DATA VALIDATION REPORT

Red Hill Bulk Fuel Storage Facility
Joint Base Pearl Harbor-Hickam
CTO 18F0126

SDG 22G0156
Third Quarter 2022
APPL, Inc.

Prepared by

ENVIRONMENTAL DATA SERVICES, LTD.

Prepared for

AECOM Environmental

Released: 8/25/22

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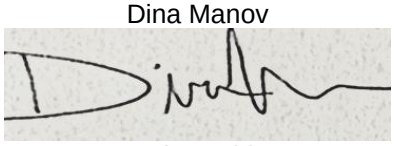
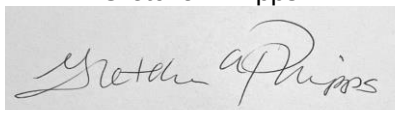
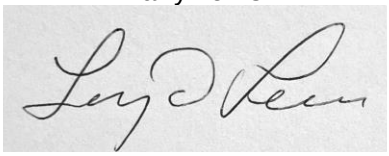


Gretchen Phipps



Larry Lewis



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ENVIRONMENTAL DATA SERVICES, LTD.

EXECUTIVE NARRATIVE

SDG: 22G0156
Laboratory: APPL, Inc.
Site: Red Hill Bulk Storage Facility, CTO 18F0126
Sampling dates: 7/21/2022
Test Method: SW 846 8270D
Analysis: 2-(2-methoxyethoxy)-ethanol

Quality Assurance Project Plan: Sampling and Analysis Plan, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i (Revision 01, April 2017), (SAP).

Validation Guidelines: Department of Defense Module 1: Data Validation Procedure for Organic Analysis by GC/MS, May 2020; United States Department of Defense (DOD) Environmental Data Quality Workgroup (EDQW), November 2019, General Data Validation Guidelines, and Department of Defense Quality Systems Manual (DoD QSM) for Environmental Laboratories Version 5.4 (DoD and DOE 2021), United States Department of Defense Data Validation Guidelines Modules 1, 2, 3, and 4 Revised Table for Sample Qualification in the Presence of Blank Contamination, February 09, 2022.

Client Sample Identification	Laboratory Sample Identification	Matrix	Validation Stage
RHMW2254-01-WGN01LF-22Q3	22G0156-01	groundwater	S2BVEM
RHMW2254-01-WGFD01LF-22Q3	22G0156-02	groundwater	S2BVEM

Table 1 provides a summary of the major and minor data quality issues identified in this data set. All data are acceptable except those results which have been qualified with "X", rejected. Data validation qualifiers along with associated descriptions are provided in Table 2. All data qualification related to this group of samples is detailed on the attached sheets.

All data users should note two facts. First, an "X" flag means that the associated value is unusable due to significant quality control (QC) problems, the data is invalid and provides no information as to whether the compound is present or not. "X" values should not appear on any data tables even as a last resort. Second, no analyte concentration, even if it passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data, but any value potentially contains error.

DATA ASSESSMENT

1. NARRATIVE AND COMPLETENESS REVIEW:

The case narrative was reviewed, and the data package was checked for completeness. No discrepancies were noted.

2. SAMPLE DELIVERY AND CONDITION:

The sample arrived at the laboratory in acceptable condition. Proper custody was documented. No qualification was required.

3. HOLDING TIME:

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detect results will be flagged as not detected at an estimated quantitation limit, "UJ", unless the holding time is grossly exceeded (by more than three times the holding time specified), in which case non-detect results are flagged "X", rejected. Qualifications were applied to the samples and analytes as shown below.

No problems were found for this criterion.

4. MASS SPECTROMETER TUNING:

Tuning and performance criteria are established to ensure adequate mass resolution, proper identification of compounds and to some degree, sufficient instrument sensitivity. These criteria are not sample specific. Instrument performance is determined using standard materials. Therefore, these criteria should be met in all circumstances. The tuning standard for semi-volatile organics is decafluorotriphenylphosphine. If the mass calibration is in error, all associated data will be classified as unusable "X". Qualifications were applied to the samples and analytes as shown below.

