LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

AECOM
1001 Bishop Street Suite 1600
Honolulu, HI 96813
ATTN: Ms. Alethea Ramos
alethea.ramos@aecom.com

March 14, 2022

SUBJECT: Red Hill Bulk Storage Facility, CTO 18F0126 - Data Validation

Dear Ms. Ramos,

Enclosed is the final validation report for the fraction listed below. This SDG was received on November 24, 2021. Attachment 1 is a summary of the samples that were reviewed for analysis.

Revision:52747B1a – updated the surrogate worksheet. 52747B2b – updated the initial calibration worksheet

LDC Project #52747_RV1:

SDG #	Fraction
96919 97850	Volatiles, Phenol, Polynuclear Aromatic Hydrocarbons, Gasoline Range Organics, Total Petroleum Hydrocarbons As Extractables, Total Oraganic Carbon

The data validation was performed under Stage 2B & 4 validation guidelines. The analysis was validated using the following documents and variances, as applicable to method:

- Work Plan/Scope of Work, 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 02, January 2017)
- 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)
- Sampling and Analysis Plan, Addendum 01, 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 00, September 2017)
- Sampling and Analysis Plan, Addendum 03, 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 00, June 2018)
- U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019)
- DoD General Validation Guidelines (November 2019)
- U.S. Department of Defense (DoD) Data Validation Guidelines Module 1: Data Validation Procedure for Organic Analysis by GC/MS (May 2020)
- U.S. Department of Defense (DoD) Data Validation Guidelines Module 4: Data Validation Procedure for Organic Analysis by GC (March 2021)
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014; update VI, July 2018

Please feel free to contact us if you have any questions.

Sincerely,

Stella Cuenco
Operations Manager/Senior Chemist
scuenco@lab-data.com

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

AECOM
1001 Bishop Street Suite 1600
Honolulu, HI 96813
ATTN: Ms. Alethea Ramos
alethea.ramos@aecom.com

March 1, 2022

SUBJECT: Red Hill Bulk Storage Facility, CTO 18F0126 - Data Validation

Dear Ms. Ramos,

Enclosed is the final validation report for the fraction listed below. This SDG was received on November 24, 2021. Attachment 1 is a summary of the samples that were reviewed for analysis.

LDC Project #52747:

SDG #	Fraction
96919 97850	Volatiles, Phenol, Polynuclear Aromatic Hydrocarbons, Gasoline Range Organics, Total Petroleum Hydrocarbons As Extractables, Total Oraganic Carbon

The data validation was performed under Stage 2B & 4 validation guidelines. The analysis was validated using the following documents and variances, as applicable to method:

- Work Plan/Scope of Work, 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 02, January 2017)
- 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)
- Sampling and Analysis Plan, Addendum 01, 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 00, September 2017)
- Sampling and Analysis Plan, Addendum 03, 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 00, June 2018)
- U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019)
- DoD General Validation Guidelines (November 2019)
- U.S. Department of Defense (DoD) Data Validation Guidelines Module 1: Data Validation Procedure for Organic Analysis by GC/MS (May 2020)
- U.S. Department of Defense (DoD) Data Validation Guidelines Module 4: Data Validation Procedure for Organic Analysis by GC (March 2021)
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014; update VI, July 2018

Please feel free to contact us if you have any questions.

Sincerely,

Stella Cuenco
Operations Manager/Senior Chemist
scuenco@lab-data.com

195 pages-DL

Attachment 1

90/10 2B/4 EDD

LDC# 52747 (AECOM - Honolulu, HI / Red Hill Bulk Storage Facility, CTO 18F0126)

LDC	SDG#	DATE REC'D	(2) DATE DUE	BTEX (8260B)		(3)PAHs (8270D -SIM)		GRO (8260B)		TPH-E (8015B)		SGCU TPH-E (8015B)		TOC (9060A)																	
Matrix:	Water/Soil			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	96919	11/24/21	12/10/21	8	0	4	0	8	0	4	0	4	0	-	-																
B	97850	11/24/21	12/10/21	6	0	3	0	6	0	3	0	3	0	3	0																
B	97850	11/24/21	12/10/21	2	0	1	0	2	0	1	0	1	0	1	0																
Total	T/SC			16	0	8	0	16	0	8	0	8	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60

Shaded cells indicate Stage 4 validation (all other cells are Stage 2B validation). These sample counts do not include MS/MSD, and DUPs

V:\LOGIN\AECOM\Red Hill\52747ST-18F0126-NOI.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 18F0126

LDC Report Date: December 16, 2021

Parameters: Volatiles

Validation Level: Stage 2B

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 96919

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH1540	BA36546	Water	07/22/21
ERH1541	BA36547	Water	07/22/21
ERH1542	BA36549	Water	07/22/21
ERH1543	BA36550	Water	07/22/21
ERH1544	BA36552	Water	07/22/21
ERH1545	BA36553	Water	07/22/21
ERH1546	BA36555	Water	07/22/21
ERH1547	BA36556	Water	07/22/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Work Plan/Scope of Work, 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 02, January 2017), the 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), the Sampling and Analysis Plan, Addendum 01, 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 00, September 2017), the Sampling and Analysis Plan, Addendum 03, 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 00, June 2018), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019), the DoD General Validation Guidelines (November 2019), and the U.S. Department of Defense (DoD) Data Validation Guidelines Module 1: Data Validation Procedure for Organic Analysis by GC/MS (May 2020). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) which are Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was not detected and the associated numerical value is approximate.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Qualification Code Reference

a ICP Serial Dilution %D was not within control limits.

b Presumed contamination from preparation (method blank).

c Calibration %RSD, r, r^2, %D or %R was noncompliant.

d The analysis with this flag should not be used because another more technically sound analysis is available.

e MS/MSD or Duplicate RPD was high.

f Presumed contamination from FB or ER.

g ICP ICS results were unsatisfactory.

h Holding times were exceeded.

i Internal standard performance was unsatisfactory.

k Estimated Maximum Possible Concentration (HRGC/HRMS only)

l LCS/LCSD %R was not within control limits.

m Result exceeded the calibration range.

o Cooler temperature or temperature blank was noncompliant and/or sample custody problems.

p RPD between two columns was high (GC only).

q MS/MSD recovery was not within control limits.

s Surrogate recovery was not within control limits.

t Presumed contamination from trip blank.

v Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

w LCS/LCSD RPD was high.

y Chemical recovery was not within control limits (Radiochemistry only).

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 15.0% for all analytes.

Average relative response factors (RRF) for all analytes were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

The percent differences (%D) of the ending continuing calibration verifications (CCVs) were less than or equal to 50.0% for all analytes.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Samples ERH1540, ERH1542, ERH1544, and ERH1546 were identified as trip blanks. No contaminants were found.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected or recommended for exclusion in this SDG.

Red Hill Bulk Storage Facility, CTO 18F0126
Volatiles - Data Qualification Summary - SDG 96919

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 18F0126
Volatiles - Laboratory Blank Data Qualification Summary - SDG 96919

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 18F0126
Volatiles - Field Blank Data Qualification Summary - SDG 96919

No Sample Data Qualified in this SDG

LDC #: 52747A1a
SDG #: 96919
Laboratory: APPL, Inc., Clovis, CA

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 12/11/21
Page: 1 of 1
Reviewer: IL
2nd Reviewer: [illegible]

METHOD: GC/MS Volatiles (BTEX)(EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD≤15 19≤20
IV.	Continuing calibration / end	A	D≤20/50
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB=~~2,4,6,8~~ 1,3,5,7
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
1	ERH1540	TB	BA36546	Water	07/22/21
2	ERH1541		BA36547	Water	07/22/21
3	ERH1542	TB	BA36549	Water	07/22/21
4	ERH1543		BA36550	Water	07/22/21
5	ERH1544	TB	BA36552	Water	07/22/21
6	ERH1545		BA36553	Water	07/22/21
7	ERH1546	TB	BA36555	Water	07/22/21
8	ERH1547		BA36556	Water	07/22/21
9					

Notes:

	210727AM						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 18F0126

LDC Report Date: December 16, 2021

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 96919

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH1541	BA36547	Water	07/22/21
ERH1543	BA36550	Water	07/22/21
ERH1545	BA36553	Water	07/22/21
ERH1547	BA36556	Water	07/22/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Work Plan/Scope of Work, 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 02, January 2017), the 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), the Sampling and Analysis Plan, Addendum 01, 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 00, September 2017), the Sampling and Analysis Plan, Addendum 03, 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 00, June 2018), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019), the DoD General Validation Guidelines (November 2019), and the U.S. Department of Defense (DoD) Data Validation Guidelines Module 1: Data Validation Procedure for Organic Analysis by GC/MS (May 2020). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polynuclear Aromatic Hydrocarbons (PAHs) which are 1-Methylnaphthalene, 2-Methylnaphthalene, and Naphthalene by Environmental Protection Agency (EPA) SW 846 Method 8270D in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was not detected and the associated numerical value is approximate.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Qualification Code Reference

a ICP Serial Dilution %D was not within control limits.

b Presumed contamination from preparation (method blank).

c Calibration %RSD, r, r^2, %D or %R was noncompliant.

d The analysis with this flag should not be used because another more technically sound analysis is available.

e MS/MSD or Duplicate RPD was high.

f Presumed contamination from FB or ER.

g ICP ICS results were unsatisfactory.

h Holding times were exceeded.

i Internal standard performance was unsatisfactory.

k Estimated Maximum Possible Concentration (HRGC/HRMS only)

l LCS/LCSD %R was not within control limits.

m Result exceeded the calibration range.

o Cooler temperature or temperature blank was noncompliant and/or sample custody problems.

p RPD between two columns was high (GC only).

q MS/MSD recovery was not within control limits.

s Surrogate recovery was not within control limits.

t Presumed contamination from trip blank.

v Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

w LCS/LCSD RPD was high.

y Chemical recovery was not within control limits (Radiochemistry only).

