ENVIRONMENTAL DATA SERVICES, LTD.

DATA VALIDATION REPORT

Red Hill Bulk Fuel Storage Facility
Joint Base Pearl Harbor-Hickam
CV 23F0104

SDG: 580-124460-2
Eurofins Savannah

Prepared by

ENVIRONMENTAL DATA SERVICES, LTD.

Prepared for

AECOM Environmental

Released: 3/27/23

Data Validators and Peer Reviewers:

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ENVIRONMENTAL DATA SERVICES, LTD.

EXECUTIVE NARRATIVE

Sample Delivery Groups: 580-124460-2
Laboratory: Eurofins, Savannah
Site: Red Hill Bulk Storage Facility, CV 23F0104
Sampling dates: 03/03/2023
Number of Samples: 5
Test Method: SW-846 8015C
Analysis: 2-(2-Butoxyethoxy)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); PFAS-Specific Sampling and Analysis plan, Red Hill Bulk Fuel Storage Facility, Adit 6, Joint Base Pearl Harbor-Hickam, O'Ahu, Hawai'i (November 30, 2022) (SAP).

Validation Guidelines: United States Department of Defense Data Validation Guidelines Module 4: Data Validation Procedure for Organic Analysis by GC, Environmental Data Quality Workgroup, March 9, 2021; United States Department of Defense (DOD) General Data Validation Guidelines Environmental Data Quality Workgroup (EDQW), November 2019. 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
AF-RHMW17-WGN01LF-2302W4	580-124460-3	water	S2BVEM
AF-RHMW17S-WGN01LF-2302W4	580-124460-4	water	S2BVEM
AF-RHMW17S-WQEB01-2302W4	580-124460-5	equipment blank	S2BVEM
AF-RHMW17D-WGN01LF-2302W4	580-124460-6	water	S2BVEM
AF-RHMW17D-WQFB01-2302W4	580-124460-7	field blank	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 samples arrived at the laboratory in acceptable condition. Proper custody was documented.

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 two 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. 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.

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 response factor (RRF) from the initial calibration. Percent difference is a measure of the instrument's daily performance. If the %D exceeds 20% for any analyte, qualify all associated positive results "J" and non-detects "UJ". If %RSD and %D grossly exceed QC criteria, non-detect data may be qualified "X".

A multi-point initial calibration curve was used for the target analyte. The initial calibration demonstrated instrumental linearity. The %RSD was within validation guidelines.

Continuing calibrations were analyzed at the proper frequencies and the observed %D values met quality control criteria.

5.   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, equipment and rinse blanks measure cross-contamination of samples during field operations.

A)   Method blank contamination

No problems were found for this criterion.

B)   Field/Equipment blank contamination

Samples AF-RHMW17D-WQFB01-2302W4 and AF-RHMW17S-WQEB01-2302W4 were submitted as field/equipment blanks in association with the samples in this sample delivery group (SDG). No problems were found for this criterion.

6.   SURROGATES / SYSTEM MONITORING COMPOUNDS

All samples are spiked with surrogate/system monitoring compounds (SMC) prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique.   If the measured surrogate/SMC concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

No surrogates were used for this analysis.

7.   COMPOUND IDENTIFICATION

The retention times (RTs) of reported compounds must fall within the calculated retention time windows for chromatographic column.

Retention Time

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

Relative Percent Difference

No positive results were reported for the samples in this SDG.

8.   COMPOUND QUANTIFICATION

Analyte quantitation was not reviewed at the Stage 2B level.

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

9.   **MATRIX SPIKE / MATRIX SPIKE RECOVERY**

Matrix spike / matrix spike duplicate (MS/MSD) data is 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.

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

10.   **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 control limits. Qualifications were applied to the samples and analytes as shown below.

No problems were found for this criterion.

11.   **INTERNAL STANDARDS PERFORMANCE:**

Internal standard performance criteria are meant to ensure that the gas chromatograph (GC) 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 ±10 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 with potential negative bias, "J-". If the area count is less than 50%, positive results are flagged as estimated with potential positive bias, "J+", and non-detected results are flagged "UJ". If the area count is less than 20%, positive results 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.

