APPENDIX F

Data Validation Memoranda
Laboratory Reports (CD)
Historical Data Summary Tables – VOCs and
Groundwater Elevations (CD)

Geosyntec consultants

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Memorandum

Date: 19 March 2019

To: Cindy Bartlett, RG, LG

Geosyntec Consultants, Portland, Oregon

From: Mary Tyler

Jennifer Pinion

Subject: Stage 2A Data Validations - Level II Data Deliverables – Pace Analytical Sample Delivery Groups L1067715 and L1067718 and ALS Environmental Service Request Numbers P1900825 and P1900092.

SITE: Cascade Corp., Fairview Oregon; Job No: PNG0564

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of twenty-five water samples, two field duplicate samples and two trip blanks collected 2/5-6/18, and seven air samples collected on January 8 and February 12, 2019 as part of the site investigation activities for the Cascade Corp., Fairview Oregon.

The water samples were analyzed by Pace Analytical [formerly ESC Lab Sciences (ESC)], Mt. Juliet, Tennessee for the following analytical test:

- EPA Method 8260B - Volatile Organic Compounds (VOCs)

The air samples were analyzed by ALS Environmental, Simi Valley, California for the following analytical test:

- EPA Method TO-15 using Selected Ion Monitoring (SIM) – Selected VOCs (1,1-Dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride)

EXECUTIVE SUMMARY

Overall, based on this Stage 2A data validation covering the quality control (QC) parameters listed below and based on the information provided, the data are usable for meeting project objectives.

The data were reviewed based on the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, January 2017 (EPA-540-R-2017-002), the pertinent methods referenced in the data package and professional and technical judgment.

The following samples were analyzed in the data set:

Laboratory ID	Client ID
L1067715-01	TS-C-INF-020519
L1067715-02	TS-C-EFF-020519
L1067715-03	TS-C-EFF-020519-DUP
L1067715-04	TRIP BLANK LOT #414
L1067718-01	EW16-020519
L1067718-02	EW23-020519
L1067718-03	EW14-020519
L1067718-04	EW2-020519
L1067718-05	EW1-020519
L1067718-06	VMWA-020519
L1067718-07	VMWB-020519
L1067718-08	VMWC-020519
L1067718-09	VMWD-020519
L1067718-10	CMW17DS-020519
L1067718-11	CMW17DS-020519-DUP
L1067718-12	D17DG-020619
L1067718-13	D17DS-020619
L1067718-14	EW12-020619-L

Laboratory ID	Client ID
L1067718-15	CMW18DS-020619
L1067718-16	CMW14RDS-020619
L1067718-17	CMW26DG-020619
L1067718-18	CMW36DG-020619
L1067718-19	CMW25DG-020619
L1067718-20	CMW24DG-020619-L
L1067718-21	CMW19DS-020619
L1067718-22	CMW10DS-020619
L1067718-23	PWB-1(LTS)-020619
L1067718-24	TRIP BLANK LOT #414
P1900092-001	VMW EFF-010819
P1900825-001	VMWEFF-021219
P1900825-002	VMW95.5-021219
P1900825-003	VMW A-021219
P1900825-004	VMW B-021219
P1900825-005	VMW C-021219
P1900825-006	VMW D-021219

The water samples were received at the laboratory within the temperature criteria of 0-6^{o}C.

Incorrect error corrections were observed on the chain of custody (COC) in report L1067718, instead of the proper procedure of a single strike through, correction, and initials and date of person making the corrections.

No collection times were listed for the trip blanks on the COCs in laboratory reports L1067715 and L1067718; the laboratory assigned collection times of 00:00. In addition, both trip blanks had collection dates of 10/15/18. The laboratory assigned collection dates of 2/6/19.

The year was not included in the receiving documentation on the COCs in laboratory reports L1067715 and L1067718.

It was noted that the COCs were not paginated as part of the Pace Analytical laboratory reports.

1.0 VOLATILE ORGANIC COMPOUNDS BY EPA METHOD 8260B

The water samples were analyzed for VOCs per EPA Method 8260B.

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Overall Assessment
- ✓ Holding Time
- ✓ Method Blank
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Laboratory Control Sample
- ✓ Surrogates
- ✓ Field Duplicate
- ✓ Trip Blank
- ✓ Sensitivity
- ✓ Electronic Data Deliverables Review

1.1 Overall Assessment

The VOC data reported in these sample sets are considered usable for meeting project objectives. The analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for this analysis, for the sample set is 100%.

1.2 Holding Time

The holding time for the VOC analysis of a preserved water sample is 14 days from collection to analysis. The holding times were met for the sample analyses.

1.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Four method blanks were reported (batches WG1234087, WG1234213, WG1236071 and WG1234172). VOCs were not detected in the method blank above the method detection limits (MDLs) with the following exceptions.

Hexachloro-1,3-butadiene, naphthalene, and 1,2,3-trichlorobenzene were detected in the method blank in batch 1234087 at estimated concentrations greater than the MDLs and less than the

reporting limits (RLs). Since hexachloro-1,3-butadiene, naphthalene, and 1,2,3-trichlorobenzene were not detected in the associated samples, no qualifications were applied to the data.

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

MS/MSD pairs were not reported.

1.5 Laboratory Control Sample (LCS)

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). One LCS and three LCS/LCS duplicate (LCSD) pairs were reported. The recovery and relative percent difference (RPD) results were within the laboratory specified acceptance criteria.

1.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

1.7 Field Duplicate

Two field duplicate samples were collected with the sample set, TS-C-EFF-020519-DUP and CMW17DS-020519-DUP. Acceptable precision (RPD $\leq$30%) was demonstrated between the field duplicates and the original samples, TS-C-EFF-020519 and CMW17DS-020519, respectively.

1.8 Trip Blank

Two trip blanks accompanied the sample shipments, both identified as TRIP BLANK LOT 414. VOCs were not detected in the trip blanks above the MDLs.

1.9 Sensitivity

The sample results were reported to the MDLs. No elevated non-detect results were reported.

1.10 Electronic Data Deliverable (EDD) Review

Results and sample IDs in the EDDs were reviewed against the information provided by the associated level II report at a minimum of 20% as part of the data validation process. It was noted that the data were reported in units of parts per million (ppm) in the EDDs, while the sample data were reported in units of parts per billion (or microgram per liter, µg/L) in the level II reports. This

did not affect the quality of the data. No other discrepancies were identified between the level II reports and the EDDs.

2.0 SELECTED VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

The air samples were analyzed for selected VOCs per EPA Method TO-15 using SIM (1,1-Dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride).

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Overall Assessment
- ✓ Holding Time
- ✓ Method Blank
- ✓ Laboratory Control Sample
- ✓ Laboratory Duplicate
- ✓ Surrogates
- ✓ Field Duplicate
- ✓ Trip Blank
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

2.1 Overall Assessment

The VOC data reported in these sample sets are considered usable for meeting project objectives. The analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for this analysis, for the sample set is 100%.

2.2 Holding Time

The holding time for the VOC analysis of an air sample collected in a SUMMA® canister is 30 days from collection to analysis. The holding times were met for the sample analyses.

2.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Three method blanks were reported (batches P190116,

P190117 and P190222). VOCs were not detected in the method blanks above the method reporting limits (MRLs).

2.4 Laboratory Control Sample

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Three LCSs were reported. The recovery results were within the laboratory specified acceptance criteria.

2.5 Laboratory Duplicate

A laboratory duplicate was not reported.

2.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

2.7 Field Duplicate

A field duplicate was not collected with the air samples.

2.8 Trip Blank

A trip blank did not accompany the sample shipment.

2.9 Sensitivity

The sample results were reported to the MRLs. Elevated non-detect results were reported due to the dilutions analyzed.

2.10 Electronic Data Deliverable Review

Results and sample IDs in the EDD were reviewed against the information provided by the associated level II reports at a minimum of 20% as part of the data validation process. It was noted that the samples were reported to the MRLs in the level II reports; both the MRLs and the MDLs were listed in the EDDs. It was also noted that the data were reported in micrograms per cubic meter ($\mu g/m^3$) in the EDDs, while the sample data were reported in both $\mu g/m^3$ and parts per billion by volume (ppbv) in the level II reports. This did not affect the quality of the data. No other discrepancies were identified between the level II reports and the EDDs.

* * * * *

ATTACHMENT 1
DATA VALIDATION QUALIFIER DEFINITIONS AND INTERPRETATION KEY
Assigned by Geosyntec's Data Validation Team

DATA QUALIFIER DEFINITIONS

U The analyte was analyzed for, but was not detected above the reported sample quantitation limit. Upon application of the U qualifier to a reported result, the definition changes to "not detected at or above the reported result".

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to positive bias of associated QC or calibration data or attributable to matrix interference.

J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to negative bias of associated QC or calibration data or attributable to matrix interference.

UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

ATTACHMENT 2
DATA VALIDATION REASON CODES
Assigned by Geosyntec's Data Validation Team

Valid Value	Description
1	Preservation requirement not met
2	Analysis holding time exceeded
3	Blank contamination (i.e., method, trip, equipment, etc.)
4	Matrix spike/matrix spike duplicate recovery or RPD outside limits
5	LCS recovery outside limits and RPD outside limits (LCS/LCSD)
6	Surrogate recovery outside limits
7	Field Duplicate RPD exceeded
8	Serial dilution percent difference exceeded
9	Calibration criteria not met
10	Linear range exceeded
11	Internal standard criteria not met
12	Lab duplicates RPD exceeded
13	Other

RPD-relative percent difference

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Memorandum

Date:	3 July 2019
To:	Cindy Bartlett, RG, LG
	Geosyntec Consultants, Portland, Oregon
From:	Kristoffer Henderson
Subject:	**Stage 2A Data Validations - Level II Data Deliverables – Pace Analytical Sample Delivery Groups L1082939, L1095432 and L1095434 and ALS Environmental Service Request Numbers P1901838, P1902025 and P1902643R.**

SITE: Cascade Corp., Fairview Oregon; Job No: PNG0564

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of twenty-five groundwater samples, two field duplicate samples and two trip blanks and nine air samples, collected between March 25, 2019 and May 7, 2019 as part of the site investigation activities for the Cascade Corp., Fairview Oregon.

The water samples were analyzed by Pace Analytical [formerly ESC Lab Sciences (ESC)], Mt. Juliet, Tennessee for the following analytical test:

- EPA Method 8260C - Volatile Organic Compounds (VOCs)

The air samples were analyzed by ALS Environmental, Simi Valley, California for the following analytical test:

- EPA Method TO-15 using Selected Ion Monitoring (SIM) – Selected VOCs (1,1-Dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride)

EXECUTIVE SUMMARY

Overall, based on this Stage 2A data validation covering the quality control (QC) parameters listed below and based on the information provided, the data as qualified are usable for meeting project objectives. The qualified data should be used within the limitations of the qualifications.

The data were reviewed based on the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, January 2017 (EPA-540-R-2017-002), the pertinent methods referenced in the data package and professional and technical judgment.