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 15.0% for all analytes.

Average relative response factors (RRF) for all analytes were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

The percent differences (%D) of the ending continuing calibration verifications (CCVs) were less than or equal to 50.0% for all analytes.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Analyte	Flag	A or P
ERH1545	Fluoranthene-d10	48.5 (58-120)	All analytes	UJ (all non-detects)	P

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected or recommended for exclusion in this SDG.

Due to surrogate %R, data were qualified as estimated in one sample.

Red Hill Bulk Storage Facility, CTO 18F0126
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 96919

Sample	Analyte	Flag	A or P	Reason (Code)
ERH1545	All analytes	UJ (all non-detects)	P	Surrogates (%R) (s)

Red Hill Bulk Storage Facility, CTO 18F0126
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification Summary - SDG 96919

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 18F0126
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary - SDG 96919

No Sample Data Qualified in this SDG

LDC #: 52747A2b
SDG #: 96919
Laboratory: APPL, Inc., Clovis, CA

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 12/11/21
Page: 1 of 1
Reviewer: R
2nd Reviewer: [illegible]

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW846 Method 8270D-SIM)
TTT, W, S

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD≤15 IQ≤20
IV.	Continuing calibration Level	A	D≤20/50
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	N	
XIII.	Target analyte identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	ERH1541	BA36547	Water	07/22/21
2	ERH1543	BA36550	Water	07/22/21
3	ERH1545	BA36553	Water	07/22/21
4	ERH1547	BA36556	Water	07/22/21
5				
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Notes:

	2107281						

LDC #: 52747A26

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualification below for all questions answered "N". Not applicable questions are identified as "N/A".

Y (N) N/A Were percent recoveries (%R) for surrogates within QC limits?

Y N (N/A) If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?

Y (N) ~~N/A~~ If any %R was less than 10 percent, was a reanalysis performed to confirm %R?

#	Date	Sample ID	Surrogate	%R (Limits)	Qualifications
		3 (ND)	YY-d10	48.5 (58-120)	J-/UJ/P (s)
				( )	
				( )	
				( )	
				( )	
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Base/Neutral Surrogates:
(NBZ) = Nitrobenzene-d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl-d14
(DCB) = 1,2-Dichlorobenzene-d4

Acid Surrogates:
(PHL) = Phenol-d5
(2FP)= 2-Fluorophenol
(TBP) = 2,4,6-Tribromophenol
(2CP) = 2-Chlorophenol-d4

YY-d10 : Fluoranthene-d10

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 18F0126

LDC Report Date: December 16, 2021

Parameters: Gasoline Range Organics

Validation Level: Stage 2B

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 96919

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH1540	BA36546	Water	07/22/21
ERH1541	BA36547	Water	07/22/21
ERH1542	BA36549	Water	07/22/21
ERH1543	BA36550	Water	07/22/21
ERH1544	BA36552	Water	07/22/21
ERH1545	BA36553	Water	07/22/21
ERH1546	BA36555	Water	07/22/21
ERH1547	BA36556	Water	07/22/21

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Work Plan/Scope of Work, 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 02, January 2017), the 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), the Sampling and Analysis Plan, Addendum 01, 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 00, September 2017), the Sampling and Analysis Plan, Addendum 03, 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 00, June 2018), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019), the DoD General Validation Guidelines (November 2019), and the U.S. Department of Defense (DoD) Data Validation Guidelines Module 4: Data Validation Procedure for Organic Analysis by GC (March 2021). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Gasoline Range Organics by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was not detected and the associated numerical value is approximate.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Qualification Code Reference

a ICP Serial Dilution %D was not within control limits.

b Presumed contamination from preparation (method blank).

c Calibration %RSD, r, r^2, %D or %R was noncompliant.

d The analysis with this flag should not be used because another more technically sound analysis is available.

e MS/MSD or Duplicate RPD was high.

f Presumed contamination from FB or ER.

g ICP ICS results were unsatisfactory.

h Holding times were exceeded.

i Internal standard performance was unsatisfactory.

k Estimated Maximum Possible Concentration (HRGC/HRMS only)

l LCS/LCSD %R was not within control limits.

m Result exceeded the calibration range.

o Cooler temperature or temperature blank was noncompliant and/or sample custody problems.

p RPD between two columns was high (GC only).

q MS/MSD recovery was not within control limits.

s Surrogate recovery was not within control limits.

t Presumed contamination from trip blank.

v Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

w LCS/LCSD RPD was high.

y Chemical recovery was not within control limits (Radiochemistry only).

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

A curve fit, based on the initial calibration, was established for quantitation. The coefficient of determination (r^2) was greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0%.

III. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0%.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

Samples ERH1540, ERH1542, ERH1544, and ERH1546 were identified as trip blanks. No contaminants were found.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected or recommended for exclusion in this SDG.

Red Hill Bulk Storage Facility, CTO 18F0126
Gasoline Range Organics - Data Qualification Summary - SDG 96919

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 18F0126
Gasoline Range Organics - Laboratory Blank Data Qualification Summary - SDG 96919

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 18F0126
Gasoline Range Organics - Field Blank Data Qualification Summary - SDG 96919

No Sample Data Qualified in this SDG

LDC #: 52747A7

SDG #: 96919

Laboratory: APPL, Inc., Clovis, CA

VALIDATION COMPLETENESS WORKSHEET

Stage 2B

Date: 12/1/21

Page: 1 of 1

Reviewer: JL

2nd Reviewer: CV

METHOD: GC/MS Gasoline Range Organics (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
~~II.~~	~~GC/MS Instrument performance check~~		
III.	Initial calibration/ICV	A / A	%R 10%≤20
IV.	Continuing calibration	A	%D≤20
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1, 3, 5, 7
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	N	
~~XI.~~	~~Internal standards~~		
XII.	Target analyte quantitation	N	
XIII.	Target analyte identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID		Lab ID	Matrix	Date
1	ERH1540	TB	BA36546	Water	07/22/21
2	ERH1541		BA36547	Water	07/22/21
3	ERH1542	TB	BA36549	Water	07/22/21
4	ERH1543		BA36550	Water	07/22/21
5	ERH1544	TB	BA36552	Water	07/22/21
6	ERH1545		BA36553	Water	07/22/21
7	ERH1546	TB	BA36555	Water	07/22/21
8	ERH1547		BA36556	Water	07/22/21
9					

Notes:

	210727AM						

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 18F0126

LDC Report Date: December 16, 2021

Parameters: Total Petroleum Hydrocarbons as Extractables

Validation Level: Stage 2B

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 96919

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH1541	BA36547	Water	07/22/21
ERH1543	BA36550	Water	07/22/21
ERH1545	BA36553	Water	07/22/21
ERH1547	BA36556	Water	07/22/21
ERH1541(SGCU)	BA36547(SGCU)	Water	07/22/21
ERH1543(SGCU)	BA36550(SGCU)	Water	07/22/21
ERH1545(SGCU)	BA36553(SGCU)	Water	07/22/21
ERH1547(SGCU)	BA36556(SGCU)	Water	07/22/21

Samples appended with "SGCU" underwent Silica Gel cleanup

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Work Plan/Scope of Work, 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 02, January 2017), the 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), the Sampling and Analysis Plan, Addendum 01, 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 00, September 2017), the Sampling and Analysis Plan, Addendum 03, 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 00, June 2018), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019), the DoD General Validation Guidelines (November 2019), and the U.S. Department of Defense (DoD) Data Validation Guidelines Module 4: Data Validation Procedure for Organic Analysis by GC (March 2021). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Total Petroleum Hydrocarbons (TPH) as Extractables by Environmental Protection Agency (EPA) SW 846 Method 8015B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was not detected and the associated numerical value is approximate.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Qualification Code Reference

a ICP Serial Dilution %D was not within control limits.

b Presumed contamination from preparation (method blank).

c Calibration %RSD, r, r^2, %D or %R was noncompliant.

d The analysis with this flag should not be used because another more technically sound analysis is available.

e MS/MSD or Duplicate RPD was high.

f Presumed contamination from FB or ER.

g ICP ICS results were unsatisfactory.

h Holding times were exceeded.

i Internal standard performance was unsatisfactory.

k Estimated Maximum Possible Concentration (HRGC/HRMS only)

l LCS/LCSD %R was not within control limits.

m Result exceeded the calibration range.

o Cooler temperature or temperature blank was noncompliant and/or sample custody problems.

p RPD between two columns was high (GC only).

q MS/MSD recovery was not within control limits.

s Surrogate recovery was not within control limits.

t Presumed contamination from trip blank.

v Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

w LCS/LCSD RPD was high.

y Chemical recovery was not within control limits (Radiochemistry only).

