

## LABORATORY DATA CONSULTANTS, INC.

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AECOM  
1001 Bishop Street Suite 1600  
Honolulu, HI 96813  
ATTN: Ms. Margie Pascua  
[Margie.Pascua@aecom.com](mailto:Margie.Pascua@aecom.com)

October 14, 2019

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

Dear Ms. Pascua

Enclosed are the revised validation reports for the fractions listed below. These SDGs were received on August 28, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

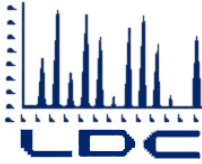
- ERH838 and ERH839 were identified as field duplicates for BTEX, Phenol, PAH, 2-(2-Methoxyethoxy)-ethanol, GRO and TPHE.

### **LDC Project #45841 RV2:**

<b><u>SDG #</u></b>	<b><u>Fraction</u></b>
89570, 89593 89607	Volatiles, Phenol, Polynuclear Aromatic Hydrocarbons, 2-(2-Methoxyethoxy)-Ethanol, Wet Chemistry, Gasoline Range Organics, Total Petroleum Hydrocarbons as Extractables, Methane

The data validation was performed under Level C & D validation guidelines. The analyses were validated using the following documents and variances, as applicable to each 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
- Project Procedures Manual U.S. Naval Facilities Engineering Command Environmental Restoration Program, NAVFAC Pacific; DON 2015
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.1; 2017



## LABORATORY DATA CONSULTANTS, INC.

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- 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; IIB, November 2004; update IV, February 2007; update V, July 2014

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

Sincerely,

Stella Cuenco

[scuenco@lab-data.com](mailto:scuenco@lab-data.com)

Operations Manager/Senior Chemist

EDD 90/10 C/D

LDC #45841 (AECOM-Honolulu, HI / Red Hill Bulk Storage Facility, CTO 18F0126)

LDC	SDG#	DATE REC'D	(2) DATE DUE	BTEX (8260B)		Phenol (8270D)		PAH (8270D -SIM)		(1)SVOA (8270D -Mod)		GRO (8260B)		TPH-E (8015B)		SGCU (TPH-E (8015B)		Methane (175)		Alk. (2320B)		Cl,NO <sub>3</sub> SO <sub>4</sub> (300.0)		NO <sub>3</sub> /NO <sub>2</sub> -N (353.2)		Fe II (3500 -Fe B)		TOC (9060A)												
				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	W	S			
Matrix: Water/Soil																																								
A	89570	08/28/19	09/12/19	4	0	3	0	3	0	3	0	5	0	3	0	-	-	4	0	2	0	2	0	2	0	2	0	2	0											
B	89593	08/28/19	09/12/19	9	0	5	0	5	0	5	0	9	0	5	0	2	0	10	0	4	0	4	0	4	0	4	0	4	0											
B	89593	08/28/19	09/12/19	2	0	1	0	1	0	1	0	2	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0									
C	89607	08/28/19	09/12/19	6	0	3	0	3	0	3	0	6	0	3	0	2	0	6	0	3	0	3	0	3	0	3	0	3	0	3	0									
Total	J/SC			21	0	12	0	12	0	12	0	22	0	12	0	5	0	21	0	10	0	10	0	10	0	10	0	10	0	10	0	0	0	0	0	0	167			

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** October 11, 2019

**Parameters:** Volatiles

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89570

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH856	AZ95186	Water	07/22/19
ERH857	AZ95187	Water	07/22/19
ERH837	AZ95188	Water	07/22/19
ERH838	AZ95189	Water	07/22/19
ERH839	AZ95190	Water	07/22/19
ERH838MS	AZ95189MS	Water	07/22/19
ERH838MSD	AZ95189MSD	Water	07/22/19



## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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.

For compounds where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 15.0%

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

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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 ERH856 and ERH837 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**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## **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**

Samples ERH838 and ERH839 were identified as field duplicates. No results were detected in any of the samples.