No problems were found for this criterion.

5. CALIBRATION:

Satisfactory instrument calibration is established to ensure that the instrument can produce acceptable quantitative data. An initial calibration demonstrates that the instrument can give acceptable performance at the beginning of an experimental sequence. The continuing calibration checks document that the instrument is giving satisfactory daily performance.

A) Response Factor:

The response factor measures the instrument's response to specific chemical compounds. All analytes for initial and continuing calibration should meet the minimum relative response factor (RRF) criteria. If the RRF is less than minimum RRF specified, professional judgment is used, and all detects in the sample will be qualified as "J". All non-detects for that compound will be rejected "X". Qualifications were applied to the samples and analytes as shown below.

No problems were found for this criterion.

B) Percent Relative Standard Deviation and Percent Difference:

Percent relative standard deviation (%RSD) is calculated from the initial calibration and is used to indicate the stability of the specific compound response factor over increasing concentration. Percent difference (%D) compares the response factor of the continuing calibration check to the mean RRF from the initial calibration.

Percent RSD must be less than maximum %RSD listed in the Department of Defense Quality Systems Manual or, in cases where linear and non-linear regressions are used, correlation coefficients must be greater than those listed in the Department of Defense Quality Systems Manual. For the opening or closing continuing calibration verification (CCV) the %D must be within the inclusive opening or closing maximum %D limits as listed in the Department of Defense Quality Systems Manual for all target compounds. A value outside of these limits indicates potential detection and quantitation errors. If the %RSD exceeds quality control criteria, detects may be qualified as "J" and professional judgment is used to qualify non-detects. If the %D exceeds quality control criteria, the positive results are flagged as estimated, "J" and non-detects are flagged "UJ". Qualifications were applied to the samples and analytes as shown below.

No problems were found for this criterion.

6. BLANK CONTAMINATION:

Quality assurance (QA) blanks, i.e., method, trip, field, or rinse blanks are prepared to identify any contamination which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below. When an equipment blank, trip blank, or lab blank has an analyte detection greater than ½ the analyte Limit of Quantitation (LOQ), then all associated field samples are flagged per validation guidance.

A) Method blank contamination:

No problems were found for this criterion.

B) Field /Equipment blank contamination:

No samples were submitted as field/equipment blanks submitted in association with the samples in this sample delivery group (SDG).

7. SURROGATES:

All samples are spiked with system monitoring compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate recovery limits were outside quality control limits established in the Department of Defense Quality Systems Manual, qualifications were applied to all the samples and analytes as shown below.

Surrogates were not added to the samples by the laboratory. Using professional judgement, no sample results were qualified since the LCS/LCSD percent recoveries were within QC limits or did not result in a need to qualify sample results.

8. MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY:

Matrix spike/matrix spike duplicate (MS/MSD) data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD data may be used in conjunction with other quality control criteria for additional qualification of data. All MS/MSD percent recoveries must fall within the Department of Defense Quality Systems Manual limits. In addition, relative percent differences observed between results reported for the pair must be ≤ 20%.

No sample was submitted for MS/MSD analyses in association with this SDG.

9. COMPOUND IDENTIFICATION AND QUANTIFICATION:

Compound Identification

The compounds are identified on the GC/MS by using the analytes relative retention time (RRT) and ion spectra. For the results to be a positive hit the sample peak must be within ±0.06 RRT units of the standard compound and have an ion spectrum which has a ratio of the primary and secondary m/e intensities within 20% of that in the standard compound. In the cases where there is not an adequate ion spectrum match, the laboratory may have provided false positive identifications.

Target compound identifications were not reviewed at the Stage 2B level.

Tentatively Identified Compounds (TICs) were not reported and were not required to be reported for this program per the project SAP.