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met with the following exceptions:

Sample	Analyte	Total Days From Sample Extraction Until Analysis	Required Holding Time (in Days) From Sample Extraction Until Analysis	Flag	A or P
ERH1541(SGCU) ERH1543(SGCU) ERH1545(SGCU) ERH1547(SGCU)	All analytes	64	40	J- (all detects) UJ (all non-detects)	P

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For analytes where average calibration factors were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes with the following exceptions:

III. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Extraction Date	Analyte	Concentration	Limit of Quantitation	Associated Samples
210728B-BLK	07/28/21	Oil (C24-C40)	150 ug/L	320 ug/L	ERH1541 ERH1543 ERH1545 ERH1547

Blank ID	Extraction Date	Analyte	Concentration	Limit of Quantitation	Associated Samples
210728B1-BLK	07/28/21	Oil (C24-C40)	200 ug/L	320 ug/L	ERH1541(SGCU) ERH1543(SGCU) ERH1545(SGCU) ERH1547(SGCU)

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
ERH1541	Oil (C24-C40)	280 ug/L	300U ug/L
ERH1543	Oil (C24-C40)	520 ug/L	520U ug/L
ERH1545	Oil (C24-C40)	570 ug/L	570U ug/L
ERH1547	Oil (C24-C40)	400 ug/L	400U ug/L
ERH1541(SGCU)	Oil (C24-C40)	180 ug/L	300U ug/L
ERH1543(SGCU)	Oil (C24-C40)	210 ug/L	300U ug/L
ERH1545(SGCU)	Oil (C24-C40)	270 ug/L	300U ug/L
ERH1547(SGCU)	Oil (C24-C40)	320 ug/L	320U ug/L

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Analyte	Flag	A or P
ERH1543(SGCU)	Octacosane Ortho-Terpheynl	159 (60-142) 130 (56-125)	All analytes	J+ (all detects)	P

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Analyte	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
210728B1-LCS/LCSD (ERH1543(SGCU))	Diesel (C10-C24)	144 (36-132)	151 (36-132)	J+ (all detects)	P
210728B1-LCS/LCSD (ERH1541(SGCU) ERH1545(SGCU) ERH1547(SGCU))	Diesel (C10-C24)	144 (36-132)	151 (36-132)	NA	-
210728B1-LCS/LCSD (ERH1541(SGCU) ERH1543(SGCU) ERH1545(SGCU) ERH1547(SGCU))	Oil (C24-C40)	156 (51-113)	172 (41-113)	J+ (all detects)	P

Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Target Analyte Quantitation

Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte Identification

Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected or recommended for exclusion in this SDG.

Due to technical holding time, surrogate %R, and LCS/LCSD %R, data were qualified as estimated in four samples.

Due to laboratory blank contamination, data were qualified as not detected in right samples.

Red Hill Bulk Storage Facility, CTO 18F0126
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary - SDG 96919

Sample	Analyte	Flag	A or P	Reason (Code)
ERH1541(SGCU) ERH1543(SGCU) ERH1545(SGCU) ERH1547(SGCU)	All analytes	J- (all detects) UJ (all non-detects)	P	Technical holding times (h)
ERH1543(SGCU)	All analytes	J+ (all detects)	P	Surrogates (%R) (s)
ERH1543(SGCU)	Diesel (C10-C24)	J+ (all detects)	P	Laboratory control samples (%R) (l)
ERH1541(SGCU) ERH1543(SGCU) ERH1545(SGCU) ERH1547(SGCU)	Oil (C24-C40)	J+ (all detects)	P	Laboratory control samples (%R) (l)

Red Hill Bulk Storage Facility, CTO 18F0126
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data Qualification Summary - SDG 96919

Sample	Analyte	Modified Final Concentration	A or P	Code
ERH1541	Oil (C24-C40)	300U ug/L	A	b
ERH1543	Oil (C24-C40)	520U ug/L	A	b
ERH1545	Oil (C24-C40)	570U ug/L	A	b
ERH1547	Oil (C24-C40)	400U ug/L	A	b
ERH1541(SGCU)	Oil (C24-C40)	300U ug/L	A	b
ERH1543(SGCU)	Oil (C24-C40)	300U ug/L	A	b
ERH1545(SGCU)	Oil (C24-C40)	300U ug/L	A	b
ERH1547(SGCU)	Oil (C24-C40)	320U ug/L	A	b

Red Hill Bulk Storage Facility, CTO 18F0126
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification Summary - SDG 96919

No Sample Data Qualified in this SDG

LDC #: 52747A8
SDG #: 96919
Laboratory: APPL, Inc., Clovis, CA

VALIDATION COMPLETENESS WORKSHEET
Stage 2B

Date: 12/11/21
Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC TPH as Extractables (EPA SW 846 Method 8015B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A SW	
II.	Initial calibration/ICV	A, A	RSD≤20, r² IV≤20
III.	Continuing calibration	A	D≤20
IV.	Laboratory Blanks	SW	
V.	Field blanks	N	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	SW	LCS/D
IX.	Field duplicates	N	
X.	Target analyte quantitation	N	
XI.	Target analyte identification	N	
XII.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
1	ERH1541	BA36547	Water	07/22/21
2	ERH1543	BA36550	Water	07/22/21
3	ERH1545	BA36553	Water	07/22/21
4	ERH1547	BA36556	Water	07/22/21
5	ERH1541(SGCU)	BA36547(SGCU)	Water	07/22/21
6	ERH1543(SGCU)	BA36550(SGCU)	Water	07/22/21
7	ERH1545(SGCU)	BA36553(SGCU)	Water	07/22/21
8	ERH1547(SGCU)	BA36556(SGCU)	Water	07/22/21
9				
10				
11				
12				
13				

Notes:

	210728B						
	210728B1						

LDC #: 52147A8

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Reviewer: JC

All circled dates have exceeded the technical holding times.
(Y) N N/A Were all cooler temperatures within validation criteria?

METHOD: ✓ GC __ HPLC HT: 40

Sample ID	Matrix	Preserved	Sampling Date	Extraction date	Analysis date	Total # of Days	Qualifier
5-8 (det/ND)	W		7/22/21	7/28/21	9/30/21	64	J-/UJ/P (h)

TECHNICAL HOLDING TIME CRITERIA

VOLATILES:	Water unpreserved:	Aromatic within 7 days, non-aromatic within 14 days of sample collection.
	Water preserved:	Both within 14 days of sample collection.
	Soils:	Both within 14 days of sample collection.
EXTRACTABLES:		
	Water:	Extracted within 7 days, analyzed within 40 days.
	Soil:	Extracted within 14 days, analyzed within 40 days.

LDC #: 52147AE

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: AC

METHOD: ✓ GC ___ HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were all samples associated with a given method blank?
Y N N/A Was a method blank performed for each matrix and whenever a sample extraction procedure was performed?
Y N N/A Was a method blank performed with each extraction batch?
Y N N/A Were any contaminants found in the method blanks? If yes, please see findings below.

Level IV/D Only

Y N N/A (Gasoline and aromatics only)Was a method blank analyzed with each 24 hour batch?
Y N N/A Was a method blank analyzed for each analytical / extraction batch of ≤20 samples?

Blank extraction date: 7/28/21 **Blank analysis date:** _____ **Associated samples:** 1-4 (b)
Conc. units: ug/L

Compound	Blank ID	Sample Identification						
	210728B-BLK	5X	1	2	3	4		
Oil (C24-C40)	150	750	280/300.0U	520/U	570/U	400/U		
LOQ	320							

Blank extraction date: 7/28/21 **Blank analysis date:** _____ **Associated samples:** 5-8
Conc. units: ug/L

Compound	Blank ID	Sample Identification						
	210728B1-BLK	5X	5	6	7	8		
Oil (C24-C40)	200	1000	180/300.0U	210/300.0U	270/300.0U	320/U		
LOQ	320							

ALL CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC #: 574748

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Reviewer: [illegible]

METHOD: ✓ GC __ HPLC

Are surrogates required by the method? Yes ✓ or No ____.

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Were surrogates spiked into all samples and blanks?

Y (N) N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	6 Zn (dup)		G	159 (60-142)	J+ dets/P (S)
			H	130 (56-125)	↓
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
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				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	G	Octacosane	M	Benzo(e)Pyrene	S	1-Chloro-3-Nitrobenzene	Y	Tetrachloro-m- xylene
B	4-Bromofluorobenzene (BFB)	H	Ortho-Terphenyl	N	Terphenyl-D14	T	3,4-Dinitrotoluene	Z	1,2-Dinitrobenzene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin		
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin		
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate		
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 52747A8

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Reviewer: PR

METHOD: GC

LCS percent recoveries (%R) and relative percent differences (RPD) within the QC limitswith the following exceptions:

#	LCS/LCSD ID	Analyte	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	210728B1-LCS/D	Diesel (C10-C24)	144 (36-132)	151 (36-132)	(2-det)	~~All (2-det)~~	J+dets/P (L)
		Oil (C24-C40)	156 (41-113)	172 (41-113)	(det)	~~1 (det)~~	↓
			( )	( )	( )	5-8	
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 18F0126

LDC Report Date: December 16, 2021

Parameters: Volatiles

Validation Level: Stage 2B & 4

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 97850

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH1802	BA43144	Water	10/13/21
ERH1803	BA43145	Water	10/13/21
ERH1805	BA43146	Water	10/13/21
ERH1806**	BA43147**	Water	10/13/21
ERH1808	BA43148	Water	10/13/21
ERH1809**	BA43149**	Water	10/13/21
ERH1811	BA43150	Water	10/13/21
ERH1812	BA43151	Water	10/13/21