The following samples were analyzed in the data sets:

Laboratory ID	Client ID
L1082939-01	VMW-H-032519
L1082939-02	VMW-C-032519
L1082939-03	VMW-G-032519
L1082939-04	VMW-F-032519
L1082939-05	VMW-E-032519
L1082939-06	TRIP BLANK LOT #370
L1095432-01	VMWA-050219
L1095432-02	VMWC-050219
L1095432-03	VMWB-050219
L1095432-04	VMWD-050219
L1095432-05	VMWH-050219
L1095432-06	VMWG-050219
L1095432-07	VMWF-050219
L1095432-08	CMW17DS-050219
L1095432-09	VMWE-050219
L1095432-10	EW1-050219
L1095432-11	EW2-050219
L1095432-12	EW14-050219
L1095432-13	D17DG-050219

Laboratory ID	Client ID
L1095432-14	D17DS-050219
L1095432-15	EW12-050219
L1095432-16	CMW18DS-050219
L1095432-17	CMW18DS-050219-DUP
L1095432-18	CMW19DS-050219
L1095432-19	CMW10DS-050219
L1095432-20	TRIP LOT #414
L1095434-01	TS-C-EFF-050319
L1095434-02	TS-C-EFF-050319-DUP
L1095434-03	TS-C-INF-050319
P1901838-001	VMW-H-040219
P1902025-001	SVE-EFF-040919
P1902643-001	VMWEFF-050719
P1902643-002	VMW95.5-050719
P1902643-003	VMWC-050719
P1902643-004	VMWE-050719
P1902643-005	VMWF-050719
P1902643-006	VMWG-050719
P1902643-007	VMWH-050719

The water samples were received at the laboratory within the temperature criteria of 0-6ºC.

Incorrect error corrections were observed on the chain of custody (COC) in report L1095432, instead of the proper procedure of a single strike through, correction, and initials and date of person making the corrections.

No collection times were listed for the trip blanks on the COCs in laboratory reports L1082939 and L1095432; the laboratory assigned collection times of 00:00. In addition, no collection date was listed for the trip blank in laboratory report L1095432; the laboratory assigned a collection date of May 3, 2019.

The COCs were not paginated as part of the Pace Analytical laboratory reports.

ALS laboratory report P1902643R was revised on June 26, 2019 to correct the results for samples VMWE-050719 and VMWF-050719 which were originally reported from the wrong canisters. The revised report was identified as P1902643R.

1.0 VOLATILE ORGANIC COMPOUNDS BY EPA METHOD 8260C

The water samples were analyzed for VOCs per EPA method 8260C.

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

✓ Overall Assessment
✓ Holding Time
✓ Method Blank
✓ Matrix Spike/Matrix Spike Duplicate
✓ Laboratory Control Sample
✓ Surrogates
✓ Field Duplicate
✓ Trip Blank
✓ Sensitivity
✓ Electronic Data Deliverables Review

1.1 Overall Assessment

The VOC data reported in these sample sets are considered usable for meeting project objectives. The analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for this analysis, for the sample set is 100%.

The laboratory J0 flagged the bromomethane results in L1082939 and the acetone, chloromethane and 2-butanone results in L1095432. J0 was defined in the laboratory reports as, "the identification of the analyte is acceptable, but the reported concentration is an estimate". The laboratory was contacted and provided additional information; they indicated that the results were flagged due to continuing calibration verification (CCV) recoveries outside the limit of 80-120% recovery as following:

- Laboratory report L1082939: Bromomethane CCV recovery 77.3%.
- Laboratory report L1095432: Acetone, chloromethane and 2-butanone CCV recoveries 66.3%, 71.6% and 79.8%, respectively.

Since the percent differences (%Ds) of these compounds in the CCVs indicated were within the validation specified acceptance criteria and based on professional and technical judgment, no qualifications were applied to the data.

1.2 Holding Time

The holding time for the VOC analysis of a preserved water sample is 14 days from collection to analysis. The holding times were met for the sample analyses.

1.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Five method blanks were reported (batches WG1257024, WG1257766, WG1276798, WG1277794 and WG1277852). VOCs were not detected in the method blank above the method detection limits (MDLs) with the following exceptions.

L1095432: Butylbenzene, sec-butylbenzene, hexachlorobutadiene, p-cymene, naphthalene, 1,2,3-trichlorobenzene, 1,2,3-trimethylbenzene, 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene were detected in the method blank in batch WG1276798 at estimated concentrations greater than the MDLs and less than the reporting limits (RLs). Since these compounds were not detected in the associated samples, no qualifications were applied to the data.

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

MS/MSD pairs were not reported.

1.5 Laboratory Control Sample (LCS)

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Four LCSs and one LCS/LCS duplicate (LCSD) pair were reported. The recovery and relative percent difference (RPD) results were within the laboratory specified acceptance criteria.

1.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

1.7 Field Duplicate

Two field duplicate samples were collected with the sample set, CMW18DS-050219-DUP and TS-C-EFF-050319-DUP. Acceptable precision (RPD $\leq$30%] was demonstrated between the field duplicates and the original samples, CMW18DS-050219 and TS-C-EFF-050319, respectively.

1.8 Trip Blank

Two trip blanks accompanied the sample shipments, TRIP BLANK LOT #370 and TRIP LOT #414. VOCs were not detected in the trip blanks above the MDLs.

1.9 Sensitivity

The sample results were reported to the MDLs. Elevated non-detect results were reported for sample VMW-G-032519 due to dilution analyzed.

1.10 Electronic Data Deliverable (EDD) Review

Results and sample IDs in the EDDs were reviewed against the information provided by the associated level II report at a minimum of 20% as part of the data validation process. It was noted that the data were reported in units of parts per million (ppm) in the EDDs, while the sample data were reported in units of parts per billion (or microgram per liter, µg/L) in the level II reports. This did not affect the quality of the data. No other discrepancies were identified between the level II reports and the EDDs.

2.0 SELECTED VOLATILE ORGANIC COMPOUNDS BY EPA METHOD TO-15

The air samples were analyzed for selected VOCs per EPA method TO-15 using SIM (1,1-dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride).

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

⊗ Overall Assessment
✓ Holding Time
✓ Method Blank
✓ Laboratory Control Sample
✓ Laboratory Duplicate
✓ Surrogates
✓ Field Duplicate
✓ Trip Blank
✓ Sensitivity
✓ Electronic Data Deliverable Review

2.1 Overall Assessment

The VOC data reported in the sample sets are considered usable for meeting project objectives. The analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for this analysis, for the sample sets is 100%.

The final canister vacuum for sample SVE-EFF-040919 was -2.0 pounds per square inch gauge (psig) when shipped to the laboratory after sampling, and approximately atmospheric at -0.24 psig upon receipt by the laboratory. The loss in vacuum in comparison to the other canister vacuums in the sample sets, as well as the final measured vacuum at near ambient, indicates a potential leak. Therefore, based on professional and technical judgment, the non-detect results in sample SVE-EFF-040919 were UJ qualified as estimated less than the method reporting limits (MRLs) and the concentrations were J qualified as estimated.

Sample ID	Compound	Laboratory Result ($\mu g/m^3$)	Laboratory Flag	Validation Result ($\mu g/m^3$)	Validation Qualifier*	Reason Code**
SVE-EFF-040919	cis-1,2-Dichloroethene	79	NA	79	J	13
SVE-EFF-040919	Tetrachloroethene (PCE)	40	NA	40	J	13
SVE-EFF-040919	Trichloroethene (TCE)	560	D	560	J	13
SVE-EFF-040919	Vinyl Chloride	1.8	U	1.8	UJ	13
SVE-EFF-040919	1,1-Dichloroethene	1.8	U	1.8	UJ	13

$\mu g/m^3$-microgram per cubic meter
NA-not applicable
U-not detected at the MRL
D-laboratory flag indicating the result is from a dilution
* Validation qualifiers are defined in Attachment 1 at the end of this report
**Reason codes are defined in Attachment 2 at the end of this report

2.2 Holding Time

The holding time for the VOC analysis of an air sample collected in a SUMMA® canister is 30 days from collection to analysis. The holding times were met for the sample analyses.

2.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Three method blanks were reported (batches P190410, P190419 and P190520). VOCs were not detected in the method blanks above the method reporting limits (MRLs).

2.4 Laboratory Control Sample

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Two LCSs and one LCS/LCSD pair were reported. The recovery and RPD results were within the laboratory specified acceptance criteria.

2.5 Laboratory Duplicate

One sample set specific laboratory duplicate was reported, using sample VMWH-050719. The RPD results were within the laboratory specified acceptance criteria.

2.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

2.7 Field Duplicate

A field duplicate was not collected with the air samples.

2.8 Trip Blank

A trip blank did not accompany the air samples.

2.9 Sensitivity

The sample results were reported to the MRLs. Elevated non-detect results were reported due to the dilutions analyzed; the narrative in report P1901838 indicated that sample VMW-H-040219 was analyzed at a dilution due to the presence of non-target analytes.

2.10 Electronic Data Deliverable Review

Results and sample IDs in the EDD were reviewed against the information provided by the associated level II reports at a minimum of 20% as part of the data validation process. It was noted that the samples were reported to the MRLs in the level II reports; both the MRLs and the MDLs were listed in the EDDs. It was also noted that the data were reported in micrograms per cubic meter ($\mu g/m^3$) in the EDDs, while the sample data were reported in both $\mu g/m^3$ and parts per billion by volume (ppbv) in the level II reports. This did not affect the quality of the data. No other discrepancies were identified between the level II reports and the EDDs.

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ATTACHMENT 1
DATA VALIDATION QUALIFIER DEFINITIONS
AND INTERPRETATION KEY
Assigned by Geosyntec's Data Validation Team

DATA QUALIFIER DEFINITIONS

U The analyte was analyzed for, but was not detected above the reported sample quantitation limit. Upon application of the U qualifier to a reported result, the definition changes to "not detected at or above the reported result".

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to positive bias of associated QC or calibration data or attributable to matrix interference.

J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to negative bias of associated QC or calibration data or attributable to matrix interference.

UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

ATTACHMENT 2
DATA VALIDATION REASON CODES
Assigned by Geosyntec's Data Validation Team

Valid Value	Description
1	Preservation requirement not met
2	Analysis holding time exceeded
3	Blank contamination (i.e., method, trip, equipment, etc.)
4	Matrix spike/matrix spike duplicate recovery or RPD outside limits
5	LCS recovery outside limits and RPD outside limits (LCS/LCSD)
6	Surrogate recovery outside limits
7	Field Duplicate RPD exceeded
8	Serial dilution percent difference exceeded
9	Calibration criteria not met
10	Linear range exceeded
11	Internal standard criteria not met
12	Lab duplicates RPD exceeded
13	Other

RPD-relative percent difference

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Memorandum

Date:	3 September 2019
To:	Cindy Bartlett, RG, LG
	Geosyntec Consultants, Portland, Oregon
From:	Matthew Richardson
	Kristoffer Henderson
CC:	J. Caprio
Subject:	**Stage 2A Data Validations - Level II Data Deliverables – Pace Analytical Sample Delivery Groups L1057797, L1114294, L1119044, L1127014, L1127015 and L1129331 and ALS Environmental Service Request Numbers P1901701, P1903475, P1904087 and P1904673.**

SITE: Cascade Corp., Fairview Oregon; Job No: PNG0564S18

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of thirty-four groundwater samples, seventeen air samples, three field duplicate samples, four investigation derived waste (IDW) samples and three trip blanks, collected between January 2, 2019 and August 13, 2019 as part of the site investigation activities for the Cascade Corp., Fairview Oregon.