Compound Quantification

Target compound results quantitation were not reviewed at the Stage 2B level.

Manual integrations were not reviewed for samples at the Stage 2B level.

10. INTERNAL STANDARDS PERFORMANCE:

Internal standard performance criteria are meant to ensure that the gas chromatograph/mass spectrometer (GC/MS) sensitivity and response are stable during every experimental run.

The internal standard area count must not vary by more than a factor of two from the associated continuing calibration standard. The retention time of the internal standard must not vary by more than ±30 seconds from the associated continuing calibration standard. The area count must be within a (50-200%) range of the associated standard. If the area count is greater than 200%, non-detected results are not qualified, and positive results are flagged as estimated "J". If the area count is less than 50%, positive results are flagged as estimated "J" and non-detected results are flagged "UJ". If the area count is less than 25%, positive results are flagged as estimated "J" and non-detected results will be classified as unusable "X". Qualifications were applied to the samples and analytes as shown below.

No problems were found for this criterion.

11. FIELD DUPLICATES:

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of ≤ 50% for the Relative Percent Difference (RPD) for water samples and ≤ 100% RPD for solid samples, shall be used for original and duplicate sample values greater than or equal to the sample specific LOQ. For field duplicate analyses that do not meet the technical criteria, the action was applied to only the parent sample and its duplicate.

Samples RHMW2254-01-WGN01LF-22Q3 and RHMW2254-01-WGFD01LF-22Q3 were submitted as a field duplicate pair in association with this SDG. Adequate field precision was demonstrated.

12. LABORATORY CONTROL SAMPLES:

The Laboratory Control Sample (LCS) serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Aqueous/water, soil/sediment, wipe, and filter LCSs shall be analyzed for each analyte utilizing the same sample preparations, analytical methods, and quality assurance/quality control (QA/QC) procedures as employed for the samples. All LCS percent recoveries must fall within the Department of Defense Quality Systems Manual limits. Qualifications were applied to the samples and analytes as shown below.

No problems were found for this criterion with the following exceptions. The observed relative percent difference (RPD) for 2-(2-methoxyethoxy)ethanol in the LCS and Laboratory Control Sample Duplicate (LCSD) was outside the acceptance limit. The associated sample results were non-detected; therefore, the sample results were not qualified on this basis.

13. OTHER PROBLEMS:

None.

14. DILUTIONS, RE-EXTRACTIONS & REANALYSIS:

Samples may be re-analyzed for dilution, re-extraction and for other QC reasons. In such cases, the best result values are used.

No dilutions, re-extractions, or other re-analyses were performed.

Table 1 Major and Minor Findings

	Were acceptance criteria met?			
	Yes	No		
Semi-volatiles		**Major**	**Minor**	**Number of Results Qualified**
Holding Time	x			
Mass Spectrometer Tuning	x			
Calibration	x			
Response Factor	x			
Percent Relative Standard Deviation and Percent Deviation	x			
Internal Standards	x			
Method Blank	x			
Equipment Blank	NA			
Surrogates	NA			
Matrix Spike/Matrix Spike Duplicate	NA			
Compound Identification and Quantitation	NA			
Field Duplicate	x			
Laboratory Control Samples	x			
Other Quality Control Data out of Specification	x			

Major = Major data quality issue identified resulting in rejection of data.
Minor = Minor data quality issue identified resulting in the qualification of data. Data qualification should be used to inform the data users of data limitations.
NA = Not applicable

Table 2 Data Validation Qualifiers

Data Qualifier	Definition
U	The analyte was analyzed for but was not detected above the level of the reported sample quantitation limit.
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
UJ	The analyte was analyzed for but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
X	The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a tentative identification.
NJ	The analyte was tentatively identified, and the associated numerical value represents its approximate concentration.