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Work Plan/Scope of Work, 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 02, January 2017), the 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), the Sampling and Analysis Plan, Addendum 01, 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 00, September 2017), the Sampling and Analysis Plan, Addendum 03, 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 00, June 2018), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019), the DoD General Validation Guidelines (November 2019), and the U.S. Department of Defense (DoD) Data Validation Guidelines Module 1: Data Validation Procedure for Organic Analysis by GC/MS (May 2020). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) which are Benzene, Toluene, Ethylbenzene, Xylenes (BTEX) by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was not detected and the associated numerical value is approximate.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Qualification Code Reference

a ICP Serial Dilution %D was not within control limits.

b Presumed contamination from preparation (method blank).

c Calibration %RSD, r, r^2, %D or %R was noncompliant.

d The analysis with this flag should not be used because another more technically sound analysis is available.

e MS/MSD or Duplicate RPD was high.

f Presumed contamination from FB or ER.

g ICP ICS results were unsatisfactory.

h Holding times were exceeded.

i Internal standard performance was unsatisfactory.

k Estimated Maximum Possible Concentration (HRGC/HRMS only)

l LCS/LCSD %R was not within control limits.

m Result exceeded the calibration range.

o Cooler temperature or temperature blank was noncompliant and/or sample custody problems.

p RPD between two columns was high (GC only).

q MS/MSD recovery was not within control limits.

s Surrogate recovery was not within control limits.

t Presumed contamination from trip blank.

v Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

w LCS/LCSD RPD was high.

y Chemical recovery was not within control limits (Radiochemistry only).

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 15.0% for all analytes.

Average relative response factors (RRF) for all analytes were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

The percent differences (%D) of the ending continuing calibration verifications (CCVs) were less than or equal to 50.0% for all analytes.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Samples ERH1802, ERH1805, ERH1808, and ERH1811 were identified as trip blanks. No contaminants were found.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Target Analyte Quantitation

All target analyte quantitations met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

All target analyte identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected or recommended for exclusion in this SDG.

Red Hill Bulk Storage Facility, CTO 18F0126
Volatiles - Data Qualification Summary - SDG 97850

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 18F0126
Volatiles - Laboratory Blank Data Qualification Summary - SDG 97850

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 18F0126
Volatiles - Field Blank Data Qualification Summary - SDG 97850

No Sample Data Qualified in this SDG

LDC #: 52747B1a

SDG #: 97850

Laboratory: APPL, Inc., Clovis, CA

VALIDATION COMPLETENESS WORKSHEET

Stage 2B/4

Date: 12/1/21

Page: 1 of 1

Reviewer: JL

2nd Reviewer: AV

METHOD: GC/MS Volatiles (BTEX)(EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD≤15 10/≤20
IV.	Continuing calibration /end	A	D≤20/50
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1, 3, 5, 7
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	A	Not reviewed for Stage 2B validation.
XIII.	Target analyte identification	A	Not reviewed for Stage 2B validation.
XIV.	System performance	A	Not reviewed for Stage 2B validation.
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Stage 4 validation

	Client ID		Lab ID	Matrix	Date
1	ERH1802	TB	BA43144	Water	10/13/21
2	ERH1803		BA43145	Water	10/13/21
3	ERH1805	TB	BA43146	Water	10/13/21
4	ERH1806**		BA43147**	Water	10/13/21
5	ERH1808	TB	BA43148	Water	10/13/21
6	ERH1809**		BA43149**	Water	10/13/21
7	ERH1811	TB	BA43150	Water	10/13/21
8	ERH1812		BA43151	Water	10/13/21
9					

Notes:

	2110/SAM1						

LDC #: 52478B19

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: K

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12-hour clock criteria?	✓			
III. Initial calibration and initial calibration verification				
Did the laboratory perform a 5-point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?			✓	
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) ≥ 0.05?	✓			
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks?		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?	✓			
Were target analytes detected in the field blanks?		✓		
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?		✓		
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			✓	

LDC #: 52947B1a

VALIDATION FINDINGS CHECKLIST

Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?			✓	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?			✓	
Were target analytes detected in the field duplicates?			✓	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Target analyte quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the analyte?			✓	
Were analyte quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target analyte identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?			✓	
Did analyte spectra meet specified EPA "Functional Guidelines" criteria?			✓	
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 52747B1a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound
S= Standard deviation of the RRFs

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 5 std)	Recalculated RRF (RRF 5 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	10/15/2021	Benzene (Fluorobenzene)	0.4345	0.4345	0.4384	0.4384	4.3	4.3
			Ethylbenzene (Chlorobenzene-d5)	0.7106	0.7106	0.6860	0.6860	8.1	8.1

LDC # 52747B16

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound
Ais = Area of associated internal standard (IS)
Cx = Concentration of compound
Cis = Concentration of IS

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	1018M02	3/16/2021	Benzene (Fluorobenzene)	0.4384	0.4067	0.4067	7.2	7.2
			Ethylbenzene (Chlorobenzene-d5)	0.6860	0.6897	0.6897	0.55	0.54
2			Benzene (Fluorobenzene)					
			Ethylbenzene (Chlorobenzene-d5)					
3			Benzene (Fluorobenzene)					
			Ethylbenzene (Chlorobenzene-d5)					

LDC #52747B19

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogate compounds were recalculated for the compounds identified below using the following calculation:

Surrogate Found = (Area surr) (Conc IS) / (Area IS) (average RRF surr)
%Recovery: Surrogate Found/Surrogate Spiked * 100

Sample: 4

	Surrogate Spiked (ug/L)	Surrogate Found (ug/L)	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
1,2-Dichloroethane-d4	25.0	23.99	95.9 ~~105~~	96	
4-Bromofluorobenzene	25.0	25.33	101 ~~104~~ KC	101	
Dibromofluoromethane	25.0	24.99	100 ~~105~~	100	
Toluene-d8	25.0	24.84	99.4 ~~104~~	99	

LDC # 52478B

VALIDATION FINDINGS WORKSHEET
LCS Results Verification

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control duplicate were recalculated for the compounds identified below using the following calculation:

SSC = (Area spike) (Conc IS) / (Area IS) (average RRF spike)
%Recovery = 100 * SSC/SA

Where:
SSC = Spiked concentration
SA = Spike added
LCS = Laboratory control spike recovery
LCSD = Laboratory control spike duplicate recovery

RPD = | LCS - LCSD | * 2/(LCS + LCSD)

LCS/LCSD ID: 211018AM1-LCS/D

Compound	SA (ug/L)		SSC (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Benzene	10.0	10.0	9.87	10.5	98.7	98.7	105	105	6.2	6.2

LDC #52747B19

VALIDATION FINDINGS WORKSHEET
Sample Results Verification

Reviewer: SC

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Compound results for all Level IV samples reported with a positive detect were recalculated and verified using the following equation:

$$\text{Concentration} = \frac{(Ax)\,(Cis)\,(Df)}{(Ais)\,(RRF)}$$

Where:

Ax = Area or height of the peak for the compound to be measured
Ais = Area or height of internal standard
Cis = Concentration of internal standard
RRF = Average relative response factor
DF = Dilution factor

Sample #	Compound	Ax	Ais	Cis (ug/L)	DF	RRF	Calculated Concentration (ug/L)	Reported Concentration (ug/L)	% Diff
LCS	Benzene	64620	373214	25.0	1	0.4384	9.87	9.87	
4,6 (ND)									

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 18F0126

LDC Report Date: March 1, 2022

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Stage 2B & 4

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 97850

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH1803	BA43145	Water	10/13/21
ERH1806**	BA43147**	Water	10/13/21
ERH1809	BA43149	Water	10/13/21
ERH1812	BA43151	Water	10/13/21

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Work Plan/Scope of Work, 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 02, January 2017), the 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), the Sampling and Analysis Plan, Addendum 01, 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 00, September 2017), the Sampling and Analysis Plan, Addendum 03, 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 00, June 2018), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019), the DoD General Validation Guidelines (November 2019), and the U.S. Department of Defense (DoD) Data Validation Guidelines Module 1: Data Validation Procedure for Organic Analysis by GC/MS (May 2020). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Polynuclear Aromatic Hydrocarbons (PAHs) which are 1-Methylnaphthalene, 2-Methylnaphthalene, and Naphthalene by Environmental Protection Agency (EPA) SW 846 Method 8270D in Selected Ion Monitoring (SIM) mode

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was not detected and the associated numerical value is approximate.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Qualification Code Reference

a ICP Serial Dilution %D was not within control limits.

b Presumed contamination from preparation (method blank).

c Calibration %RSD, r, r^2, %D or %R was noncompliant.

d The analysis with this flag should not be used because another more technically sound analysis is available.

e MS/MSD or Duplicate RPD was high.

f Presumed contamination from FB or ER.

g ICP ICS results were unsatisfactory.

h Holding times were exceeded.

i Internal standard performance was unsatisfactory.

k Estimated Maximum Possible Concentration (HRGC/HRMS only)

l LCS/LCSD %R was not within control limits.

m Result exceeded the calibration range.

o Cooler temperature or temperature blank was noncompliant and/or sample custody problems.

p RPD between two columns was high (GC only).

q MS/MSD recovery was not within control limits.

s Surrogate recovery was not within control limits.

t Presumed contamination from trip blank.

v Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

w LCS/LCSD RPD was high.

y Chemical recovery was not within control limits (Radiochemistry only).