The water and solid samples were analyzed by Pace Analytical [formerly ESC Lab Sciences (ESC)], Mt. Juliet, Tennessee for the following analytical tests:

- United States (US) Environmental Protection Agency (EPA) Methods 8260B and 8260C - Volatile Organic Compounds (VOCs) by Gas Chromatography/Mass Spectrometry (GC/MS)
- US EPA Method 6010D - Metals by Inductively Coupled Plasma (ICP)/ Atomic Emission Spectrometry (AES)
- US EPA Methods 1311/6010D – Toxicity Characteristic Leaching Procedure (TCLP) Chromium by ICP/AES
- US EPA Method 7471B – Mercury
- Standard Method 2540G - Percent Moisture/Solids

The air samples were analyzed by ALS Environmental, Simi Valley, California for the following analytical tests:

- US EPA Method TO-15 and US EPA Method TO-15 Modified – Selected VOCs (1,1-Dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride)

EXECUTIVE SUMMARY

Overall, based on this Stage 2A data validation covering the quality control (QC) parameters listed below and based on the information provided, the data as qualified are usable for supporting project objectives. The qualified data should be used within the limitations of the qualifications.

The data were reviewed based on the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, January 2017 (EPA-540-R-2017-002), USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Methods Data Review, January 2017 (EPA-540-R-2017-001), the pertinent methods referenced in the data package and professional and technical judgment.

The following samples were analyzed in the data sets:

Laboratory ID	Client ID
L1057797-01	D17DG-010219
L1057797-02	TRIP BLANK LOT # 414
L1114294-01	VMW_IDW01
L1114294-02	VMW_IDW02
L1114294-03	VMW_IDW03
L1119044-01	HOLD01
L1127014-01	EW1-080619
L1127014-02	EW2-080619
L1127014-03	EW14-080619
L1127014-04	EW23-080619
L1127014-05	D17DG-080619
L1127014-06	D17DS-080619
L1127014-07	EW8-080619
L1127014-08	EW12-080619
L1127014-09	EW15-080619
L1127014-10	EW16-080619
L1127014-11	CMW10DS-080619
L1127014-12	CMW14RDS-080619
L1127014-13	CMW17DS-080619
L1127014-14	CMW17DS-080619-DUP
L1127014-15	CMW18DS-080619
L1127014-16	CMW18DS-080619-DUP
L1127014-17	CMW19DS-080619
L1127014-18	CMW20DS-080619

Laboratory ID	Client ID
L1127014-19	CMW22DG-080619
L1127014-20	CMW24DG-080619
L1127014-21	CMW25DG-080619
L1127014-22	CMW26DG-080619
L1127014-23	PWB-1(UTS)-080619
L1127014-24	PWB-1(LTS)-080619
L1127014-25	VMWA-080619
L1127014-26	VMWB-080619
L1127014-27	VMWC-080619
L1127014-28	VMWD-080619
L1127014-29	VMWE-080619
L1127014-30	VMWF-080619
L1127014-31	VMWG-080619
L1127014-32	VMWH-080619
L1127014-33	TRIP BLANK#LOT 406
L1127015-01	TS-C-EFF-080619
L1127015-02	TS-C-EFF-080619-DUP
L1127015-03	TS-C-INF-080619
L1127015-04	TRIP BLANK #LOT 406
L1129331-01	CMW36DG-081319
L1129331-02	TRIP BLANK #404
P1901701-001	VMWEFF-032619
P1901701-002	VMWC-032619
P1901701-003	VMWE-032619

Laboratory ID	Client ID
P1901701-004	VMWF-032619
P1901701-005	VMWG-032619
P1903475-001	VMWA-061119
P1903475-002	VMWB-061119
P1903475-003	VMWD-061119
P1903475-004	EFF-061119
P1904087-001	SVE-EFF-070919

Laboratory ID	Client ID
P1904673-001	VMWEFF-080519
P1904673-002	VMW95.5-080519
P1904673-003	VMWC-080519
P1904673-004	VMWH-080519
P1904673-005	VMWE-080519
P1904673-006	VMWF-080519
P1904673-007	VMWG-080519

The water and solid samples were received at the laboratory within the temperature criteria of 0-6ºC.

The following issues were noted on the chain of custody (COC) forms. These issues did not have any impact on the data; therefore, no qualifications were applied to the data.

- Incorrect error corrections were observed on the COC in report P1903475, instead of the proper procedure of a single strike through, correction, and initials and date of person making the correction.

- Samples HOLD01, HOLD02 and HOLD03 were received on hold as noted by the COCs for laboratory reports L1114294 and L1119044. Sample HOLD01 was analyzed for chromium by TCLP in laboratory report L1119044 per the client's request. Samples HOLD02 and HOLD03 were not reported with the data.

- No collection times were listed for the trip blanks on the COCs in laboratory reports L1057797, L1127015, L1127014 and L1129331. The laboratory assigned the collection time of 00:00. The sample matrix was not listed for the trip blank in laboratory report L1129331.

- Sample VMWH-032619 was listed on the COC for laboratory report P1901701 but was cancelled by the client and was not reported.

Percent solids by Method 2540G was analyzed for dry-weight reporting in laboratory report L1114294; however, the data were not validated.

1.0 VOLATILE ORGANIC COMPOUNDS

The water samples were analyzed for VOCs per EPA method 8260B and 8260C.

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

⊗ Overall Assessment
✓ Holding Times
⊗ Method Blank
✓ Matrix Spike/Matrix Spike Duplicate
✓ Laboratory Control Sample
✓ Surrogate
✓ Field Duplicate
✓ Trip Blank
✓ Sensitivity
⊗ Electronic Data Deliverable Review

1.1 Overall Assessment

1.1.1 Completeness

The VOC data reported in these sample sets are considered usable for supporting project objectives. The analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for this analysis, for the sample sets is 100%.

1.1.2 Analysis Anomaly

Multiple results were flagged J0 to indicate the recoveries of the specified compound(s) in the continuing calibration verification (CCV) standards were outside the laboratory specified acceptance criteria. The laboratory provided the compounds and recoveries that were outside of the criteria.

L1127014 and L1127015: The recoveries of bromoform, bromomethane and chloroethane were low and outside the laboratory specified acceptance criteria in the CCV in batch WG1327324. Since the bromoform and chloroethane results in the CCV were within the validation specified acceptance criteria, no qualifications were applied to the bromoform and chloroethane data, based on professional and technical judgment. However, the non-detect bromomethane results in the associated samples were UJ qualified as estimated less than the reporting limit (RL).

L1127014: The recovery of naphthalene was low and outside the laboratory specified acceptance criteria in the CCV in batch WG1326885. Therefore, the non-detect naphthalene results in the associated samples were UJ qualified as estimated less than the RL.

L1127014: The recoveries of bromomethane, carbon tetrachloride, chloroethane, chloromethane and trichlorofluoromethane were low and outside the laboratory specified acceptance criteria in the CCV in batch WG1327140. Since the carbon tetrachloride, chloroethane, chloromethane and trichlorofluoromethane results in the CCV were within the validation specified acceptance criteria, no qualifications were applied to the carbon tetrachloride, chloroethane, chloromethane and trichlorofluoromethane data, based on professional and technical judgment. However, the non-detect bromomethane results in the associated samples were UJ qualified as estimated less than the RL.

Sample	Analyte	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier	Reason Code
VMWD-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
VMWE-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
VMWF-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
VMWG-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
VMWH-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
CMW22DG-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
CMW24DG-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
CMW25DG-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
CMW26DG-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
PWB-1(LTS)-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
PWB-1(UTS)-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
TS-C-EFF-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
TS-C-EFF-080619-DUP	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
TS-C-INF-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
VMWA-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
VMWB-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
VMWC-080619	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
TRIP BLANK #LOT 406	Methyl Bromide	0.00250	U,J0	0.00250	UJ	9
CMW10DS-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
CMW14RDS-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9

Sample	Analyte	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier	Reason Code
CMW19DS-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
CMW20DS-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
D17DG-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
D17DS-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
EW1-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
EW12-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
EW14-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
EW15-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
EW16-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
EW2-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
EW23-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
EW8-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
CMW17DS-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
CMW17DS-080619-DUP	Naphthalene	0.00250	U,J0	0.00250	UJ	9
CMW18DS-080619	Naphthalene	0.00250	U,J0	0.00250	UJ	9
CMW18DS-080619-DUP	Naphthalene	0.00250	U,J0	0.00250	UJ	9

ppm-parts per million
J0-laboratory flag defined as the identification of the analyte is acceptable, but the reported concentration is an estimate. The calibration met method criteria.
* Validation qualifiers are defined in Attachment 1 at the end of this report
**Reason codes are defined in Attachment 2 at the end of this report

1.2 Holding Time

The holding time for the VOC analysis of a preserved water sample is 14 days from collection to analysis. The holding times for VOC analysis of a water preserved soil sample collected in a Terra Core® sample are 48 hours from sample collection to freezing and 14 days from sample collection to analysis. The holding times were met for the sample analyses.

1.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Seven method blanks were reported (batches WG1219077, WG1307486, WG1326885, WG1327140, WG1327324, WG1330890 and WG1331185). VOCs were not detected in the method blanks above the method detection limits (MDLs), with the following exceptions.

L1057797: Naphthalene was detected in the method blank in batch WG1219077 at an estimated concentration greater than the MDL and less than the RL. Since naphthalene was not detected in the associated samples, no qualifications were applied to the data.

L1114294: 2-Butanone (0.0287 mg/kg) was detected in the method blank in batch WG1307486 at a concentration greater than the RL. Therefore, the 2-butanone concentration in sample VMW_IDW03 was J+ qualified as estimated with a high bias, based on technical and professional judgment.

L1127014: Acetone and tetrachloroethene were detected in the method blank in batch WG1326885 at estimated concentrations greater than the MDLs and less than the RLs. Since acetone and tetrachloroethene were either not detected or detected above the RLs in the associated samples, no qualifications were applied to the data.

L1127014: Acetone was detected in the method blank in batch WG1327140 at an estimated concentration greater than the MDL and less than the RL. Since acetone was either not detected or detected above the RL in the associated samples, no qualifications were applied to the data.

L1127014 & L1127015: Hexachloro-1,3-butadiene and 1,2,3-trichlorobenzene were detected in the method blank in batch WG1327324 at estimated concentrations greater than the MDLs and less than the RLs. Since hexachloro-1,3-butadiene and 1,2,3-trichlorobenzene were not detected in the associated samples, no qualifications were applied to the data.