Calculation Documentation

Field Duplicate Calculations

Parameters	Original Sample	Duplicate Sample	RPD	LOQ	Flag
	RHMW2254-01-WGN01LF-22Q3	RHMW2254-01-WGFD01LF-22Q3			
2-(2-Methoxy ethoxy)ethanol	0	0	#DIV/0!	100	

Data Validation Worksheet

DATA VALIDATION GC/MS (8260/8270)

DOD MODULE 1

Validator: LL

Date Validated: 08/24/2022

Reviewer: GAP

Review Date: 8/25/22

Project: Red Hill Bulk Storage Facility, CTO 18F0126

SDG: 22G0156

LAB: APPL, Inc.

Samples Collected: 7/21/2022

Sample Receipt and Case Narrative Review

- ✓ Traffic reports, chain-of-custody forms or SDG narrative do not indicate any problems with sample receipt, condition of the samples, analytical problems or special circumstances affecting the quality of the data.

  No problems found

Holding Times (see Table 1 Module)

- ✓ VOC: aqueous: ≤6◦C analyzed and properly preserved analyzed within 14 days
- ✓ VOC: solid: ≤6◦C and properly preserved analyzed within 14 days
- ✓ SVOC: aqueous: ≤6◦C extraction within 7 days, analysis withing 40days of extraction
- ✓ SVOC: solid: ≤6◦C extraction within 14 days, analysis withing 40days of extraction
- ✓ VOC: if sample vial has air bubble or headspace, is cracked, or improperly sealed qualify J- / UJ
- ✓ If hold time is exceeded qualify J- / UJ
- ✓ If hold time is grossly exceeded by a factor of 2 qualify J- / X

  Samples collected on 7/21/2022
  Samples extracted on 7/21/2022
  Samples analyzed on 7/25/2022

Tune Check/ICAL//ICV/CCV (from VI, VII, VII/Analysis Run Log)

- ✓ Tune check was performed at the beginning of each 12-hour period which sample were analyzed
- ✓ All tune check criteria is met

All okay unless noted below.

INST: Kylo

MS Tune SB01606-TUN1 0628K003.D 06/28/22 09:00	all ok
Cal Standard SB01606-CAL1 0628K004.D 06/28/22 09:13	all ok
Secondary Cal Check SB01606-SCV1 0628K012.D 06/28/22 12:02	all ok
MS Tune SB01968-TUN1 0628K044.D 07/22/22 09:49	all ok
Calibration Check SB01968-CCV1 0628K045.D 07/22/22 10:02	all ok
Closing Cal Check SB01968-HCV1 0628K054.D 07/22/22 19:04	all ok
MS Tune SB01994-TUN1 0628K057.D 07/25/22 08:54	all ok
Calibration Check SB01994-CCV1 0628K058.D 07/25/22 09:07	all ok
Closing Cal Check SB01994-HCV1 0628K071.D 07/25/22 15:33	all ok

SVOC

- ✓ minimum RF met listed below in Table IX
- ✓ if RF out then qualify J / UJ
- ✓ if RF <0.01 then qualify J / X
- ✓ ICAL: all %RSDs ≤15% or r2≥0.99
- ✓ if %RSD out then qualify J / UJ (>30% J / X)
- ✓ ICV after ICAL
- ✓ CCVs before sample, every 12 hours, ending
- ✓ all ICV/CCV %D ± 20%; if out ↑ qualify J+ / UJ; if out ↓ qualify J- / UJ
- ✓ closing CCV %D ± 50%
- ✓ RTs within established window
- ✓ For 8270 SIM analyses % degradation ≤20% for DDT

Surrogate (Form II)

- ✓ if acceptance criteria is not defined by project, use limits in Table C below
- ✓ RTs within range of 5 pt
- ✓ do not evaluate for if diluted out

SVOCs

- ✓ if surrogate <lower limit but >10% within a fraction (acid or base/neutral) qualify associated fraction J- / UJ
- ✓ if surrogate >upper limit within a fraction (acid or base/neutral) qualify associated fraction J+
- ✓ if surrogate <10% within a fraction (acid or base/neutral) qualify associated fraction J- / X