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals.

All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

The percent relative standard deviations (%RSD) were less than or equal to 15.0% for all analytes.

Average relative response factors (RRF) for all analytes were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Analyte	Flag	A or P
ERH1803	Fluoranthene-d10	51.3 (58-120)	All analytes	J- (all detects) UJ (all non-detects)	P
ERH1806**	Fluoranthene-d10	27.3 (58-120)	All analytes	J- (all detects)	P
ERH1809	Fluoranthene-d10	50.1 (58-120)	All analytes	UJ (all non-detects)	P

VIII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

No field duplicates were identified in this SDG.

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Target Analyte Quantitation

All target analyte quantitations met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIII. Target Analyte Identification

All target analyte identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected or recommended for exclusion in this SDG.

Due to surrogate %R, data were qualified as estimated in three samples.

Red Hill Bulk Storage Facility, CTO 18F0126
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 97850

Sample	Analyte	Flag	A or P	Reason (Code)
ERH1803 ERH1806** ERH1812	All analytes	J- (all detects) UJ (all non-detects)	P	Surrogates (%R) (s)

Red Hill Bulk Storage Facility, CTO 18F0126
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification Summary - SDG 97850

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 18F0126
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary - SDG 97850

No Sample Data Qualified in this SDG

LDC #: 52747B2b

SDG #: 97850

Laboratory: APPL, Inc., Clovis, CA

VALIDATION COMPLETENESS WORKSHEET

Stage 2B/4

Date: 12/11/21

Page: 1 of 1

Reviewer: JK

2nd Reviewer: JV

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270D-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	RSD ≤ 15 %D ≤ 20
IV.	Continuing calibration / end	A	%D ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	A	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Target analyte quantitation	A	Not reviewed for Stage 2B validation.
XIII.	Target analyte identification	A	Not reviewed for Stage 2B validation.
XIV.	System performance	A	Not reviewed for Stage 2B validation.
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1	ERH1803	BA43145	Water	10/13/21
2	ERH1806**	BA43147**	Water	10/13/21
3	ERH1809	BA43149	Water	10/13/21
4	ERH1812	BA43151	Water	10/13/21
5				
6				
7				
8				
9				

Notes:

	211019AK						

LDC #: 52747B2B

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: AC

Method: PAH (EPA SW 846 Method 8270D-SIM)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Were cooler temperature criteria met?	✓			
II. GC/MS instrument performance check (Not required)				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12-hour clock criteria?	✓			
III. Initial calibration and initial calibration verification				
Did the laboratory perform a 5-point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 15 20% and relative response factors (RRF) within method criteria?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?			✓	
Was an initial calibration verification (ICV) standard analyzed after each initial calibration for each instrument?	✓			
Were all ICV percent differences (%D) ≤ 20 30%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks?		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?		✓		
Were target analytes detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent differences (%R) within QC limits?	N ✓	✓		
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any percent recoveries (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			✓	

LDC #: 52747B26

VALIDATION FINDINGS CHECKLIST

Reviewer: 1

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		✓		
Were target analytes detected in the field duplicates?			✓	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Target analyte quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the analyte?			✓	
Were analyte quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target analyte identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?			✓	
Did analyte spectra meet specified EPA "Functional Guidelines" criteria?			✓	
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 52747B26

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Reviewer: JT

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualification below for all questions answered "N". Not applicable questions are identified as "N/A".

Y (N) N/A Were percent recoveries (%R) for surrogates within QC limits?
Y N (N/A) If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?
Y N (N/A) If any %R was less than 10 percent, was a reanalysis performed to confirm %R?

#	Date	Sample ID	Surrogate	%R (Limits)	Qualifications
		1 (2nd ND)	Fluoranthene-d	10 51.3 (58-120)	J-/UJ/P (S)
		2 (2nd)	↓	27.3 ( )	↓
		3 (ND)	↓	50.1 (↓)	↓
				( )	
				( )	
				( )	
				( )	
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				( )	

Base/Neutral Surrogates:
(NBZ) = Nitrobenzene-d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl-d14
(DCB) = 1,2-Dichlorobenzene-d4

Acid Surrogates:
(PHL) = Phenol-d5
(2FP)= 2-Fluorophenol
(TBP) = 2,4,6-Tribromophenol
(2CP) = 2-Chlorophenol-d4

LDC #: 57473B26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: AC

METHOD: GC/MS PAH (EPA SW 846 Method 8270D SIM)

The relative response factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound
S= Standard deviation of the RRFs

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 5.0 std)	Recalculated RRF (RRF 5.0 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	10/19/2021	Naphthalene (Naphthalene-d8)	1.308	~~1.169~~ 1.358	1.299	1.299	8.6	8.6
2			Naphthalene (Naphthalene-d8)						
3			Naphthalene (Naphthalene-d8)						

LDC # 53147B26

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

METHOD: GC/MS PAH (EPA SW 846 Method 8270D SIM)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound
Cx = Concentration of compound,
Ais = Area of associated internal stanc
Cis = Concentration of internal standa

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	1019K087	8/6/2021	Naphthalene (Naphthalene-d8)	1.299	1.316	1.316	1.4	1.3
2			Naphthalene (Naphthalene-d8)					
3			Naphthalene (Naphthalene-d8)					

LDC #: 52747B26

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: S

METHOD: GC/MS PAH (EPA SW 846 Method 8270D SIM)

The percent recoveries (%R) of surrogate compounds were recalculated for the compounds identified below using the following calculation:

%Recovery: SURRF/SURRS * 100

Where: SURRF = Surrogate Found
SURRS = Surrogate Spiked

Sample ID: 2

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
2-Methylnaphthalene-d10	5.263	3.32	63.0	63.1	
Fluoranthene-d10	5.263	1.43	27.3	27.2	

LDC # 52747B26

VALIDATION FINDINGS WORKSHEET
LCS Results Verification

Page: ___of___
Reviewer:_____

METHOD: GC/MS PAH (EPA SW 846 Method 8270D SIM)

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * SSC/SA

Where:
SSC = Spiked concentration
SA = Spike added

LCS = Laboratory control spike recovery
LCSD = Laboratory control spike duplicate recovery

RPD = | LCS - LCSD | * 2/(LCS + LCSD)

LCS/LCSD ID: 211019AK-LCS/LCSD

Compound	SA (ug/L)		SSC (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Naphthalene	5.00	5.00	4.12	4.16	82.4	82.4	83.2	83.2	0.97	0.97

LDC #: 52747B2b

VALIDATION FINDINGS WORKSHEET
Sample Results Verification

METHOD: GC/MS PAH (EPA SW 846 Method 8270D SIM)

Compound results for all Level IV samples reported with a positive detect were recalculated and verified using the following equation:

$$\text{Concentration} = \frac{(Ax)(Cis)(Vt)(Df)}{(RRF)(Vo)(Ais)(\%S)}$$

Where:

Ax = Area of the peak for the compound to be measured
Ais = Area of internal standard
Cis = Concentration of internal standard
DF = Dilution factor

RRF = Average relative response factor from intial calibration
Vo = Volume of extract in milliliters (mL)
Wt = Weight of sample in grams (g)
%S = Percent solids factor
Vc = Volume of cleanup extract in milliters (mL)

Sample #	Compound	Ax	Ais	Cis (ug/L)	DF	RRF	Vt (mL)	Vo (mL)	%S	Calculated Concentration (ug/L)	Reported Concentration (ug/L)	% Diff
2	Naphthalene	329066	14604	2.5	1.0	1.299	1	950		46	46	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 18F0126

LDC Report Date: December 16, 2021

Parameters: Total Organic Carbon

Validation Level: Stage 2B & 4

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 97850

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH1803	BA43145	Water	10/13/21
ERH1806**	BA43147**	Water	10/13/21
ERH1809	BA43149	Water	10/13/21
ERH1812	BA43151	Water	10/13/21

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Work Plan/Scope of Work, 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 02, January 2017), the 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), the Sampling and Analysis Plan, Addendum 01, 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 00, September 2017), the Sampling and Analysis Plan, Addendum 03, 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 00, June 2018), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019), and the DoD General Validation Guidelines (November 2019). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Total Organic Carbon by Environmental Protection Agency (EPA) SW 846 Method 9060A

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was not detected and the associated numerical value is approximate.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Qualification Code Reference

a ICP Serial Dilution %D was not within control limits.

b Presumed contamination from preparation (method blank).

c Calibration %RSD, r, r^2, %D or %R was noncompliant.

d The analysis with this flag should not be used because another more technically sound analysis is available.

e MS/MSD or Duplicate RPD was high.

f Presumed contamination from FB or ER.

g ICP ICS results were unsatisfactory.

h Holding times were exceeded.

i Internal standard performance was unsatisfactory.

k Estimated Maximum Possible Concentration (HRGC/HRMS only)

l LCS/LCSD %R was not within control limits.

m Result exceeded the calibration range.

o Cooler temperature or temperature blank was noncompliant and/or sample custody problems.

p RPD between two columns was high (GC only).

q MS/MSD recovery was not within control limits.

s Surrogate recovery was not within control limits.

t Presumed contamination from trip blank.

v Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

w LCS/LCSD RPD was high.

y Chemical recovery was not within control limits (Radiochemistry only).