## **XI. Internal Standards**

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

## **XII. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Laboratory Blank Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Field Blank Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

LDC #: 45841A1a  
 SDG #: 89570  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/5/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**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, r <sup>2</sup>   CV ≤ 20
IV.	Continuing calibration	A	ending   CV ≤ 20 / 50
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 1, 3
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCs 10
X.	Field duplicates	ND	D = 4 + 5
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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

	Client ID	Lab ID	Matrix	Date
1	ERH856, TB	AZ95186	Water	07/22/19
2	ERH857	AZ95187	Water	07/22/19
3	ERH837, TB	AZ95188	Water	07/22/19
4	ERH838	AZ95189	Water	07/22/19
5	ERH839	AZ95190	Water	07/22/19
6	ERH838MS	AZ95189MS	Water	07/22/19
7	ERH838MSD	AZ95189MSD	Water	07/22/19
8				

Notes:

190727BL-BLK				

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** October 11, 2019

**Parameters:** Phenol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89570

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH857	AZ95187	Water	07/22/19
ERH838	AZ95189	Water	07/22/19
ERH839	AZ95190	Water	07/22/19
ERH838MS	AZ95189MS	Water	07/22/19
ERH838MSD	AZ95189MSD	Water	07/22/19



## Introduction

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The analyses were performed by the following method:

Phenol by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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.

## **VIII. Matrix Spike/Matrix Spike Duplicates**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## **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**

Samples ERH838 and ERH839 were identified as field duplicates. No results were detected in any of the samples.

## **XI. Internal Standards**

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

## **XII. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Laboratory Blank Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Field Blank Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

LDC #: 45841A2a  
 SDG #: 89570  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/5/19  
 Page: bf 7  
 Reviewer: EF  
 2nd Reviewer: AE

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

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	$\Delta/\Delta$	
II.	GC/MS Instrument performance check	$\Delta$	
III.	Initial calibration/ICV	$\Delta/\Delta$	% PSD $\leq 15$ ICV $\leq 20$
IV.	Continuing calibration <i>ending</i>	$\Delta$	COV $\leq 20$   50
V.	Laboratory Blanks	$\Delta$	
VI.	Field blanks	N	
VII.	Surrogate spikes	$\Delta$	
VIII.	Matrix spike/Matrix spike duplicates	$\Delta$	
IX.	Laboratory control samples	$\Delta$	res 10
X.	Field duplicates	ND	$d = 2 + 3$
XI.	Internal standards	$\Delta$	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	$\Delta$	

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

	Client ID	Lab ID	Matrix	Date
1	ERH857	AZ95187	Water	07/22/19
2	ERH838	AZ95189	Water	07/22/19
3	ERH839	AZ95190	Water	07/22/19
4	ERH838MS	AZ95189MS	Water	07/22/19
5	ERH838MSD	AZ95189MSD	Water	07/22/19
6				
7				
8				

Notes:

ROTSA - BIK				

**Laboratory Data Consultants, Inc.**  
**Data Validation Report**

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

**LDC Report Date:** October 11, 2019

**Parameters:** Polynuclear Aromatic Hydrocarbons

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89570

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH857	AZ95187	Water	07/22/19
ERH838	AZ95189	Water	07/22/19
ERH839	AZ95190	Water	07/22/19
ERH838MS	AZ95189MS	Water	07/22/19
ERH838MSD	AZ95189MSD	Water	07/22/19



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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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
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- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
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- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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.

## **VIII. Matrix Spike/Matrix Spike Duplicates**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## **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**

Samples ERH838 and ERH839 were identified as field duplicates. No results were detected in any of the samples.

## **XI. Internal Standards**

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

## **XII. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification  
Summary - SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -  
SDG 89570**

No Sample Data Qualified in this SDG

LDC #: 45841A2b  
 SDG #: 89570  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/5/19  
 Page: 1 of 1  
 Reviewer: EF  
 2nd Reviewer: KE

**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	% PSD ≤ 15      ICV ≤ 20
IV.	Continuing calibration <i>tending</i>	A	CW ≤ 20 / 50
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	Les ID
X.	Field duplicates	N/D	D = 2+3
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH857	AZ95187	Water	07/22/19
2	ERH838	AZ95189	Water	07/22/19
3	ERH839	AZ95190	Water	07/22/19
4	ERH838MS	AZ95189MS	Water	07/22/19
5	ERH838MSD	AZ95189MSD	Water	07/22/19
6				
7				
8				

Notes:

	190725A - BIK				

TTT, W, S

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** October 11, 2019

**Parameters:** 2-(2-Methoxyethoxy)-ethanol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89570

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH857	AZ95187	Water	07/22/19
ERH838	AZ95189	Water	07/22/19
ERH839	AZ95190	Water	07/22/19
ERH838MS	AZ95189MS	Water	07/22/19
ERH838MSD	AZ95189MSD	Water	07/22/19



## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

2-(2-Methoxyethoxy)-ethanol by Environmental Protection Agency (EPA) SW 846 Method 8270D Modified

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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 not added to all samples as required by the method. Using professional judgment, no data were qualified. Although the LCSD percent recovery was outside the QC limit, the LCS/MS/MSD were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis.

## VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## 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 with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
190726A-LCS/D (All samples in SDG 89570)	2-(2-Methoxyethoxy)-ethanol	-	151 (30-130)	NA	-

Relative percent differences (RPD) were within QC limits.

## X. Field Duplicates

Samples ERH838 and ERH839 were identified as field duplicates. No results were detected in any of the samples.

## XI. Internal Standards

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

## XII. Compound Quantitation

Raw data were not reviewed for Level C validation.

## XIII. Target Compound Identifications

Raw data were not reviewed for Level C validation.

## XIV. System Performance

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

The analysis was conducted within all specifications of the method with the exception noted in Section VII. No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -  
SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG  
89570**

No Sample Data Qualified in this SDG

LDC #: 45841A2c  
 SDG #: 89570  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/5/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-Modified)

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	% PSD ≤ 15      ICV ≤ 20
IV.	Continuing calibration <i>ending</i>	A	CCV ≤ 20 / SD
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	LCS ID
X.	Field duplicates	ND	D = 2+3
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH857	AZ95187	Water	07/22/19
2	ERH838	AZ95189	Water	07/22/19
3	ERH839	AZ95190	Water	07/22/19
4	ERH838MS	AZ95189MS	Water	07/22/19
5	ERH838MSD	AZ95189MSD	Water	07/22/19
6				
7				
8				

Notes:

	190726A - BIK				



LDC #: 45841A2C

### VALIDATION FINDINGS WORKSHEET Surrogate Recovery

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: [Signature]

**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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	all	Surrogates were not added to all samples as required by the method. Using professional judgment, no data were qualified. Although the LCSD percent recovery was outside the QC limit, the LCS/MS/MSD were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis.		Text
			( )	
			( )	
			( )	
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			( )	
			( )	

(NBZ) = Nitrobenzene - d5

(2FP) = 2-Fluorophenol

**VALIDATION FINDINGS WORKSHEET**  
**Laboratory Control Samples (LCS)**

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

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

Y N N/A Was a LCS required?  
Y N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	190726A- LCS 10	*	<del>129 (30-130)</del> FT ( )	151 (30-130) ( )	( ) ( )	All (L)	IdU / P ND
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 5, 2019

**Parameters:** Wet Chemistry

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89570

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH857	AZ95187	Water	07/22/19
ERH838	AZ95189	Water	07/22/19
ERH857MS	AZ95187MS	Water	07/22/19
ERH857MSD	AZ95187MSD	Water	07/22/19
ERH838MS	AZ95189MS	Water	07/22/19
ERH838MSD	AZ95189MSD	Water	07/22/19
ERH838DUP	AZ95189DUP	Water	07/22/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Alkalinity by Standard Method 2320B

Chloride, Nitrate, and Sulfate by Environmental Protection Agency (EPA) Method 300.0

Ferrous Iron by Standard Method 3500-Fe B

Nitrate/Nitrite as Nitrogen by EPA Method 353.2

Total Organic Carbon by EPA SW 846 Method 9060A

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is  $<0.995$ .
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

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

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
ERH857	Ferrous iron	11 days	7 days	UJ (all non-detects)	P

## II. Initial Calibration

All criteria for the initial calibration of each method were met.

## III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

## IV. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Limit of Quantitation	Associated Samples
PB (prep blank)	Bicarbonate alkalinity Total alkalinity	3.7 mg/L 3.7 mg/L	2.0 mg/L 2.0 mg/L	ERH838

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

## V. Field Blanks

No field blanks were identified in this SDG.

## VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits.

## 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
LCS/D (ERH857 ERH838)	Total organic carbon	116 (90-110)	114 (90-110)	J (all detects)	P

Relative percent differences (RPD) were within QC limits.

## IX. Field Duplicates

No field duplicates were identified in this SDG.