No surrogate reported

LCS (Form III)

- ✓ one per prep batch
- ✓ If spike compound is not listed in Table C-15(solid) or C-16(aqueous) below then use lab limits
- ✓ if %R >upper limit qualify J+
- ✓ if %R <lower limit qualify J- / X
- ✓ if RPD out qualify J (positive results only)

Use 70-130%

LCS BBG0383-BS1 0628K047.D 07/22/22 16:39
LCS Dup BBG0383-BSD1 0628K048.D 07/22/22 16:59 RPD out, sample ND no Q

MS/MSD (Form III)

- ✓ one per prep batch
- ✓ If spike compound is not listed in Table C-25 to C-28 above then use lab limits
- ✓ do not evaluate if sample concentration is >4X spike concentration
- ✓ if %R >upper limit qualify parent sample J+
- ✓ if %R <lower limit but >10%qualify parent sample J- / UJ
- ✓ if %R <10%qualify parent sample J- / X
- ✓ if RPD out qualify J (positive results only)

None

Blanks (Form IV/Form1)

✓ method blank – analyzed one per prep batch

✓ if method blank contamination is greater than field blank contamination then qualify the field blank (however, **do not** qualify a method blank for field blank contamination)

Professional judgment should be applied to any field blank result that was associated with a contaminated method blank. Generally, if the blank result was qualified as a non-detect due to the method blank, it does not need to be applied to the associated sample results.

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Department of Defense
Module 1 Data Validation Guidelines: Data Validation Procedure for Organic Analysis by GC/MS
May 2020 Revision 1

However, the fact that the field blank was qualified should be noted in the data validation report.

Multiple blank contaminations (such as a batch with field blanks and a method blank) does not establish a 'hierarchy' of one blank over another. Each blank must be evaluated individually. Blanks should not be qualified due to the results of other blanks.

Method Blank

BBG0383-BLK1 ND

Field Blank

✓ trip blanks required for VOC – one per cooler

✓ use 5X rule to qualify

✓ use 10X rule to qualify for methylene chloride, acetone, 2-butanone, phthalates(SVOC)

United States Department of Defense Data Validation Guidelines Modules 1, 2, 3, and 4 Revised Table for Sample Qualification in the Presence of Blank Contamination, February 09, 2022

Table A: Sample Qualification in the Presence of Blank Contamination

	Sample		
Row Number	Result	Validated Result	Validation Qualifier
1	non-detect or detect ≤ LOD	Report at LOD	U
2	> LOD and ≤ 5x blank	Report at Sample Result	J+
3	> 5x blank	Report at Sample Result	None

LOD = Limit of Detection

See Note Above

none submitted

Internal Standard Areas and RTs (Form VIII)

- ✓ areas within -50% to +100% of ICAL midpoint standard
- ✓ if area >200% of ICAL midpoint standard qualify J- (no qual for ND)
- ✓ if area <50% but >20% of ICAL midpoint standard qualify J+ / UJ
- ✓ if area <20% of ICAL midpoint standard qualify positive and NDs X
- ✓ RTs within 30 seconds of midpoint standard
- ✓ if RTs not withing 30 seconds qualify NDs X

Internal standard used – 1,4-DCBd4 all ok

Sample Data (Form I)

- ✓ Chromatogram acceptable
- ✓ manual integrations acceptable

NA

FIELD DUPLICATES

✓ if RPD is greater than those stated in the QAPP, qualification of the associated sample results is not necessary, but any non-conformities should be noted in the data validation summary.