Sample	Analyte	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier	Reason Code
VMW_IDW03	2-Butanone	0.0508	B	0.0508	J+	3

ppm-parts per million
B-laboratory flag indicating analyte was detected in both the sample and associated method blank

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

MS/MSD pairs were not reported with the data.

1.5 Laboratory Control Sample (LCS)

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Three LCSs and four LCS/LCS duplicate (LCSD) pairs were reported. The recovery and relative percent difference (RPD) results were within the laboratory specified acceptance criteria with the following exceptions.

L1057797: The recoveries of acrolein were high and outside the laboratory specified acceptance criteria in the LCS/LCSD pair in batch WG1219077. Since acrolein was not detected in the associated samples, no qualifications were applied to the data.

L1114294: The recovery of 1,2,3-trimethylbenzene was high and outside the laboratory specified acceptance criteria in the LCS in batch WG1307486. Since 1,2,3-trimethylbenzene was not detected in the associated samples, no qualifications were applied to the data.

L1127014: The recovery of carbon tetrachloride was high and outside the laboratory specified acceptance criteria in the LCS in in batch WG1326885. Since carbon tetrachloride was not detected in the associated samples, no qualifications were applied to the data.

L1127014: The recoveries of acrolein and the RPDs of naphthalene and 1,2,3-trichlorobenzene were high and outside the laboratory specified acceptance criteria in the LCS/LCSD pair in batch WG1327140. Since these compounds were not detected in the associated samples, no qualifications were applied to the data.

L1127014 and L1127015: One or both the recoveries of acrolein and 1,3-dichlorobenzene were high and outside the laboratory specified acceptance criteria in batch WG1327324. Since acrolein and 1,3-dichlorobenzene were not detected in the associated samples, no qualifications were applied to the data.

1.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

1.7 Field Duplicate

Two field duplicate samples were collected with the sample set, CMW17DS-080619-DUP and

CMW18DS-080619-DUP. Acceptable precision (RPD $\leq$30%] was demonstrated between the field duplicates and the original samples, CMW17DS-080619 and CMW18DS-080619, respectively.

1.8 Trip Blank

Three trip blanks accompanied the sample shipments, TRIP LOT #414, TRIP BLANK#LOT 406 and TRIP BLANK #404. VOCs were not detected in the trip blanks above the RLs.

TRIP BLANK#LOT 406 was reported in both laboratory reports L1127014 and L1127015. Based on the sample receipt date and time and the analysis batch date and time it was determined to be the same trip blank.

1.9 Sensitivity

The sample results were reported to the RLs. No elevated non-detect results were reported with the following exception.

L1114294: Elevated non-detect results were reported for samples VMW_IDW01 and VMW_IDW03 due to dilutions analyzed.

1.10 Electronic Data Deliverable (EDD) Review

Results and sample IDs in the EDDs were reviewed against the information provided by the associated level II report at a minimum of 20% as part of the data validation process. It was noted that the data were reported in units of parts per million (ppm) in the EDDs, while the sample data were reported in units of parts per billion (or microgram per liter, µg/L) in the level II reports. This did not affect the quality of the data. No other discrepancies were identified between the level II reports and the EDDs.

2.0 SELECTED VOLATILE ORGANIC COMPOUNDS

The air samples were analyzed for selected VOCs per EPA method TO-15 and EPA method TO-15 modified (1,1-dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride).

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

⊗ Overall Assessment
✓ Holding Times
✓ Method Blank
✓ Laboratory Control Sample
✓ Laboratory Duplicate
✓ Surrogates
✓ Field Duplicate
✓ Sensitivity
✓ Electronic Data Deliverable Review

2.1 Overall Assessment

2.1.1 Completeness

The VOC data reported in the sample sets are considered usable for supporting project objectives. The analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for this analysis, for the sample sets is 100%.

2.1.2 Analysis Anomaly

The canister vacuum for sample VMWEFF-032619 was recorded as -1.96 pound per square inch gauge (psig) in the field and was recorded at a pressure above ambient of 1.04 psig after laboratory receipt. This loss in vacuum in comparison to the other canister vacuums in the batch, as well as

the final measured vacuum above ambient, indicates a potential leak. Therefore, based on professional and technical judgment, the non-detect results were UJ qualified as estimated less than the MRL and concentrations were J qualified as estimated in sample VMWEFF-032619.

Sample	Analyte	Laboratory Result (µg/m^3)	Laboratory Flag	Validation Result (µg/m3)	Validation Qualifier	Reason Code
VMWEFF-032619	Vinyl Chloride	1.7	U	1.7	UJ	13
VMWEFF-032619	1,1-Dichloroethene	1.7	U	1.7	UJ	13
VMWEFF-032619	cis-1,2-Dichloroethene	59	NA	59	J	13
VMWEFF-032619	Tetrachloroethene (PCE)	43	NA	43	J	13
VMWEFF-032619	Trichloroethene (TCE)	680	D	680	J+	13

µg/m^3-micrograms per cubic meter
U-not detected at or above the MRL
D-laboratory flag indicating result is from a dilution
NA-not applicable

2.2 Holding Time

The holding time for the VOC analysis of an air sample collected in a SUMMA® canister is 30 days from collection to analysis. The holding times were met for the sample analyses.

2.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Five method blanks were reported (batches P190408, P190624, P190717, P190818 and P190819). VOCs were not detected in the method blanks above the method reporting limits (MRLs).

2.4 Laboratory Control Sample

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Five LCSs were reported. The recovery results were within the laboratory specified acceptance criteria.

2.5 Laboratory Duplicate

A laboratory duplicate was not reported with the air samples.

2.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

2.7 Field Duplicate

A field duplicate was not collected with the air samples.

2.8 Sensitivity

The sample results were reported to the MRLs. Elevated non-detect results were reported due to the dilutions analyzed.

2.9 Electronic Data Deliverable Review

Results and sample IDs in the EDD were reviewed against the information provided by the associated level II reports at a minimum of 20% as part of the data validation process. It was noted that the samples were reported to the MRLs in the level II reports; both the MRLs and the MDLs were listed in the EDDs. It was also noted that the data were reported in micrograms per cubic meter ($\mu g/m^3$) in the EDDs, while the sample data were reported in both $\mu g/m^3$ and parts per billion by volume (ppbv) in the level II reports. This did not affect the quality of the data. No other discrepancies were identified between the level II reports and the EDDs.

3.0 METALS

The samples were analyzed for Metals by US EPA Method 6010B and TCLP Chromium by EPA Methods 1311/6010B. Mercury was assessed separately, in section 4.0, below.

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised over the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Overall Assessment
- ✓ Holding Times
- ✓ Method Blank
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Laboratory Control Sample
- ✓ Laboratory Duplicate
- ✓ Field Duplicate
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

3.1 Overall Assessment

The metals data reported in this package are considered usable for supporting project objectives. The results are considered valid; the analytical completeness defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total

number of analytical results requested on the samples submitted for these analyses, for this sample set is 100%.

3.2 Holding Times

The holding time for the metals analysis of a solid sample is 180 days from sample collection to analysis. The holding times for TCLP are 180 days from collection to TCLP extraction and 180 days from TCLP extraction to analysis. The holding times were met for the sample analyses.

3.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Two method blanks were reported (batches WG1307036 and WG1313684). Metals were not detected in the method blanks above the MDLs, with the following exception.

L1114294: Barium was detected in the method blank (batch WG1307036) at a concentration greater than the RL. Since the concentrations of barium in the associated samples was greater than ten times the method blank result, no qualifications were applied to the data based on technical and professional judgment.

3.4 Matrix Spike/Matrix Spike Duplicate

MS/MSD pairs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). One sample set specific MS/MSD pair was reported for TCLP chromium using sample HOLD01. The recovery and RPD results were within the laboratory specified acceptance criteria.

One batch MS/MSD pair was also reported. Since these were batch QC, the results do not affect the samples in this data set and qualifications were not applied to the data.

3.5 Laboratory Control Sample

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). One LCS/LCSD pair was reported. The recovery and RPD results were within the laboratory specified acceptance criteria.

3.6 Laboratory Duplicate

A laboratory duplicate was not reported with the sample set.

3.7 Field Duplicate

A field duplicate was not submitted with the sample set.

3.8 Sensitivity

The sample results were reported to the MDLs. No elevated non-detect results were reported.

3.9 Electronic Data Deliverable Review

The results and sample IDs in the EDD were reviewed against the information provided by the associated level II report at a minimum of 20% as part of the data validation process. No discrepancies were identified between the level II report and the EDD.

4.0 MERCURY

The sample was analyzed for mercury by US EPA Method 7471B.

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised over the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Overall Assessment
- ✓ Holding Times
- ✓ Method Blank
- ✓ Matrix Spike/Matrix Spike Duplicate
- ✓ Laboratory Control Sample
- ✓ Laboratory Duplicate
- ✓ Field Duplicate
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

4.1 Overall Assessment

The mercury data reported in this package are considered usable for supporting project objectives. The results are considered valid; the analytical completeness defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on the samples submitted for this analysis, for this sample set is 100%.

4.2 Holding Times

The holding time for mercury analyses of a solid sample is 28 days from sample collection to analysis. The holding times were met for the sample analyses.

4.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). One method blank was reported (batch WG1307294). Mercury was not detected in the method blank above the MDL.

4.4 Matrix Spike/Matrix Spike Duplicate

MS/MSD pairs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). One sample set specific MS/MSD pair was reported, using sample VMW_IDW01. The recovery and RPD results were within the laboratory specified acceptance criteria.

4.5 Laboratory Control Sample

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). One LCS/LCSD pair was reported. The recovery and RPD results were within the laboratory specified acceptance criteria.

4.6 Laboratory Duplicate

A laboratory duplicate was not reported with the sample set.

4.7 Field Duplicate

A field duplicate was not reported with the sample set.

4.8 Sensitivity

The samples were reported to the MDL. Elevated non-detect results were not reported.

4.9 Electronic Data Deliverable Review

The results and sample IDs in the EDD were reviewed against the information provided by the associated level II report at a minimum of 20% as part of the data validation process. No discrepancies were identified between the level II report and the EDD.

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ATTACHMENT 1
DATA VALIDATION QUALIFIER DEFINITIONS AND INTERPRETATION KEY
Assigned by Geosyntec's Data Validation Team

DATA QUALIFIER DEFINITIONS

U The analyte was analyzed for, but was not detected above the reported sample quantitation limit. Upon application of the U qualifier to a reported result, the definition changes to "not detected at or above the reported result".

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to positive bias of associated QC or calibration data or attributable to matrix interference.

J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to negative bias of associated QC or calibration data or attributable to matrix interference.

UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

ATTACHMENT 2
DATA VALIDATION REASON CODES
Assigned by Geosyntec's Data Validation Team

Valid Value	Description
1	Preservation requirement not met
2	Analysis holding time exceeded
3	Blank contamination (i.e., method, trip, equipment, etc.)
4	Matrix spike/matrix spike duplicate recovery or RPD outside limits
5	LCS recovery outside limits and RPD outside limits (LCS/LCSD)
6	Surrogate recovery outside limits
7	Field Duplicate RPD exceeded
8	Serial dilution percent difference exceeded
9	Calibration criteria not met
10	Linear range exceeded
11	Internal standard criteria not met
12	Lab duplicates RPD exceeded
13	Other

Geosyntec consultants

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Memorandum

Date:	9 December 2019
To:	Cindy Bartlett, RG, LG
	Geosyntec Consultants, Portland, Oregon
From:	Matthew Richardson
CC:	J. Caprio
Subject:	**Stage 2A Data Validations - Level II Data Deliverables – Pace Analytical Sample Delivery Groups L1157928 and L1157939 and ALS Environmental Service Request Number P1905977.**

SITE: Cascade Corp., Fairview Oregon; Job No: PNG0564S18

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of five air samples, five air samples collected on October 3, 2019 and twenty-two groundwater samples, one field duplicate sample, and one trip blank, collected on October 3, 2019 as part of the site investigation activities for the Cascade Corp., Fairview Oregon sampling event.

The water samples were analyzed by Pace Analytical [formerly ESC Lab Sciences (ESC)], Mt. Juliet, Tennessee for the following analytical test:

- United States (US) Environmental Protection Agency (EPA) Methods 8260C - Volatile Organic Compounds (VOCs) by Gas Chromatography/Mass Spectrometry (GC/MS)

The air samples were analyzed by ALS Environmental, Simi Valley, California for the following analytical tests:

- US EPA Method TO-15 and US EPA Method TO-15 Modified – Selected VOCs (1,1-Dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride)

EXECUTIVE SUMMARY

Overall, based on this Stage 2A data validation covering the quality control (QC) parameters listed below and based on the information provided, the data as qualified are usable for supporting project objectives. The qualified data should be used within the limitations of the qualifications.

The data were reviewed based on the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, January 2017 (EPA-540-R-2017-002) and the pertinent methods referenced in the data package and professional and technical judgment.

The following samples were analyzed in the data sets:

Laboratory ID	Client ID
L1157928-01	CMW17DS-110419
L1157928-02	EW1-110419
L1157928-03	EW2-110419
L1157928-04	EW14-110419
L1157928-05	EW23-110419
L1157928-06	D17DS-110419
L1157928-07	D17DG-110419
L1157928-08	EW12-110419
L1157928-09	CMW10DS-110419
L1157928-10	CMW18DS-110419
L1157928-11	CMW18DS-110419
L1157928-12	CMW19DS-110419
L1157928-13	VMWA-110419
L1157928-14	VMWB-110419
L1157928-15	VMWC-110419

Laboratory ID	Client ID
L1157928-16	VMWD-110419
L1157928-17	VMWE-110419
L1157928-18	VMWF-110419
L1157928-19	VMWG-110419
L1157928-20	VMWH-110419
L1157939-01	TS-C-EFF-110419
L1157939-02	TS-C-EFF-110419-DUP
L1157939-03	TS-C-INF-110419
L1157939-04	TRIP BLANK LOT#414
P1905977-001	VW-17d-95.5-100319
P1905977-002	VMW-A-100319
P1905977-003	VMW B-100319
P1905977-004	VMW D-100319
P1905977-005	SVE EFF-100319

The water samples were received at the laboratory within the temperature criteria of 0-6ºC.

The following issues were noted on the chain of custody (COC) forms. No qualifications were applied to the data based on the issues discussed below.

- The sample matrix was not properly documented on the COC for laboratory report L1157939.
- Two samples were collected and identified as CMW18DS-110419 with two separate sample collection times.
- No collection times were listed for the trip blank on the COC in laboratory report L1157939. The laboratory assigned the collection time of 00:00.

1.0 VOLATILE ORGANIC COMPOUNDS

The water samples were analyzed for VOCs per EPA method 8260C.

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

⊗ Overall Assessment
✓ Holding Times
⊗ Method Blank
✓ Matrix Spike/Matrix Spike Duplicate
✓ Laboratory Control Sample
✓ Surrogate
✓ Field Duplicate
✓ Trip Blank
✓ Sensitivity
⊗ Electronic Data Deliverable Review

1.1 Overall Assessment

1.1.1 Completeness

The VOC data reported in these sample sets are considered usable for supporting project objectives. The analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for this analysis, for the sample sets is 100%.

1.1.2 Analysis Anomaly

Multiple results were flagged J0 to indicate the recoveries of the specified compound(s) in the continuing calibration verification (CCV) standards were outside the laboratory specified acceptance criteria. Upon request, the laboratory provided the compounds and recoveries that were outside of the criteria.

L1157928: The recoveries of bromomethane and chloromethane were low and outside the laboratory specified acceptance criteria in the CCV in batch WG1327324. Since the chloromethane result in the CCV was within the validation specified acceptance criteria, no qualifications were applied to the chloromethane data, based on professional and technical judgment. However, the non-detect bromomethane (methyl bromide) results in the associated samples were UJ qualified as estimated less than the reporting limit (RL).

L1157939: The recovery of bromomethane was low and outside the laboratory specified acceptance criteria in the CCV in batch WG1326885. Therefore, the non-detect bromomethane results in the associated samples were UJ qualified as estimated less than the RL.

Sample	Analyte	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
CMW10DS-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9

Sample	Analyte	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier*	Reason Code**
CMW17DS-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
CMW18DS-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
CMW18DS-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
CMW19DS-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
D17DG-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
D17DS-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
EW1-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
EW12-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
EW14-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
EW2-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
EW23-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
TS-C-EFF-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
TS-C-EFF-110419-DUP	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
TS-C-INF-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
VMWA-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
VMWB-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
VMWC-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
VMWD-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
VMWE-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
VMWF-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
VMWG-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
VMWH-110419	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9
TRIP BLANK LOT#414	Methyl Bromide	0.000157	U,J0	0.000157	UJ	9

ppm-parts per million
J0-laboratory flag defined as the identification of the analyte is acceptable, but the reported concentration is an estimate. The calibration met method criteria.
* Validation qualifiers are defined in Attachment 1 at the end of this report

**Reason codes are defined in Attachment 2 at the end of this report

1.2 Holding Time

The holding time for the VOC analysis of a preserved water sample is 14 days from collection to analysis. The holding times were met for the sample analyses.

1.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Four method blanks were reported (batches WG1380372, WG1381136, WG1378829, and WG1380768). VOCs were not detected in the method blanks above the method detection limits (MDLs), with the following exceptions.

L1157928: Cis-1,2-dichloroethene was detected in the method blank in batch WG1378829 at an estimated concentration greater than the MDL and less than the RL. No qualifications were applied to the data where cis-1,2-dichloroethene was either not detected or detected at a concentration greater than the RL. However, the cis-1,2-dichloroethene estimated concentrations in samples EW1-110419, EW14-110419, EW2-110419, VMWA-110419, VMWC-110419, VMWD-110419, VMWE-110419, VMWF-110419, and VMWH-110419 were U qualified as not detected at the RL based on technical and professional judgment.

L1127014: Acetone was detected in the method blank in batch WG1381136 at an estimated concentration greater than the MDL and less than the RL. Since acetone was not detected in the associated samples, no qualifications were applied to the data.

Sample	Analyte	Laboratory Result (ppm)	Laboratory Flag	Validation Result (ppm)	Validation Qualifier	Reason Code
EW1-110419	cis-1,2-Dichloroethene	0.000948	B	0	U	3
EW14-110419	cis-1,2-Dichloroethene	0.00115	B	0	U	3
EW2-110419	cis-1,2-Dichloroethene	0.00165	B	0	U	3
VMWA-110419	cis-1,2-Dichloroethene	0.000805	B	0	U	3
VMWC-110419	cis-1,2-Dichloroethene	0.00247	B	0	U	3
VMWD-110419	cis-1,2-Dichloroethene	0.000704	B	0	U	3
VMWE-110419	cis-1,2-Dichloroethene	0.00174	B	0	U	3
VMWF-110419	cis-1,2-Dichloroethene	0.00142	B	0	U	3
VMWH-110419	cis-1,2-Dichloroethene	0.000629	B	0	U	3

ppm-parts per million
B-laboratory flag indicating analyte was detected in both the sample and associated method blank

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

MS/MSD pairs were not reported with the data.

1.5 Laboratory Control Sample (LCS)

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Three LCSs and one LCS/LCS duplicate (LCSD) pair were reported. The recovery and relative percent difference (RPD) results were within the laboratory specified acceptance criteria.

1.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

1.7 Field Duplicate

One field duplicate sample was collected with the sample set, TS-C-EFF-110419-DUP. Acceptable precision (RPD $\leq$30%) was demonstrated between the field duplicates and the original sample, TS-C-EFF-110419.

1.8 Trip Blank

One trip blank, TRIP BLANK LOT#414, accompanied the sample shipments. VOCs were not detected in the trip blank above the RLs.

1.9 Sensitivity

The sample results were reported to the RLs. No elevated non-detect results were reported.

1.10 Electronic Data Deliverable (EDD) Review

Results and sample IDs in the EDDs were reviewed against the information provided by the associated level II report at a minimum of 20% as part of the data validation process. It was noted that the data were reported in units of parts per million (ppm) in the EDDs, while the sample data were reported in units of parts per billion (or microgram per liter, µg/L) in the level II reports. This did not affect the quality of the data. No other discrepancies were identified between the level II reports and the EDDs.

2.0 SELECTED VOLATILE ORGANIC COMPOUNDS

The air samples were analyzed for selected VOCs per EPA method TO-15/EPA method TO-15 modified (1,1-dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride).

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues

were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

- ✓ Overall Assessment
- ✓ Holding Times
- ✓ Method Blank
- ✓ Laboratory Control Sample
- ✓ Laboratory Duplicate
- ✓ Surrogates
- ✓ Field Duplicate
- ✓ Sensitivity
- ✓ Electronic Data Deliverable Review

2.1 Overall Assessment

The VOC data reported in the sample sets are considered usable for supporting project objectives. The analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for this analysis, for the sample sets is 100%.

2.2 Holding Time

The holding time for the VOC analysis of an air sample collected in a SUMMA® canister is 30 days from collection to analysis. The holding times were met for the sample analyses.

2.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). One method blank was reported (batch P191023). VOCs were not detected in the method blank above the method reporting limits (MRLs).

2.4 Laboratory Control Sample

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). One LCS was reported. The recovery results were within the laboratory specified acceptance criteria.

2.5 Laboratory Duplicate

A laboratory duplicate was not reported with the air samples.

2.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

2.7 Field Duplicate

A field duplicate was not collected with the air samples.

2.8 Sensitivity

The sample results were reported to the MRLs. Elevated non-detect results were reported due to the dilutions analyzed.