12.   **FIELD DUPLICATE**

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 30% for the Relative Percent Difference (RPD) shall be used for original and duplicate sample values greater than the LOQ. A control limit of a difference between results no more than the LOQ shall be used if either the sample or duplicate value is less than the LOQ. For field duplicate analyses that do not meet the technical criteria, the action was applied to only the parent sample and its duplicate.

No samples were submitted as a field duplicate pair in association with this SDG.

12. **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. The level of quantitation (LOQ) specified in the SAP for the analytes reported have been achieved.

13. **OTHER PROBLEMS**

None.

Table 1 Major and Minor Findings

2-(2-Butoxyethoxy)ethanol	Were acceptance criteria met?		
	Yes	No	
		Major	Minor
Holding Time	x		
Calibration	x		
Method Blank	x		
Field/Equipment Blank	x		
Surrogates/System Monitoring Compounds	NA		
Compound Identification	NA		
Compound Quantitation	NA		
Matrix Spike/Matrix Spike Duplicate	NA		
Internal Standards	x		
Field Duplicate	NA		
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.

Data Qualification Reason Codes	
Reason Code	**Reason Code Description**
A	Serial dilution
A1	Ambient Blank
B	The analyte was found in an associated blank as well as in the sample.
B2	CCB
B3	CCB - Neg
B4	Grinding Blank
C	LCS Recovery
C1	Reference Recovery
C2	Reference Recovery RPD
D	MS RPD
D1	Lab Replicate RPD
D2	No precision available
D3	Field Duplicate RPD
D4	Field Triplicate RSD
D5	Laboratory Triplicate RSD
F	Field Blank
F1	Hydrocarbon pattern does not match standard
G1	Initial Calibration RRF
G2	Initial Calibration RSD/r^2/r
G3	ICV RRF
H1	Test Hold Time
H2	Prep Hold Time
I	Surrogate recovery outside project limits.
J	CRA/CRI Recovery
K	An analyte (non-common laboratory artifact) was detected in the sample at a concentration less than 5X the concentration detected in the associated method blank.
L	Lab Blank
L1	Lab Blank - Neg
M	MS Recovery
M2	Post Spike
N	Blank - No Action
O	ICS
P	Sample preservation/collection requirement not met.
P1	Column RPD
P2	Improper preparation/extraction
Q	Encore sample holding time exceeded by more than 2X.
Q1	Material Blank

Q2	Encore sample holding time exceeded by less than 2X.
R	Exceeds LinearCalibration Range
S	Internal standard
T	Trip Blank
TI	Tentatively Identified Compound
TR	Trace Level Detect
U	Receipt Temperature
V	Equipment Blank
V1	ICV
V2	CCV
V3	CCV RRF
V4	Sample Receipt Condition
V5	Ending Continuing Calibration Verification
V6	Low Level Calibration Verification
V7	Interference Check Sample A
V8	Interference Check Sample AB
V9	Interference Check Sample A - Negative
W	Column breakdown (pesticides/8270)
X	Raised reporting limit
Y	Cooler temperature greater than 10 degreec C.
Y1	False Positive
Y2	Data rejected due to radiological anomolies
Y3	Non-accredited analyte/compound. Accreditation not offered at time of analyses for the analyte/compound by the stated method and matrix.
Y4	Performance Check - Degradation of DDT
Y5	Extracted Internal Standard
Y6	Analyte not confirmed on second column.
Y7	Signal to Noise Ratio not met
Z	LCS RPD
Z1	Non-accredited analyte/compound
Z1	Data rejected, more valid data available.
Z2	Detection Level not met uncertainty greater than DL
Z4	MDA Greater than RDL.
Z5	Ion Ratio
Z6	Samples were analyzed past the 12 hour time period from the Tune or opening CCV.

Data Validation Worksheet

DATA VALIDATION GC (8015C)

DOD

Validator: LL

Date Validated: 3/24/23

Reviewer: DM

Date Reviewed: 3/25/23

Project: Red Hill Bulk Storage Facility, CV 23F0104

SDG: 580-124460-2

LAB: Eurofins, Savannah

Samples Collected: 3/3

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

✓ Aqueous samples extracted within 7 days of collection and analyzed within 40 days of extraction
✓ Solid samples extracted within 14 days of collection and analyzed within 40 days of extraction
✓ There is no specific holding time for PCB samples
✓ If temp of receipt is >6◦ but ≤15% qualify J-/UJ
✓ If temp >15◦C qualify X
✓ If holding time is exceeded qualify J-/UJ
✓ If holding time is grossly exceeded (>2X) qualify J-/X