✓ See field duplicate worksheet

RHMW2254-01-WGN01LF-22Q3 22G0156-01

RHMW2254-01-WGFD01LF-22Q3 22G0156-02

ok

Automated Data Review Detail Report for 22G0156
RH Groundwater Long Term Monitoring
RHS Groundwater Long Term Monitoring UFP-QAPP

Sample Summary

Location	Field Sample ID	Date	Time	Sample Type	Matrix	SBD	SED	SW8270D
RHMW2254-01	RHMW2254-01-WGN01LF-22Q3	07-21-2022	0835	N	WG	0.00	0.00	X
RHMW2254-01	RHMW2254-01-WGFD01LF-22Q3	07-21-2022	0835	FD	WG	0.00	0.00	X
							Total	**2**

Automated Data Review Detail Report for 22G0156
RH Groundwater Long Term Monitoring
RHS Groundwater Long Term Monitoring UFP-QAPP

Batch Report

Test Method: SW8270D Analysis Batch: SB01968

Location	Matrix	Field Sample ID	Lab Sample ID	Calibration Ref	Run#/ Dil'n	Collection Date/Time	Extraction Date/Time	Analysis Date/Time	Prep/Leach Batch	Sample Type
LABQC	WQ	LABQC	BBG0383-BLK1	2227002	1/1	7/21/2022 16:01	7/21/2022 16:01	7/22/2022 16:18	BBG0383/	LB
LABQC	WQ	LABQC	BBG0383-BS1	2227002	1/1	7/21/2022 16:01	7/21/2022 16:01	7/22/2022 16:39	BBG0383/	BS
LABQC	WQ	LABQC	BBG0383-BSD1	2227002	1/1	7/21/2022 16:01	7/21/2022 16:01	7/22/2022 16:59	BBG0383/	BD

Test Method: SW8270D Analysis Batch: SB01994

Location	Matrix	Field Sample ID	Lab Sample ID	Calibration Ref	Run#/ Dil'n	Collection Date/Time	Extraction Date/Time	Analysis Date/Time	Prep/Leach Batch	Sample Type
RHMW2254-01	WG	RHMW2254-01-WGN01LF-22Q3	22G0156-01	2227002	1/1	7/21/2022 08:35	7/21/2022 16:01	7/25/2022 10:15	BBG0383/	N
RHMW2254-01	WG	RHMW2254-01-WGFD01LF-22Q3	22G0156-02	2227002	1/1	7/21/2022 08:35	7/21/2022 16:01	7/25/2022 10:35	BBG0383/	FD

Automated Data Review Detail Report for 22G0156
RH Groundwater Long Term Monitoring
RHS Groundwater Long Term Monitoring UFP-QAPP

Field Batch Report

--No Records Found--

MS Mismatch Report

--No Records Found--

Section to identify Matrix Spike mismatches where parent sample differs from MS by dilution.

Automated Data Review Detail Report for 22G0156
RH Groundwater Long Term Monitoring
RHS Groundwater Long Term Monitoring UFP-QAPP

QC Outlier Report

Test Method: SW8270D Extraction Method: SW3535A Leach Method: NONE

QC Element	Sample ID/ Lab Sample ID	Run#/ Dil'n	Analyte	Result (Units)	Qualifier	Warning Limits	Control Limits	Reason	Comment	Rule	Action Level
LCS RPD	BBG0383-BSD1 (BD) / BBG0383-BSD1	1 / 1.00	2-(2-Methoxy ethoxy)ethanol	24.56 (rpd)	R/R	< 20	< 20	Z			

Rule is the multiplier used when blank contamination occurs to determine action level.

Automated Data Review Detail Report for 22G0156
RH Groundwater Long Term Monitoring
RHS Groundwater Long Term Monitoring UFP-QAPP

Qualified Results

--No Records Found--

Detected Results

--No Records Found--

Rejected Results

--No Records Found--

Anomalies Count

--No Records Found--

Automated Data Review Detail Report for 22G0156
RH Groundwater Long Term Monitoring
RHS Groundwater Long Term Monitoring UFP-QAPP

Reporting Anomalies

--No Records Found--

Automated Data Review Detail Report for 22G0156
RH Groundwater Long Term Monitoring
RHS Groundwater Long Term Monitoring UFP-QAPP

Review Questions