2.9 Electronic Data Deliverable Review

Results and sample IDs in the EDD were reviewed against the information provided by the associated level II reports at a minimum of 20% as part of the data validation process. It was noted that the samples were reported to the MRLs in the level II reports; both the MRLs and the MDLs were listed in the EDDs. It was also noted that the data were reported in micrograms per cubic meter ($\mu g/m^3$) in the EDDs, while the sample data were reported in both $\mu g/m^3$ and parts per billion by volume (ppbv) in the level II reports. This did not affect the quality of the data. No other discrepancies were identified between the level II reports and the EDDs.

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ATTACHMENT 1
DATA VALIDATION QUALIFIER DEFINITIONS AND INTERPRETATION KEY
Assigned by Geosyntec's Data Validation Team

DATA QUALIFIER DEFINITIONS

U The analyte was analyzed for, but was not detected above the reported sample quantitation limit. Upon application of the U qualifier to a reported result, the definition changes to "not detected at or above the reported result".

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to positive bias of associated QC or calibration data or attributable to matrix interference.

J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to negative bias of associated QC or calibration data or attributable to matrix interference.

UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

ATTACHMENT 2
DATA VALIDATION REASON CODES
Assigned by Geosyntec's Data Validation Team

Valid Value	Description
1	Preservation requirement not met
2	Analysis holding time exceeded
3	Blank contamination (i.e., method, trip, equipment, etc.)
4	Matrix spike/matrix spike duplicate recovery or RPD outside limits
5	LCS recovery outside limits and RPD outside limits (LCS/LCSD)
6	Surrogate recovery outside limits
7	Field Duplicate RPD exceeded
8	Serial dilution percent difference exceeded
9	Calibration criteria not met
10	Linear range exceeded
11	Internal standard criteria not met
12	Lab duplicates RPD exceeded
13	Other

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Memorandum

Date:	24 January 2020
To:	Cindy Bartlett, RG, LG
	Geosyntec Consultants, Portland, Oregon
From:	Matthew Richardson
CC:	J. Caprio
Subject:	**Stage 2A Data Validations - Level II Data Deliverables –ALS Environmental Service Request Numbers P1907399 and 1911442.**

SITE: Cascade Corp., Fairview Oregon; Job No: PNG0564S19

INTRODUCTION

This report summarizes the findings of the Stage 2A data validation of eight air samples collected on November 5, 2019 and December 3, 2019 as part of the site investigation activities for the Cascade Corp., Fairview Oregon sampling event.

The samples were analyzed by ALS Environmental, Cincinnati, Ohio for the following analytical test:

- United States Environmental Protection Agency (US EPA) Method TO-15 – Volatile Organic Compounds (VOCs)

The sample, SVE-EFF-120319, was analyzed by ALS Environmental, Simi Valley, California for the following analytical test:

- US EPA Method TO-15 Modified – Selected VOCs (1,1-dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride)

EXECUTIVE SUMMARY

Overall, based on this Stage 2A data validation covering the quality control (QC) parameters listed below and based on the information provided, the data as qualified are usable for supporting project objectives. The qualified data should be used within the limitations of the qualifications

The data were reviewed based on the USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, January 2017 (EPA-540-R-2017-002) and the pertinent methods referenced in the data package and professional and technical judgment.

The following samples were analyzed in the data sets:

Laboratory ID	Client ID
P1907399-001	SVE-EFF-120319
1911442-01	SVE-EFF-110519
1911442-02	VW-17D-95.5-110519
1911442-03	VMWC-110519

Laboratory ID	Client ID
1911442-04	VMWE-110519
1911442-05	VMWF-110519
1911442-06	VMWG-110519
1911442-07	VMWH-110519

The laboratory did not report the initial canister pressures upon receipt in laboratory report 1911442. No qualifications were applied to the data. However, the data user should be aware of the implications of the undocumented canister pressures.

1.0 VOLATILE ORGANIC COMPOUNDS

The samples in laboratory report 1911442 were analyzed for the full list of VOCS per US EPA method TO-15 and sample SVE-EFF-120319, was analyzed for selected VOCs per US EPA method TO-15/ US EPA method TO-15 modified (1,1-dichloroethene, cis-1,2-dichloroethene, trichloroethene, tetrachloroethene, and vinyl chloride).

The areas of data review are listed below. A leading check mark (✓) indicates an area of review in which the data were acceptable. A preceding crossed circle (⊗) signifies areas where issues were raised during the course of the validation review and should be considered to determine any impact on data quality and usability.

⊗ Overall Assessment
✓ Holding Times
✓ Method Blank
✓ Laboratory Control Sample
✓ Laboratory Duplicate
✓ Surrogates
✓ Field Duplicate
✓ Sensitivity
⊗ Electronic Data Deliverable Review

1.1 Overall Assessment

1.1.1 Completeness

The VOC data reported in the sample sets are considered usable for supporting project objectives. The analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for this analysis, for the sample sets is 100%.

1.1.2 Analysis Anomaly

The acetone concentration in sample VMWE-110519 was flagged E by the laboratory to indicate the concentration exceeded the calibration range. Therefore, the acetone concentration in sample VMWE-110519 was J qualified as estimated. The data user should be advised the parts per billion by volume (ppbv) acetone result in sample VMWE-110519 is considered to be an estimated concentration as well.

Sample	Analyte	Laboratory Result ($\mu g/m^3$)	Laboratory Flag	Validation Result ($\mu g/m^3$)	Validation Qualifier*	Reason Code**
VMWE-110519	Acetone	72	NA	72	J	10

µg/m3-microgram per cubic meter
NA-not applicable
* Validation qualifiers are defined in Attachment 1 at the end of this report
**Reason codes are defined in Attachment 2 at the end of this report

1.2 Holding Time

The holding time for the VOC analysis of an air sample collected in a SUMMA® canister is 30 days from collection to analysis. The holding times were met for the sample analyses.

1.3 Method Blank

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Four method blanks were reported (batches P191220, P191221, R172423 and R172466). VOCs were not detected in the method blanks above the method reporting limits (MRLs).

1.4 Laboratory Control Sample (LCS)

LCSs were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Four LCSs were reported. The recovery results were within the laboratory specified acceptance criteria.

1.5 Laboratory Duplicate

A laboratory duplicate was not reported with the air samples.

1.6 Surrogates

Acceptable surrogate recoveries were reported for the sample analyses.

1.7 Field Duplicate

A field duplicate was not collected with the air samples.

1.8 Sensitivity

The sample results were reported to the MRLs. Elevated non-detect results were reported due to the dilution analyzed.

1.9 Electronic Data Deliverable Review

Results and sample IDs in the EDD were reviewed against the information provided by the associated level II reports at a minimum of 20% as part of the data validation process. It was noted that the samples were reported to the MRLs in the level II reports; both the MRLs and the MDLs were listed in the EDDs. The EDD did not include the laboratory qualifiers used in the level II reports. It was also noted that the data were reported in micrograms per cubic meter ($\mu g/m^3$) in the EDDs, while the sample data were reported in both $\mu g/m^3$ and parts per billion by volume (ppbv) in the level II reports. This did not affect the quality of the data. No other discrepancies were identified between the level II reports and the EDDs.

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ATTACHMENT 1
DATA VALIDATION QUALIFIER DEFINITIONS AND INTERPRETATION KEY
Assigned by Geosyntec's Data Validation Team

DATA QUALIFIER DEFINITIONS

U The analyte was analyzed for, but was not detected above the reported sample quantitation limit. Upon application of the U qualifier to a reported result, the definition changes to "not detected at or above the reported result".

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

J+ The analyte was positively identified; however, the associated numerical value is likely to be higher than the concentration of the analyte in the sample due to positive bias of associated QC or calibration data or attributable to matrix interference.

J- The analyte was positively identified; however, the associated numerical value is likely to be lower than the concentration of the analyte in the sample due to negative bias of associated QC or calibration data or attributable to matrix interference.

UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

ATTACHMENT 2
DATA VALIDATION REASON CODES
Assigned by Geosyntec's Data Validation Team

Valid Value	Description
1	Preservation requirement not met
2	Analysis holding time exceeded
3	Blank contamination (i.e., method, trip, equipment, etc.)
4	Matrix spike/matrix spike duplicate recovery or RPD outside limits
5	LCS recovery outside limits and RPD outside limits (LCS/LCSD)
6	Surrogate recovery outside limits
7	Field Duplicate RPD exceeded
8	Serial dilution percent difference exceeded
9	Calibration criteria not met
10	Linear range exceeded
11	Internal standard criteria not met
12	Lab duplicates RPD exceeded
13	Other

Technical Memorandum

TO: Chris Kimmel, Project Manager

FROM: Kristi Schultz and Danille Jorgensen

DATE: March 8, 2019

RE: **Boeing Portland (TSA)**
First Quarter 2019 Groundwater Quality Sampling
Laboratory Data Quality Evaluation

This technical memorandum provides the results of a focused data validation associated with 8 groundwater samples and 1 trip blank collected during the first quarter 2019 TSA water quality sampling event at Boeing Portland. Samples were analyzed by Eurofins Lancaster Laboratories Environmental LLC (LLI), located in Lancaster, Pennsylvania. This data quality evaluation covers LLI data package 2028663. Samples submitted to LLI were analyzed for volatile organic compounds ([VOCs]; US Environmental Protection Agency [EPA] Method SW8260C).

The verification and validation check was conducted with guidance from applicable portions of EPA's *National Functional Guidelines for Organic Data Review* (EPA 2016). Landau Associates performed an EPA-equivalent Level IIa verification and validation check on each laboratory data package, which included the following:

- Verification that the laboratory data package contained all necessary documentation (including chain-of-custody records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; explanation of any significant corrective actions taken by the laboratory during the analytical process; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related quality control data, and quality control acceptance criteria).
- Verification that all requested analyses, special cleanups, and special handling methods were performed.
- Evaluation of sample holding times.
- Evaluation of quality control data compared to acceptance criteria, including method blanks, surrogate recoveries, matrix spike results, laboratory duplicate and/or replicate results, and laboratory control sample results.
- Evaluation of overall data quality and completeness of analytical data.

Data validation qualifiers are added to the sample results, as appropriate, based on the verification and validation check. The absence of a data qualifier indicates that the reported result is acceptable without qualification. The data quality evaluation is summarized below. All data was found to be acceptable with no qualifications.

Chain-of-Custody Records

A signed chain-of-custody (COC) record was attached to the data packages. The laboratory received all samples in good condition. All analyses were performed as requested. No special cleanups or handling methods were requested.

Upon receipt by LLI, the sample container information was compared to the associated chain-of-custody and the cooler temperatures were recorded. The coolers were received with temperatures within the EPA-recommended limit of ≤6°C. No qualification of the data was necessary.

Holding Times

For all analyses and all samples, the time between sample collection, extraction (if applicable), and analysis was determined to be within EPA- and project-specified holding times. No qualification of the data was necessary.

Blank Results

Laboratory Method Blanks

At least one method blank was analyzed with each batch of samples for VOCs analysis. Target analytes were not detected at concentrations greater than the reporting limits in the associated method blanks. No qualification of the data was necessary.