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met with the following exceptions:

Date	Lab. Reference/ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
11/05/21	CCV (04:24)	Total organic carbon	88.2 (90-110)	ERH1809	J- (all detects)	P
11/05/21	CCV (17:26)	Total organic carbon	87.7 (90-110)	ERH1803 ERH1806**	J- (all detects)	P
11/06/21	CCV (03:12)	Total organic carbon	82.2 (90-110)	ERH1803 ERH1806**	J- (all detects)	P

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Target Analyte Quantitation

All target analyte quantitation met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected or recommended for exclusion in this SDG.

Due to continuing calibration %R, data were qualified as estimated in three samples.

Red Hill Bulk Storage Facility, CTO 18F0126
Total Organic Carbon - Data Qualification Summary - SDG 97850

Sample	Analyte	Flag	A or P	Reason (Code)
ERH1809 ERH1803 ERH1806**	Total organic carbon	J- (all detects)	P	Continuing calibration (%R) (c)

Red Hill Bulk Storage Facility, CTO 18F0126
Total Organic Carbon - Laboratory Blank Data Qualification Summary - SDG 97850

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 18F0126
Total Organic Carbon - Field Blank Data Qualification Summary - SDG 97850

No Sample Data Qualified in this SDG

LDC #: 52747B6
SDG #: 97850
Laboratory: APPL, Inc., Clovis, CA

VALIDATION COMPLETENESS WORKSHEET
Stage 2B/4

Date: 12/10/21
Page: 1 of 1
Reviewer: ATV
2nd Reviewer: AC

METHOD: (Analyte) TOC (EPA SW846 Method 9060A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	SW	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	C,S
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS/LCSD
IX.	Field duplicates	N	
X.	Target Analyte Quantitation	A	Not reviewed for Stage 2B validation.
XI.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1	ERH1803	BA43145	Water	10/13/21
2	ERH1806**	BA43147**	Water	10/13/21
3	ERH1809	BA43149	Water	10/13/21
4	ERH1812	BA43151	Water	10/13/21
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes:

METHOD: Inorganics				
Validation Area	**Yes**	**No**	**NA**	**Comments**
I. Technical holding times				
Were all technical holding times met?	✓			
II. Calibration				
Were all instruments calibrated at the required frequency?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verifications within the QC limits?		✓		
Were all initial calibration correlation coefficients within limits as specifed by the method?	✓			
Were balance checks performed as required?			✓	
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks?		✓		
Was there contamination in the initial and continuing calibration blanks?		✓		
IV. Matrix Spike/Matrix Spike Duplicates/Laboratory Duplicates				
Were MS/MSD recoveries within the QC limits? (If the sample concentration exceeded the spike concentration by a factor of 4, no action was taken.)			✓	
Were the MS/MSD or laboratory duplicate relative percent differences (RPDs) within the QC limits?			✓	
V. Laboratory Control Samples				
Was a LCS analyzed for each batch in the SDG?	✓			
Were the LCS recoveries and RPDs (if applicable) within QC limits?	✓			
X. Target Analyte Quantitation				
Were all reporting limits adjusted to reflect sample dilutions?	✓			
Were all soil samples dry weight corrected?			✓	
XI. Overall Assessment of Data				
Was the overall assessment of the data found to be acceptable?	✓			

METHOD: Inorganics				
Validation Area	**Yes**	**No**	**NA**	**Comments**
XII. Field Duplicates				
Were field duplicates identifed in this SDG?		✓		
Were target analytes detected in the field duplicates?			✓	
XIII. Field Blanks				
Were field blanks identified in this SDG?		✓		
Were target analytes detected in the field blanks?			✓	

LDC #: 52747B6

VALIDATION FINDINGS WORKSHEET
Calibration

Reviewer: ATL

METHOD: Inorganics, EPA Method See cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Were all instruments calibrated daily, each set-up time, and were the proper number of standards used?
Y (N) N/A Were all initial and continuing calibration verification percent recoveries (%R) within the control limits of 90-110% ?
(Y) N N/A Are all correlation coefficients ≥0.995 ?

LEVEL IV/D ONLY:

(Y) N N/A Were recalculated results acceptable? See Level IV Initial and Continuing Calibration Recaluculation Worksheet for recalulations.
Y N (N/A) Was a balance check conducted prior to the TDS analysis.?
Y N (N/A) Was the titrant normality checked?

#	Date	Calibration ID	Analyte	%R	Associated Samples	Qualifications Code: c
	11/05/21	CCV (04:24)	TOC	88.2 (90-110)	3	J-/UJ/P (detect)
		CCV (17:26)	TOC	87.7 (90-110)	1,2	J-/UJ/P (detect)
	11/06/21	CCV (03:12)	TOC	82.2 (90-110)	1,2	J-/UJ/P (detect)

Comments:

LDC #: 52747B6

Validation Findings Worksheet
Initial and Continuing Calibration Calculation Verification

Reviewer: ATL

Method: Inorganics, Method See Cover

The correlation coefficient (r) for the calibration of TOC was recalculated. Calibration date: 10/25/21

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

$$\%R = \frac{\text{Found} \times 100}{\text{True}}$$

Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution

True = concentration of each analyte in the ICV or CCV source

Type of analysis	Analyte	FOUND Standard	TRUE Conc. (mg/L)	Area	Recalculated r or r^2	Reported r or r^2	Acceptable (Y/N)
Initial calibration	TOC	s1	0.0	4558	*0.99987*	*0.99987*	Y
		s2	0.5	9475			
		s3	2	29763			
		s4	5	69278			
		s5	10	139847			
		s6	20	273227			
ICV (10/25 @ 10:39) Calibration verification	TOC	10.540	10.000		105.4	105.5	Y
CCV (11/05 @ 17:26) Calibration verification	TOC	4.436	5.000		88.7	87.7	Y
CCV (11/06 @ 03:12) Calibration verification	TOC	4.159	5.000		83.2	82.2	Y

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 52747B6

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: ATL

METHOD: Inorganics, Method See cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$ Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (mg/L) (units)	True / D (mg/L) (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
LCS	Laboratory control sample	TOC	4.4738	5.00	89.5	90.8	Y
	Matrix spike sample		(SSR-SR)				
	Duplicate sample						

Comments: _____

LDC #: 52747BG

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: ATL

METHOD: Inorganics, Method See cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Have results been reported and calculated correctly?
(Y) N N/A Are results within the calibrated range of the instruments?
(Y) N N/A Are all detection limits below the CRQL?

Compound (analyte) results for TOC reported with a positive detect were recalculated and verified using the following equation:

Concentration = Recalculation: #2

$$[51041 \times [7.398 \times 10^{-5}] + 0.2376] \times 5 = 17.6925$$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
	2	TOC	18.0	17.6925	Y

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 18F0126

LDC Report Date: December 16, 2021

Parameters: Gasoline Range Organics

Validation Level: Stage 2B & 4

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 97850

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH1802	BA43144	Water	10/13/21
ERH1803	BA43145	Water	10/13/21
ERH1805	BA43146	Water	10/13/21
ERH1806**	BA43147**	Water	10/13/21
ERH1808	BA43148	Water	10/13/21
ERH1809**	BA43149**	Water	10/13/21
ERH1811	BA43150	Water	10/13/21
ERH1812	BA43151	Water	10/13/21

**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Work Plan/Scope of Work, 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 02, January 2017), the 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), the Sampling and Analysis Plan, Addendum 01, 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 00, September 2017), the Sampling and Analysis Plan, Addendum 03, 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 00, June 2018), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019), the DoD General Validation Guidelines (November 2019), and the U.S. Department of Defense (DoD) Data Validation Guidelines Module 1: Data Validation Procedure for Organic Analysis by GC/MS (May 2020). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Gasoline Range Organics by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was not detected and the associated numerical value is approximate.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Qualification Code Reference

a ICP Serial Dilution %D was not within control limits.

b Presumed contamination from preparation (method blank).

c Calibration %RSD, r, r^2, %D or %R was noncompliant.

d The analysis with this flag should not be used because another more technically sound analysis is available.

e MS/MSD or Duplicate RPD was high.

f Presumed contamination from FB or ER.

g ICP ICS results were unsatisfactory.

h Holding times were exceeded.

i Internal standard performance was unsatisfactory.

k Estimated Maximum Possible Concentration (HRGC/HRMS only)

l LCS/LCSD %R was not within control limits.

m Result exceeded the calibration range.

o Cooler temperature or temperature blank was noncompliant and/or sample custody problems.

p RPD between two columns was high (GC only).

q MS/MSD recovery was not within control limits.

s Surrogate recovery was not within control limits.

t Presumed contamination from trip blank.

v Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

w LCS/LCSD RPD was high.

y Chemical recovery was not within control limits (Radiochemistry only).

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the methods.

A curve fit, based on the initial calibration, was established for quantitation. The coefficient of determination (r^2) was greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

III. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks.

V. Field Blanks

Samples ERH1802, ERH1805, ERH1808, and ERH1811 were identified as trip blanks. No contaminants were found.

VI. Surrogates

Surrogates were added to all samples as required by the methods. All surrogate recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the methods. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Target Analyte Quantitation

All target analyte quantitations met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XI. Target Analyte Identification

All target analyte identifications met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected or recommended for exclusion in this SDG.

