808                  | MB        |        |      |      |       |      |      |            |       |          |       |
| Hexavalent Chromium           |           |        | U    | 160  | ug/Kg |      |      |            | VH1   | 03/13/17 | 15:13 |
| QC1203742812                  | 417825006 | MS     |      |      |       |      |      |            |       |          |       |
| Hexavalent Chromium           | 3330      | B      | 170  | 2930 | ug/Kg |      | 82.9 | (75%-125%) |       | 03/13/17 | 15:14 |
| QC1203742814                  | 417825006 | MSD    |      |      |       |      |      |            |       |          |       |
| Hexavalent Chromium           | 3630      | B      | 170  | 3230 | ug/Kg | 9.74 | 84.3 | (0%-35%)   |       | 03/13/17 | 15:14 |

**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

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.