Field Trip Blanks and Field Equipment Blanks

One trip blank was submitted to the laboratory for VOC analysis with each sample batch. Target analytes were not detected at concentrations greater than the reporting limits in the associated trip blanks. No qualification of the data was necessary.

No field equipment blanks were submitted for analysis with this sample batch.

Surrogate Recoveries

Appropriate compounds were used as surrogate spikes for the VOCs analysis. Recovery values for the surrogate spikes were within the current laboratory-specified control limits. No qualification of the data was necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) and Laboratory Replicate Results

No matrix spikes were analyzed with this sample batch. No qualification of the data was determined necessary.

Laboratory Control Sample and Laboratory Control Sample Duplicate (LCS/LCSD) Results

At least one laboratory control sample and/or laboratory control sample duplicate (LCS/LCSD) was analyzed with each batch of samples for VOCs analysis. Recoveries and RPDs for the laboratory control

samples and associated duplicates were within the current laboratory-specified control limits. No qualification of the data was necessary.

Blind Field Duplicate Results

As specified in the QAPP, blind field duplicate samples were collected at a rate of one blind field duplicate sample per 20 samples, but not less than one blind field duplicate per sampling round. One pair of blind field duplicate water samples (BOP-Z-0219/BOP-13ds-0219) was submitted for analysis with data package 2028663.

A project-specified control limit of 20 percent was used to evaluate the RPDs between the duplicate samples except when the sample results were within five times the reporting limit. In these cases, a project-specified control limit of plus or minus the reporting limit was used. RPDs for the duplicate sample pairs submitted for analysis were within the project-specified control limits. No qualification of the data was necessary.

Quantitation Limits

Project-specified quantitation limits were met for all samples except for instances where high concentrations required dilution of the sample extracts.

Audit/Corrective Action Records

No audits were performed or required. No corrective action records were generated for this sample batch. Based on the laboratory's case narratives, continuing calibration verification (CCV) recovery results were within laboratory-specified control limits. No qualification of the data was necessary.

Completeness and Overall Data Quality

The completeness for this data set is 100 percent, which meets the project-specified goal of 90 percent minimum.

Data precision was evaluated through laboratory control sample duplicates. Data accuracy was evaluated through laboratory control samples and surrogate spikes. No data were rejected.

LANDAU ASSOCIATES, INC.

Kristi Schultz
Data Specialist

Danille Jorgensen
Environmental Data Manager

DRJ/kes
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References

EPA. 2016. National Functional Guidelines for Superfund Organic Methods Data Review. edited by Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, DC: US Environmental Protection Agency.

Technical Memorandum

TO: Chris Kimmel, Project Manager

FROM: Kristi Schultz and Danille Jorgensen

DATE: May 17, 2019

RE: **Boeing Portland (TSA)**
Second Quarter 2019 Groundwater Quality Sampling
Laboratory Data Quality Evaluation

This technical memorandum provides the results of a focused data validation associated with 4 groundwater samples and 1 trip blank collected during the second quarter 2019 TSA water quality sampling event at Boeing Portland. Samples were analyzed by Eurofins Lancaster Laboratories Environmental LLC (LLI), located in Lancaster, Pennsylvania. This data quality evaluation covers LLI data package 2041709. Samples submitted to LLI were analyzed for volatile organic compounds ([VOCs]; US Environmental Protection Agency [EPA] Method SW8260C).

The verification and validation check was conducted with guidance from applicable portions of EPA's *National Functional Guidelines for Organic Data Review* (EPA 2016). Landau Associates performed an EPA-equivalent Level IIa verification and validation check on each laboratory data package, which included the following:

- Verification that the laboratory data package contained all necessary documentation (including chain-of-custody records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; explanation of any significant corrective actions taken by the laboratory during the analytical process; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related quality control data, and quality control acceptance criteria).
- Verification that all requested analyses, special cleanups, and special handling methods were performed.
- Evaluation of sample holding times.
- Evaluation of quality control data compared to acceptance criteria, including method blanks, surrogate recoveries, matrix spike results, laboratory duplicate and/or replicate results, and laboratory control sample results.
- Evaluation of overall data quality and completeness of analytical data.

Data validation qualifiers are added to the sample results, as appropriate, based on the verification and validation check. The absence of a data qualifier indicates that the reported result is acceptable without qualification. The data quality evaluation is summarized below. All data was found to be acceptable with no qualifications.

Chain-of-Custody Records

A signed chain-of-custody (COC) record was attached to the data packages. The laboratory received all samples in good condition. All analyses were performed as requested. No special cleanups or handling methods were requested.

Upon receipt by LLI, the sample container information was compared to the associated chain-of-custody and the cooler temperatures were recorded. The coolers were received with temperatures within the EPA-recommended limit of ≤6°C. No qualification of the data was necessary.

Holding Times

For all analyses and all samples, the time between sample collection, extraction (if applicable), and analysis was determined to be within EPA- and project-specified holding times. No qualification of the data was necessary.

Blank Results

Laboratory Method Blanks

At least one method blank was analyzed with each batch of samples for VOCs analysis. Target analytes were not detected at concentrations greater than the reporting limits in the associated method blanks. No qualification of the data was necessary.

Field Trip Blanks and Field Equipment Blanks

One trip blank was submitted to the laboratory for VOC analysis with each sample batch. Target analytes were not detected at concentrations greater than the reporting limits in the associated trip blanks. No qualification of the data was necessary.

No field equipment blanks were submitted for analysis with this sample batch.

Surrogate Recoveries

Appropriate compounds were used as surrogate spikes for the VOCs analysis. Recovery values for the surrogate spikes were within the current laboratory-specified control limits. No qualification of the data was necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) and Laboratory Replicate Results

No matrix spikes were analyzed with this sample batch. No qualification of the data was determined necessary.

Laboratory Control Sample and Laboratory Control Sample Duplicate (LCS/LCSD) Results

At least one laboratory control sample and/or laboratory control sample duplicate (LCS/LCSD) was analyzed with each batch of samples for VOCs analysis. Recoveries and RPDs for the laboratory control samples and associated duplicates were within the current laboratory-specified control limits. No qualification of the data was necessary.

Blind Field Duplicate Results

No blind field duplicates were submitted with this sample batch. No qualification of the data was determined necessary.

Quantitation Limits

Project-specified quantitation limits were met for all samples except for instances where high concentrations required dilution of the sample extracts.

Audit/Corrective Action Records

No audits were performed or required. No corrective action records were generated for this sample batch. Based on the laboratory's case narratives, continuing calibration verification (CCV) recovery results were within laboratory-specified control limits. No qualification of the data was necessary.

Completeness and Overall Data Quality

The completeness for this data set is 100 percent, which meets the project-specified goal of 90 percent minimum.

Data precision was evaluated through laboratory control sample duplicates. Data accuracy was evaluated through laboratory control samples and surrogate spikes. No data were rejected.

LANDAU ASSOCIATES, INC.

Kristi Schultz
Data Specialist

Danille Jorgensen
Environmental Data Manager

DRJ/kes
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References

EPA. 2016. National Functional Guidelines for Superfund Organic Methods Data Review. edited by Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, DC: US Environmental Protection Agency.

Technical Memorandum

TO: Chris Kimmel, Project Manager

FROM: Kristi Schultz and Danille Jorgensen

DATE: September 20, 2019

RE: **Boeing Portland (TSA)**
Third Quarter 2019 Groundwater Quality Sampling
Laboratory Data Quality Evaluation

This technical memorandum provides the results of a focused data validation associated with 20 groundwater samples and 1 trip blank collected during the third quarter 2019 TSA water quality sampling event at Boeing Portland. Samples were analyzed by Eurofins Lancaster Laboratories Environmental LLC (ELLE), located in Lancaster, Pennsylvania. This data quality evaluation covers LLI data package 2058749. Samples submitted to ELLE were analyzed for volatile organic compounds ([VOCs]; US Environmental Protection Agency [EPA] Method SW8260C).

The verification and validation check was conducted with guidance from applicable portions of EPA's *National Functional Guidelines for Organic Data Review* (EPA 2016). Landau Associates performed an EPA-equivalent Level IIa verification and validation check on each laboratory data package, which included the following:

- Verification that the laboratory data package contained all necessary documentation (including chain-of-custody records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; explanation of any significant corrective actions taken by the laboratory during the analytical process; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related quality control data, and quality control acceptance criteria).
- Verification that all requested analyses, special cleanups, and special handling methods were performed.
- Evaluation of sample holding times.
- Evaluation of quality control data compared to acceptance criteria, including method blanks, surrogate recoveries, matrix spike results, laboratory duplicate and/or replicate results, and laboratory control sample results.
- Evaluation of overall data quality and completeness of analytical data.

Data validation qualifiers are added to the sample results, as appropriate, based on the verification and validation check. The absence of a data qualifier indicates that the reported result is acceptable without qualification. The data quality evaluation is summarized below. Data validation qualifiers are summarized in Table 1.

Chain-of-Custody Records

A signed chain-of-custody (COC) record was attached to the data packages. The laboratory received all samples in good condition. All analyses were performed as requested. No special cleanups or handling methods were requested.

Upon receipt by LLI, the sample container information was compared to the associated chain-of-custody and the cooler temperatures were recorded. The coolers were received with temperatures within the EPA-recommended limit of ≤6°C. No qualification of the data was necessary.

Holding Times

For all analyses and all samples, the time between sample collection, extraction (if applicable), and analysis was determined to be within EPA- and project-specified holding times. No qualification of the data was necessary.

Blank Results

Laboratory Method Blanks

At least one method blank was analyzed with each batch of samples for VOCs analysis. Target analytes were not detected at concentrations greater than the reporting limits in the associated method blanks. No qualification of the data was necessary.

Field Trip Blanks and Field Equipment Blanks

One trip blank was submitted to the laboratory for VOC analysis with each sample batch. Target analytes were not detected at concentrations greater than the reporting limits in the associated trip blanks. No qualification of the data was necessary.

No field equipment blanks were submitted for analysis with this sample batch.

Surrogate Recoveries

Appropriate compounds were used as surrogate spikes for the VOCs analysis. Recovery values for the surrogate spikes were within the current laboratory-specified control limits. No qualification of the data was necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) and Laboratory Replicate Results

No matrix spikes were analyzed with this sample batch. No qualification of the data was determined necessary.

Laboratory Control Sample and Laboratory Control Sample Duplicate (LCS/LCSD) Results

At least one laboratory control sample and/or laboratory control sample duplicate (LCS/LCSD) was analyzed with each batch of samples for VOCs analysis. Recoveries and RPDs for the laboratory control samples and associated duplicates were within the current laboratory-specified control limits. No qualification of the data was necessary.

Blind Field Duplicate Results

As specified in the QAPP, blind field duplicate samples were collected at a rate of one blind field duplicate sample per 20 samples, but not less than one blind field duplicate per sampling round. Two pairs of blind field duplicate water samples (BOP-Y-0819/BOP-60dg-0819 and BOP-Z-0819/BOP-20ds-0819) were submitted for analysis with data package 2058749.