Red Hill Bulk Storage Facility, CTO 18F0126
Gasoline Range Organics - Data Qualification Summary - SDG 97850

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 18F0126
Gasoline Range Organics - Laboratory Blank Data Qualification Summary - SDG 97850

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 18F0126
Gasoline Range Organics - Field Blank Data Qualification Summary - SDG 97850

No Sample Data Qualified in this SDG

LDC #: 52747B7
SDG #: 97850
Laboratory: APPL, Inc., Clovis, CA

VALIDATION COMPLETENESS WORKSHEET
Stage 2B/4

Date: 12/11/21
Page: 1 of 1
Reviewer: JT
2nd Reviewer: AV

METHOD: GC/MS Gasoline Range Organics (EPA SW 846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
~~II.~~	~~GC/MS Instrument performance check~~		
III.	Initial calibration/ICV	A / A	r ≥ 0.99 %RSD ≤ 20
IV.	Continuing calibration	A	D ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1, 3, 5, 7
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	N	1
~~XI.~~	~~Internal standards~~	~~A~~ N	
XII.	Target analyte quantitation	A	Not reviewed for Stage 2B validation.
XIII.	Target analyte identification	A	Not reviewed for Stage 2B validation.
XIV.	System performance	A	Not reviewed for Stage 2B validation.
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Stage 4 validation

	Client ID		Lab ID	Matrix	Date
1	ERH1802	TB	BA43144	Water	10/13/21
2	ERH1803		BA43145	Water	10/13/21
3	ERH1805	TB	BA43146	Water	10/13/21
4	ERH1806**		BA43147**	Water	10/13/21
5	ERH1808	TB	BA43148	Water	10/13/21
6	ERH1809**		BA43149**	Water	10/13/21
7	ERH1811	TB	BA43150	Water	10/13/21
8	ERH1812		BA43151	Water	10/13/21
9					

Notes:

	2110/8AM1						

LDC #: 52747B7

VALIDATION FINDINGS CHECKLIST

Method: ✓ GC __ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	-		✓	
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥0.990?	✓			
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20%?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks?		✓		
V. Field Blanks				
Were field blanks identified in this SDG?	✓			
Were target compounds detected in the field blanks?		✓		
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?	✓			
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
VIII. Laboratory control samples				
Was an LCS analyzed per analytical or extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			

Validation Area	Yes	No	NA	Findings/Comments
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?		✓		
Were target compounds detected in the field duplicates?			✓	
X. Target analyte quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were analyte quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target analyte identification				
Were the retention times of reported detects within the RT windows?			✓	
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC#: 52747B7

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page:_____of_____
Reviewer: SC

METHOD: GC/MS GRO (EPA SW 846 Method 8260B)

Calibration Date	Instrument	Analyte	Standard	(Y) Response ratio	(X) Concentration ratio
8/25/2021	Max	GRO	1	11.01285414	0.80
			2	11.37878007	2.00
			3	12.07552707	4.00
			4	15.47461299	12.00
			5	19.69462765	24.00
			6	22.77407945	32.00
			7	25.39517373	40.00

Regression Output	Calculated	Reported
Constant	1.07E+01	
Std Err of Y Est		
R Squared	0.9991446	0.999000
Degrees of Freedom		
X Coefficient(s)	3.72E-01	
Std Err of Coef.		
Correlation Coefficient	0.9995722	
Coefficient of Determination (r^2)	0.9991446	0.9980000

LDC # 52147B7

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

METHOD: GC/MS GRO (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound
Ais = Area of associated internal standard (IS)
Cx = Concentration of compound
Cis = Concentration of IS

#	Standard ID	Calibration Date	Compound (IS)	True Value (Initial)	Reported Conc (CCV)	Recalculated Conc (CCV)	Reported % D	Recalculated %D
1	1018M05	10/18/2021	GRO (Fluorobenzene)	300.000	348.202	348.202	16	16
2			GRO (Fluorobenzene)					
3			GRO (Fluorobenzene)					

LDC # 52147B1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

METHOD: GC/MS GRO (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogate compounds were recalculated for the compounds identified below using the following calculation:

Surrogate Found = (Area surr) (Conc IS) / (Area IS) (average RRF surr)
%Recovery: Surrogate Found/Surrogate Spiked * 100

Sample: 1

	Surrogate Spiked (ug/L)	Surrogate Found (ug/L)	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
4-Bromofluorobenzene	25.0	25.33	101	101	

LDC # 52747B7

VALIDATION FINDINGS WORKSHEET
LCS Results Verification

METHOD: GC/MS GRO (EPA SW 846 Method 8260B)

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control duplicate were recalculated for the compounds identified below using the following calculation:

SSC = (Area spike) (Conc IS) / (Area IS) (average RRF spike)
%Recovery = 100 * SSC/SA

Where:
SSC = Spiked concentration
SA = Spike added
LCS = Laboratory control spike recovery
LCSD = Laboratory control spike duplicate recovery

RPD = | LCS - LCSD | * 2/(LCS + LCSD)

LCS/LCSD ID: 211018AM1-LCS/D

Compound	SA (ug/L)		SSC (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
GRO	300	300	346	329	115	115	110	110	5.0	5.0

LDC # 52714B7

VALIDATION FINDINGS WORKSHEET
Sample Results Verification

METHOD: GC/MS GRO (EPA SW 846 Method 8260B)

Compound results for all Level IV samples reported with a positive detect were recalculated and verified using the following equation:

$$\text{Concentration} = \frac{(Ax)\ (Cis)\ (Df)}{(Ais)\ (RRF)}$$

Where:

Ax = Area or height of the peak for the compound to be measured
Ais = Area or height of internal standard
Cis = Concentration of internal standard
RRF = Average relative response factor
DF = Dilution factor

Sample #	Compound	Ax	Ais	Cis (ug/L)	DF	RRF	Calculated Concentration (ug/L)	Reported Concentration (ug/L)	% Diff
LCS	GRO	6905671	434982	25.0	1	curve	346	346	

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 18F0126

LDC Report Date: December 16, 2021

Parameters: Total Petroleum Hydrocarbons as Extractables

Validation Level: Stage 2B & 4

Laboratory: APPL, Inc., Clovis, CA

Sample Delivery Group (SDG): 97850

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH1803	BA43145	Water	10/13/21
ERH1806**	BA43147**	Water	10/13/21
ERH1809	BA43149	Water	10/13/21
ERH1812	BA43151	Water	10/13/21
ERH1803(SGCU)	BA43145(SGCU)	Water	10/13/21
ERH1806(SGCU)**	BA43147(SGCU)**	Water	10/13/21
ERH1809(SGCU)	BA43149(SGCU)	Water	10/13/21
ERH1812(SGCU)	BA43151(SGCU)	Water	10/13/21

Samples appended with "SGCU" underwent Silica Gel cleanup
**Indicates sample underwent Stage 4 validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Work Plan/Scope of Work, 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 02, January 2017), the 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), the Sampling and Analysis Plan, Addendum 01, 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 00, September 2017), the Sampling and Analysis Plan, Addendum 03, 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 00, June 2018), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3 (2019), the DoD General Validation Guidelines (November 2019), and the U.S. Department of Defense (DoD) Data Validation Guidelines Module 4: Data Validation Procedure for Organic Analysis by GC (March 2021). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Total Petroleum Hydrocarbons (TPH) as Extractables by Environmental Protection Agency (EPA) SW 846 Method 8015B

All sample results were subjected to Stage 2B data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Stage 4 data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J+ (Estimated, High Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying high bias, due to non-conformances discovered during data validation.

J- (Estimated, Low Bias): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated, displaying low bias, due to non-conformances discovered during data validation.

J (Estimated, Bias Indeterminate): The analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation. Bias is indeterminate.

U (Non-detected): The analyte was analyzed for and positively identified by the laboratory; however the analyte should be considered non-detected due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The analyte was not detected and the associated numerical value is approximate.

X (Exclusion of data recommended): The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Exclusion of the data is recommended.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Qualification Code Reference

a ICP Serial Dilution %D was not within control limits.

b Presumed contamination from preparation (method blank).

c Calibration %RSD, r, r^2, %D or %R was noncompliant.

d The analysis with this flag should not be used because another more technically sound analysis is available.

e MS/MSD or Duplicate RPD was high.

f Presumed contamination from FB or ER.

g ICP ICS results were unsatisfactory.

h Holding times were exceeded.

i Internal standard performance was unsatisfactory.

k Estimated Maximum Possible Concentration (HRGC/HRMS only)

l LCS/LCSD %R was not within control limits.

m Result exceeded the calibration range.

o Cooler temperature or temperature blank was noncompliant and/or sample custody problems.

p RPD between two columns was high (GC only).

q MS/MSD recovery was not within control limits.

s Surrogate recovery was not within control limits.

t Presumed contamination from trip blank.

v Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

w LCS/LCSD RPD was high.

y Chemical recovery was not within control limits (Radiochemistry only).

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For analytes where average calibration factors were utilized, percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the analytes, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all analytes.

III. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all analytes.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Analyte	Flag	A or P
ERH1806(SGCU)**	Octacosane Ortho-Terphenyl	164 (60-142) 128 (56-125)	Diesel (C10-C24) Oil (C24-C40)	J+ (all detects) J+ (all detects)	P
ERH1812(SGCU)	Octacosane Ortho-Terphenyl	218 (60-142) 179 (56-125)	Oil (C24-C40)	J+ (all detects)	P

Sample	Surrogate	%R (Limits)	Affected Analyte	Flag	A or P
ERH1812(SGCU)	Octacosane Ortho-Terphenyl	218 (60-142) 179 (56-125)	Diesel (C10-C24)	NA	-

VII. Matrix Spike/Matrix Spike Duplicates

The laboratory has indicated that there were no matrix spike (MS) and matrix spike duplicate (MSD) analyses specified for the samples in this SDG, and therefore matrix spike and matrix spike duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Analyte	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
211018A1-LCS/LCSD (ERH1803(SGCU) ERH1806(SGCU)** ERH1809(SGCU))	Diesel (C10-C24) Oil (C24-C40)	- -	152 (36-132) 156 (41-113)	J+ (all detects) J+ (all detects)	P
211018A1-LCS/LCSD (ERH1812(SGCU))	Diesel (C10-C24) Oil (C24-C40)	- -	152 (36-132) 156 (41-113)	NA	-

Relative percent differences (RPD) were within QC limits with the following exceptions:

LCS ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
211018A1-LCS/LCSD (ERH1803(SGCU) ERH1806(SGCU)** ERH1809(SGCU))	Diesel (C10-C24) Oil (C24-C40)	50.1 (≤30) 56.3 (≤30)	J (all detects) J (all detects)	P
211018A1-LCS/LCSD (ERH1812(SGCU))	Diesel (C10-C24) Oil (C24-C40)	50.1 (≤30) 56.3 (≤30)	NA	-

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Target Analyte Quantitation

All target analyte quantitations met validation criteria for samples which underwent Stage 4 validation. Raw data were not reviewed for Stage 2B validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected or recommended for exclusion in this SDG.

Due to surrogate %R and LCS/LCSD %R and RPD, data were qualified as estimated in four samples.

Red Hill Bulk Storage Facility, CTO 18F0126
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary - SDG 97850

Sample	Analyte	Flag	A or P	Reason (Code)
ERH1806(SGCU)**	Diesel (C10-C24) Oil (C24-C40)	J+ (all detects) J+ (all detects)	P	Surrogates (%R) (s)
ERH1812(SGCU)	Oil (C24-C40)	J+ (all detects)	P	Surrogates (%R) (s)
ERH1803(SGCU) ERH1806(SGCU)** ERH1809(SGCU)	Diesel (C10-C24) Oil (C24-C40)	J+ (all detects) J+ (all detects)	P	Laboratory control samples (%R) (l)
ERH1803(SGCU) ERH1806(SGCU)** ERH1809(SGCU)	Diesel (C10-C24) Oil (C24-C40)	J (all detects) J (all detects)	P	Laboratory control samples (RPD) (w)

Red Hill Bulk Storage Facility, CTO 18F0126
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data Qualification Summary - SDG 97850

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 18F0126
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification Summary - SDG 97850

No Sample Data Qualified in this SDG

LDC #: 52747B8
SDG #: 97850
Laboratory: APPL, Inc., Clovis, CA

VALIDATION COMPLETENESS WORKSHEET
Stage 2B/4

Date: 12/11/21
Page: 1 of 1
Reviewer: M
2nd Reviewer: MC

METHOD: GC TPH as Extractables (EPA SW 846 Method 8015B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Initial calibration/ICV	A / A	RSD≤20, r² ICV≤20
III.	Continuing calibration	A	D≤20
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	SW	LCS/D
IX.	Field duplicates	N	
X.	Target analyte quantitation	A	Not reviewed for Stage 2B validation.
XI.	Target analyte identification	A	Not reviewed for Stage 2B validation.
XII.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample underwent Stage 4 validation

	Client ID	Lab ID	Matrix	Date
1	ERH1803	BA43145	Water	10/13/21
2	ERH1806**	BA43147**	Water	10/13/21
3	ERH1809	BA43149	Water	10/13/21
4	ERH1812	BA43151	Water	10/13/21
5	ERH1803(SGCU)	BA43145(SGCU)	Water	10/13/21
6	ERH1806(SGCU)**	BA43147(SGCU)**	Water	10/13/21
7	ERH1809(SGCU)	BA43149(SGCU)	Water	10/13/21
8	ERH1812(SGCU)	BA43151(SGCU)	Water	10/13/21
9				
10				
11				
12				
13				

Notes:

	211018A						
	211015A1						

LDC #: 52747B8

VALIDATION FINDINGS CHECKLIST

Reviewer: DC

Method: ✓ GC __ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥0.990?	✓			
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20%?	✓			
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks?		✓		
V. Field Blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?		✓		
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?		✓		
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
VIII. Laboratory control samples				
Was an LCS analyzed per analytical or extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			

Validation Area	Yes	No	NA	Findings/Comments
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?		✓		
Were target compounds detected in the field duplicates?			✓	
X. Target analyte quantitation				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	✓			
Were analyte quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target analyte identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

LDC #: 57478-8

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Reviewer: [illegible]

METHOD: ✓ GC ___ HPLC

Are surrogates required by the method? Yes ✓ or No ___.

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were surrogates spiked into all samples and blanks?

Y N N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	6 (dup)		G	164 (60-142)	J+dets/P (c)
			H	128 (56-125)	
				( )	
	8 (dup/MD)		G	218 ( )	(Dil (Unit-C4D))
			H	179 ( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
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				( )	
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				( )	
				( )	
				( )	
				( )	
				( )	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	G	Octacosane	M	Benzo(e)Pyrene	S	1-Chloro-3-Nitrobenzene	Y	Tetrachloro-m- xylene
B	4-Bromofluorobenzene (BFB)	H	Ortho-Terphenyl	N	Terphenyl-D14	T	3,4-Dinitrotoluene	Z	1,2-Dinitrobenzene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Tripentyltin		
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin		
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate		
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 52747B8

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Reviewer: R

METHOD: GC

LCS percent recoveries (%R) and relative percent differences (RPD) within the QC limitswith the following exceptions:

#	LCS/LCSD ID	Analyte	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	211018A1-LCS/D	Diesel (C10-C24)	( )	152 (36-132)	( )	5-8 (8-ND)	J+dets/P (l
		Oil (C24-C40)	( )	156 (41-113)	( )		↓
		Diesel (C10-C24)	( )	( )	50.1 (≤30)		J dets/P (w)
		Oil (C24-C40)	( )	( )	56.3 (↓)		↓
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC #: 52747B8

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

METHOD: GC TPH (EPA SW 846 Method 8015B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound
S= Standard deviation of the RRFs

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound	Reported RRF (RRF 250 std)	Recalculated RRF (RRF 250 std)	Reported Average RRF	Recalculated Average RRF	Reported %RSD	Recalculated %RSD
1	ICAL	8/30/2021	Diesel C10-C24	1954573	1954573	2019597	2019597	2.7	2.7
	ICAL								

LDC # 52747B8

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

METHOD: GC TPH (EPA SW 846 Method 8015B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	1021103	10/23/2021	Diesel C10-C24	2019597	2156260	2156256	6.8	6.8
2	1021017	10/21/2021	Diesel C10-C24	2019597	2152930	2152930	6.6	6.6
3								

LDC # 52478B

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

METHOD: GC TPH (EPA SW 846 Method 8015B)

The percent recoveries (%R) of surrogate compounds were recalculated for the compounds identified below using the following calculation:

Surrogate Found = (Area surr) (Conc IS) / (Area IS) (average RRF surr)
%Recovery: Surrogate Found/Surrogate Spiked * 100

Sample: 2

	Surrogate Spiked (ug/L)	Surrogate Found (ug/L)	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Octacosane	145.631	151.4	104	104	
o-Terphenyl	145.631	126.715	87.0	87.0	

LDC # 51747B8

VALIDATION FINDINGS WORKSHEET
LCS Results Verification

METHOD: GC TPH (EPA SW 846 Method 8015B)

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control duplicate were recalculated for the compounds identified below using the following calculation:

SSC = (Area spike) (Conc IS) / (Area IS) (average RRF spike)
%Recovery = 100 * SSC/SA

Where:
SSC = Spiked concentration
SA = Spike added
LCS = Laboratory control spike recovery
LCSD = Laboratory control spike duplicate recovery

RPD = | LCS - LCSD | * 2/(LCS + LCSD)

LCS/LCSD ID: 211018A-LCS/D

Compound	SA (ug/L)		SSC (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
DRO	2000	2000	2040	1780	102	102	89.0	89.0	13.6	13.6

LDC # 52747B8

VALIDATION FINDINGS WORKSHEET
Sample Results Verification

METHOD: GC TPH (EPA SW 846 Method 8015B)

Compound results for all Level IV samples reported with a positive detect were recalculated and verified using the following equation:

$$\text{Concentration} = \frac{(Ax)\,(Vt)\,(Df)}{(RRF)\,(Vo)}$$

Where:

Ax = Area or height of the peak for the compound to be measured
DF = Dilution factor
Wt = Weight of sample in grams (g)
Vt = Volume of extract in milliters (mL)
RRF = Average relative response factor
Vo = Volume of sample in milliters (mL)

Sample #	Compound	Ax	DF	RRF	Vo (mL)	Wt (mL)	% Solids	Calculated Concentration (ug/L)	Reported Concentration (ug/L)	% Diff
2	Diesel C10-C24	2465851786	1	2092014	5	1030		2861	3000	
6	Oil C24-C40	126169788	1	curve	5	1030		168	170	
	SGCU									