   14-day holding time used for 8015C DAI

   Samples collected on 3/3
   Samples analyzed on 3/14   all ok

ICAL (Form VI)

✓ %RSD ≤ 20% or r >0.995 or R2>0.990

✓ minimum 5 standards for linear; minimum 6 standards for quadratic

✓ 5-pt calibration for multicomponent analytes

✓ If %RSD >20% or r<0.995 or r2<0.990 qualify J/UJ

✓ If %RSD >40% or r<0.95 or r2<0.90 qualify X

Inst: CVGG2
IC 680-766428/5 03/07/2023 17:36 1 GC07013.D J&W DB WAX 0.45(mm)　　　ok

ICV/CCV (from VII/Analysis Run Log)

✓ ICV after ICAL; all %Ds within ± 20%

✓ CCVs before sample, every 10 samples

✓ all ICV/CCV %D ± 20%

✓ RTs within established window

✓ if %D is high then qualify J+

✓ if %D is low then qualify J-/UJ

✓ if %D is >50% then qualify X

Inst: CVGG2

ICV 680-766428/12 CCV 03/07/2023 20:20 1 GC07020.D J&W DB WAX 0.45(mm)

CCVIS 680-767579/6 03/14/2023 13:22 1 GC14006.D J&W DB WAX 0.45(mm)
CCV 680-767579/31 03/14/2023 23:05 1 GC14031.D J&W DB WAX 0.45(mm)

All ok

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

✓ if surrogate recovery <10% then qualify J-/X

✓ if surrogate recovery is low but >10% then qualify J-/UJ

✓ if surrogate recovery is high then qualify J+

No surrogate used

LCS (Form III)

- ✓ one per prep batch
- ✓ <mark>used QAPP 50-150, RPD 50</mark>
- ✓ if recovery low then qualify J-/X
- ✓ if recovery is high then qualify J+
- ✓ if LCS/LCSD RPD is out then qualify detects J, do not qualify NDs

LCS 680-767579/1006   LCSD 680-767579/7

All ok

MS/MSD (Form III)

- ✓ one per prep batch
- ✓ <mark>used QAPP 50-150, RPD 50</mark>
- ✓ MS/MSD RPD ≤ 30%
- ✓ if MS recovery <10% then qualify J-/X
- ✓ if MS recovery is low but >10% then qualify J-/UJ
- ✓ if MS recovery is high then qualify J+
- ✓ if MS/MSD RPD is out then qualify detects J, do not qualify NDs

None

Blanks (Form IV/Form1)

- ✓ method blank – analyzed one per prep batch

Method Blank

MB 680-767579/12   ND

Field Blank

AF-RHMW17D-WQFB01-2302W4   ND

AF-RHMW17S-WQEB01-2302W4   ND

Internal Standard Areas and RTs (Form VIII)

- ✓ areas within -50% to +100% of ICAL midpoint standard

- ✓ RTs within 30 seconds of midpoint standard

- ✓ if IS recovery is >200% then detects qualify J (do not qualify NDs)

- ✓ if IS recovery is <50% but >20% then qualify J/UJ

- ✓ if IS recovery is <20% or RT out then qualify X

Internal standard used – n-Heptyl Alcohol   all ok

Identification Summary / Second Column Confirmation (Form X)

- ✓ present for all positive results

- ✓ RTs within range for both columns (not applicable for single column 8015C)

- ✓ RPD ≤ 40% Single col analyses NA

- ✓ if RPD >40% then qualify J Single col analyses NA

N/A Level 2B

Sample Data (Form I)

- ✓ Chromatogram acceptable

- ✓ manual integrations acceptable

N/A Level 2B

Field Duplicates

- ✓ no criteria per QSM; use project specific criteria when available in QAPP

- ✓ per Module 4: if RPD > QAPP limit qualify J, no Q for non-detects

- ✓ See field duplicate worksheet

use 30% for aqueous and solids

None

Data Validation Report for 5801244602

Facility:	RH Fire Suppression System
Event:	AFFF Assessment Sampling GW 2023 February
SDG:	5801244602
Guidance Document:	RHS PFAS UFP-QAPP
Prime Contractor:	AECOM, Honolulu, HI
Project Manager:	
Contract Laboratory(ies):	Eurofins Environment Testing TestAmerica, Savannah, GA
Data Review Contractor:	
Data Review Level:	
Primary Data Reviewer:	,
Date Submitted:	