A project-specified control limit of 20 percent was used to evaluate the RPDs between the duplicate samples except when the sample results were within five times the reporting limit. In these cases, a project-specified control limit of plus or minus the reporting limit was used. RPDs for the duplicate sample pairs submitted for analysis were within the project-specified control limits. No qualification of the data was necessary.

Quantitation Limits

Project-specified quantitation limits were met for all samples except for instances where high concentrations required dilution of the sample extracts.

Audit/Corrective Action Records

No audits were performed or required. No corrective action records were generated for this sample batch. Based on the laboratory's case narratives, continuing calibration verification (CCV) recovery results were within laboratory-specified control limits, with the following exceptions:

- The case narrative indicated the CCV recoveries were low for chloromethane and/or hexanone associated with several samples in data package 2058749. The associated sample results were qualified as estimated (J, UJ), as indicated in Table 1.

Completeness and Overall Data Quality

The completeness for this data set is 100 percent, which meets the project-specified goal of 90 percent minimum.

Data precision was evaluated through laboratory control sample duplicates. Data accuracy was evaluated through laboratory control samples and surrogate spikes. No data were rejected.

LANDAU ASSOCIATES, INC.

Kristi Schultz
Data Specialist

Danille Jorgensen
Environmental Data Manager

DRJ/kes
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Attachment

Table 1. Summary of Data Qualifiers

References

EPA. 2016. National Functional Guidelines for Superfund Organic Methods Data Review. edited by Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, DC: US Environmental Protection Agency.

Table 1
Summary of Data Qualifiers
Boeing Portland TSA Phase I

Data Package	Analyte	Result	Qualifier	Sample Number	Reason
2058749	Chloromethane	0.5 U	UJ	BOP-13ds-0819	Low continuing calibration recovery
2058749	2-Hexanone	5 U	UJ	BOP-13ds-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-13dg-0819	Low continuing calibration recovery
2058749	2-Hexanone	5 U	UJ	BOP-13dg-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-20ds-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-20dg-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-21ds-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-22Rds-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-23dg-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-31ds-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-31dg-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-42ds-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-42dg-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-60dg-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-61ds-0819	Low continuing calibration recovery
2058749	2-Hexanone	5 U	UJ	BOP-61ds-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-62ds-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-65ds-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-66ds-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-y-0819	Low continuing calibration recovery
2058749	2-Hexanone	5 U	UJ	BOP-y-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-z-0819	Low continuing calibration recovery
2058749	2-Hexanone	5 U	UJ	BOP-z-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	EW-3-0819 (orig)	Low continuing calibration recovery
2058749	2-Hexanone	5 U	UJ	EW-3-0819 (orig)	Low continuing calibration recovery
2058749	Acetone	360 E	DNR	EW-3-0819 (orig)	Do not report; use dilution result
2058749	Benzene	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Bromodichloromethane	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Bromoform	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Bromomethane	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	2-Butanone	50 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Carbon Disulfide	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Carbon Tetrachloride	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Chlorobenzene	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Chloroethane	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Chloroform	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Chloromethane	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Dibromochloromethane	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	1,1-Dichloroethane	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	1,2-Dichloroethane	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	1,1-Dichloroethene	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	cis-1,2-Dichloroethene	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	trans-1,2-Dichloroethene	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	1,2-Dichloropropane	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	cis-1,3-Dichloropropene	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	trans-1,3-Dichloropropene	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Ethylbenzene	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	2-Hexanone	50 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	4-Methyl-2-pentanone	50 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Methylene Chloride	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Styrene	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result

Table 1
Summary of Data Qualifiers
Boeing Portland TSA Phase I

Data Package	Analyte	Result	Qualifier	Sample Number	Reason
2058749	1,1,2,2-Tetrachloroethane	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Tetrachloroethene	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Toluene	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	1,1,2-Trichloro-1,2,2-trifluoroethane	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	1,1,1-Trichloroethane	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	1,1,2-Trichloroethane	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Trichloroethene	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Trichlorofluoromethane	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Vinyl Acetate	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Vinyl Chloride	2 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	m,p-Xylene	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	o-Xylene	5 U	DNR	EW-3-0819 (DL)	Do not report; use original result
2058749	Chloromethane	0.5 U	UJ	EW-13-0819	Low continuing calibration recovery
2058749	2-Hexanone	5 U	UJ	EW-13-0819	Low continuing calibration recovery
2058749	Chloromethane	0.5 U	UJ	BOP-61dg-0819	Low continuing calibration recovery
2058749	2-Hexanone	5 U	UJ	BOP-61dg-0819	Low continuing calibration recovery

J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
UJ = The analyte was not detected in the sample; the reported sample reporting limit is an estimate.

Technical Memorandum

TO: Chris Kimmel, Project Manager

FROM: Kristi Schultz and Danille Jorgensen

DATE: December 1, 2019

RE: **Boeing Portland (TSA)**
Fourth Quarter 2019 Groundwater Quality Sampling
Laboratory Data Quality Evaluation

This technical memorandum provides the results of a focused data validation associated with 4 groundwater samples and 1 trip blank collected during the fourth quarter 2019 TSA water quality sampling event at Boeing Portland. Samples were analyzed by Eurofins Lancaster Laboratories Environmental LLC (ELLE), located in Lancaster, Pennsylvania. This data quality evaluation covers LLI data package 2073408. Samples submitted to ELLE were analyzed for volatile organic compounds ([VOCs]; US Environmental Protection Agency [EPA] Method SW8260C).

The verification and validation check was conducted with guidance from applicable portions of EPA's *National Functional Guidelines for Organic Data Review* (EPA 2016). Landau Associates performed an EPA-equivalent Level IIa verification and validation check on each laboratory data package, which included the following:

- Verification that the laboratory data package contained all necessary documentation (including chain-of-custody records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; explanation of any significant corrective actions taken by the laboratory during the analytical process; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related quality control data, and quality control acceptance criteria).
- Verification that all requested analyses, special cleanups, and special handling methods were performed.
- Evaluation of sample holding times.
- Evaluation of quality control data compared to acceptance criteria, including method blanks, surrogate recoveries, matrix spike results, laboratory duplicate and/or replicate results, and laboratory control sample results.
- Evaluation of overall data quality and completeness of analytical data.

Data validation qualifiers are added to the sample results, as appropriate, based on the verification and validation check. The absence of a data qualifier indicates that the reported result is acceptable without qualification. The data quality evaluation is summarized below. Data validation qualifiers are summarized in Table 1.

Chain-of-Custody Records

A signed chain-of-custody (COC) record was attached to the data packages. The laboratory received all samples in good condition. All analyses were performed as requested. No special cleanups or handling methods were requested.

Upon receipt by LLI, the sample container information was compared to the associated chain-of-custody and the cooler temperatures were recorded. The coolers were received with temperatures within the EPA-recommended limit of ≤6°C. No qualification of the data was necessary.

Holding Times

For all analyses and all samples, the time between sample collection, extraction (if applicable), and analysis was determined to be within EPA- and project-specified holding times. No qualification of the data was necessary.

Blank Results

Laboratory Method Blanks

At least one method blank was analyzed with each batch of samples for VOCs analysis. Target analytes were not detected at concentrations greater than the reporting limits in the associated method blanks. No qualification of the data was necessary.

Field Trip Blanks and Field Equipment Blanks

One trip blank was submitted to the laboratory for VOC analysis with each sample batch. Target analytes were not detected at concentrations greater than the reporting limits in the associated trip blanks. No qualification of the data was necessary.

No field equipment blanks were submitted for analysis with this sample batch.

Surrogate Recoveries

Appropriate compounds were used as surrogate spikes for the VOCs analysis. Recovery values for the surrogate spikes were within the current laboratory-specified control limits. No qualification of the data was necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) and Laboratory Replicate Results

No matrix spikes were analyzed with this sample batch. No qualification of the data was determined necessary.

Laboratory Control Sample and Laboratory Control Sample Duplicate (LCS/LCSD) Results

At least one laboratory control sample and/or laboratory control sample duplicate (LCS/LCSD) was analyzed with each batch of samples for VOCs analysis. Recoveries and RPDs for the laboratory control samples and associated duplicates were within the current laboratory-specified control limits. No qualification of the data was necessary.

Blind Field Duplicate Results

No blind field duplicates were submitted with this sample batch. No qualification of the data was determined necessary.

Quantitation Limits

Project-specified quantitation limits were met for all samples except for instances where high concentrations required dilution of the sample extracts.

Audit/Corrective Action Records

No audits were performed or required. No corrective action records were generated for this sample batch. Based on the laboratory's case narratives, continuing calibration verification (CCV) recovery results were within laboratory-specified control limits, with the following exceptions:

- The case narrative indicated the CCV recoveries were low for trichlorofluoromethane, vinyl acetate, and bromoform associated with several samples in data package 2073408. The associated sample results were qualified as estimated (J, UJ), as indicated in Table 1.

Completeness and Overall Data Quality

The completeness for this data set is 100 percent, which meets the project-specified goal of 90 percent minimum.

Data precision was evaluated through laboratory control sample duplicates. Data accuracy was evaluated through laboratory control samples and surrogate spikes. No data were rejected.

LANDAU ASSOCIATES, INC.

Kristi Schultz
Data Specialist

Danille Jorgensen
Environmental Data Manager

DRJ/kes
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Attachment

Table 1. Summary of Data Qualifiers

References

EPA. 2016. National Functional Guidelines for Superfund Organic Methods Data Review. edited by Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, DC: US Environmental Protection Agency.

Table 1
Summary of Data Qualifiers
Boeing Portland TSA Phase I

Data Package	Analyte	Result	Qualifier	Sample Number	Reason
2073408	Trichlorofluoromethane	0.5 U	UJ	BOP-13ds-1119	Low continuing calibration recovery
2073408	Vinyl Acetate	0.5 U	UJ	BOP-13ds-1119	Low continuing calibration recovery
2073408	Bromoform	0.5 U	UJ	BOP-13ds-1119	Low continuing calibration recovery
2073408	Trichlorofluoromethane	0.5 U	UJ	BOP-13dg-1119	Low continuing calibration recovery
2073408	Vinyl Acetate	0.5 U	UJ	BOP-13dg-1119	Low continuing calibration recovery
2073408	Bromoform	0.5 U	UJ	BOP-13dg-1119	Low continuing calibration recovery
2073408	Trichlorofluoromethane	0.5 U	UJ	BOP-31ds-1119	Low continuing calibration recovery
2073408	Vinyl Acetate	0.5 U	UJ	BOP-31ds-1119	Low continuing calibration recovery
2073408	Bromoform	0.5 U	UJ	BOP-31ds-1119	Low continuing calibration recovery
2073408	Trichlorofluoromethane	0.5 U	UJ	BOP-31dg-1119	Low continuing calibration recovery
2073408	Vinyl Acetate	0.5 U	UJ	BOP-31dg-1119	Low continuing calibration recovery
2073408	Bromoform	0.5 U	UJ	BOP-31dg-1119	Low continuing calibration recovery

J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

UJ = The analyte was not detected in the sample; the reported sample reporting limit is an estimate.