Field Sample ID	Lab Sample ID	Matrix	Type/Type Code	SW8015C
AF-RHMW17D-WGN01LF-2302W4	580-124460-6	Water	Field Sample/N	X
AF-RHMW17D-WQFB01-2302W4	580-124460-7	Water	Field Blank/FB	X
AF-RHMW17S-WGN01LF-2302W4	580-124460-4	Water	Field Sample/N	X
AF-RHMW17S-WQEB01-2302W4	580-124460-5	Water	Equipment Blank/EB	X
AF-RHMW17-WGN01LF-2302W4	580-124460-3	Water	Field Sample/N	X

Data Validation Report for 5801244602

This report assesses the analytical data quality associated with the analyses listed on the preceding cover page at data validation level. This assessment has been made through a combination of automated data review (ADR) and supplemental manual review, the details of which are described below. The approach taken in the review of this data set is consistent with the requirements contained in the RHS PFAS UFP-QAPP and the additional guidance documents incorporated by reference to the extent possible. Where definitive guidance is not provided, results have been evaluated in a conservative manner using professional judgment.

Sample collection was managed and directed by AECOM, Honolulu, HI; analyses were performed by Eurofins Environment Testing TestAmerica, Savannah, GA and were reported under sample delivery group (SDG) 5801244602. Data have been evaluated electronically based on electronic data deliverables (EDDs) provided by the laboratory, and hard copy data summary forms have also been reviewed during this effort and compared to the automated review output by the reviewers whose signatures appear on the following page. Findings based on the automated data submission and manual data verification processes are detailed in the ADR narrative and throughout this report.

All quality control (QC) elements associated with this SDG have been reviewed by a project chemist in accordance with the requirements defined for the project. This review is documented in the attached Data Review Checklists. The QC elements listed below were supported by the electronic deliverable and were evaluated using ADR processes.

Continuing Calibration Verification

Equipment Blank

Field Blank

Lab Blank

LCS Recovery

LCS RPD

Prep Hold Time

Surrogate

Test Hold Time

Results of the ADR process were subsequently reviewed and updated as applicable by the data review chemists identified on the signature page. Quality control elements that were not included in the electronic deliverable were reviewed manually and findings are documented within this report. Summaries of findings and associated qualified results are documented throughout this report.

A total of 0 results (0.00%) out of the 5 results (sample and field QC samples) reported are qualified based on review and 0 results (0.00%) have been rejected or deemed a serious deficiency (X qualifier). Trace values, defined as results that are qualified as estimated because they fall between the detection limit and the reporting limit/limit of quantitation, are not counted as qualified results in the above count. The qualified results are detailed throughout this report and discussed in the narrative below, where appropriate.

Narrative Comments

Analytical Method	Data Reviewer Comment

Reviewed by , ,

As the Reviewer, I certify that I have performed a data review process in accordance with the requirements of the project guidance document, and have compared the electronic data to the laboratory's hard copy report and have verified the consistency of the reported sample results and method quality control data between the two deliverables.

No Outliers were associated with this sample delivery group.

Qualified Results

 No results associated with this sample delivery group required qualification.

Results with Modified Qualifiers

 No qualifiers associated with this sample delivery group were modified manually.

Reason Code Definitions

Code	Definition

Flag Code and Definitions

Flag	Definition
J	Estimated Value
N	The analysis indicates the presence of an analyte for which there was presumptive evidence to make a tentative identification.
NJ	The analyte has been tentatively identified or presumptively as present and the associated numerical value was the estimated concentration in the sample.
R	The data are rejected due to deficiencies in meeting QC criteria and may not be used for decision making.
U	Undetected: The analyte was analyzed for, but not detected.

UJ	The analyte was not detected; however, the result is estimated due to discrepancies in meeting certain analyte-specific quality control criteria.
X	Result may require rejection; PDT attention required

Bias

-	The result may be biased low
+	The result may be biased high

Note - The bias field is a separate field; however, it is an integral part of the final flag (qualifier) on the sample result

Review Questions