## X. Sample Result Verification

Raw data were not reviewed for Level C validation.

## XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods.

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

No results were rejected in this SDG.



**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Data Qualification Summary - SDG 89570**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH857	Ferrous iron	UJ (all non-detects)	P	Technical holding times (H)
ERH857 ERH838	Total organic carbon	J (all detects)	P	Laboratory control samples (%R) (L)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Field Blank Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

LDC #: 45841A6  
 SDG #: 89570  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/15/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD: (Analyte)** Alkalinity (SM2320B), Chloride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B), Nitrate/Nitrite-N (EPA Method 353.2), TOC (EPA SW 846 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, SW	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	A	
VIII.	Laboratory control samples	SW	LCS/D
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH857	AZ95187	Water	07/22/19
2	ERH838	AZ95189	Water	07/22/19
3	ERH857MS	AZ95187MS	Water	07/22/19
4	ERH857MSD	AZ95187MSD	Water	07/22/19
5	ERH838MS	AZ95189MS	Water	07/22/19
6	ERH838MSD	AZ95189MSD	Water	07/22/19
7	ERH838DUP	AZ95189DUP	Water	07/22/19
8				
9				
10				

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

LDC #: 48841A6

**VALIDATION FINDINGS WORKSHEET**  
**Sample Specific Analysis Reference**

Page: 1 of 1  
 Reviewer: CR  
 2nd reviewer: TC

All circled methods are applicable to each sample.

Sample ID	Parameter
1,2	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub> <span style="margin-left: 100px;">NO<sub>3</sub>/NO<sub>2</sub>-N</span> <span style="margin-left: 20px;">Fe<sup>3+</sup></span>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
3,4 5,6 7	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub> <span style="margin-left: 100px;">Fe<sup>3+</sup></span>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub> <span style="margin-left: 100px;">NO<sub>3</sub>/NO<sub>2</sub>-N</span> <span style="margin-left: 20px;">Fe<sup>3+</sup></span>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
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	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
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	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
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	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
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	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
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Comments: \_\_\_\_\_



LDC #: 45841A6

# VALIDATION FINDINGS WORKSHEET

## Blanks

Page: 1 of 1  
Reviewer: [Signature]  
2nd Reviewer: [Signature]

METHOD: Inorganics, Method See Cover

Conc. units: mg/L

Associated Samples: 2

Analyte	Blank ID	Blank ID	Blank Action Limit											
	PB	ICB/CCB (mg/L)		No qual (>5x)										
Bicarbonate Alkalinity	3.7		18.5											
Total Alkalinity	3.7		18.5											

LoQ = 2.0

LDC #: 4584(A6)

### VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: 1 of 1  
Reviewer: [Signature]  
2nd Reviewer: [Signature]

METHOD: Inorganics, Method see cal

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

- Y  N  N/A Was a laboratory control sample (LCS) analyzed for each matrix in this SDG?
- Y  N  N/A Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?

#### LEVEL IV ONLY:

- Y  N  N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

(L)

#	LCS/LCSD ID	Matrix	Analyte	LCS %R (limits)	LCSD %R (limits)	RPD (limits)	Associated Samples	Qualifications
	LCS/D		TOC	116 (90-110)	114		1 (Det)	Jdet/P
	LCS/D		TOC	116 ↓	114		2 (Det)	Jdet/P

Comments: \_\_\_\_\_

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** October 11, 2019

**Parameters:** Gasoline Range Organics

**Validation Level:** Level C

**Laboratory:** APPL. Inc

**Sample Delivery Group (SDG):** 89570

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH856	AZ95186	Water	07/22/19
ERH857	AZ95187	Water	07/22/19
ERH837	AZ95188	Water	07/22/19
ERH838	AZ95189	Water	07/22/19
ERH839	AZ95190	Water	07/22/19
ERH838MS	AZ95189MS	Water	07/22/19
ERH838MSD	AZ95189MSD	Water	07/22/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 ERH856 and ERH837 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**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## **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**

Samples ERH838 and ERH839 were identified as field duplicates. No results were detected in any of the samples.

## **X. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XI. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Laboratory Blank Data Qualification Summary - SDG  
89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Field Blank Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

LDC #: 45841A7

**VALIDATION COMPLETENESS WORKSHEET**

SDG #: 89570

Level C

Laboratory: APPL, Inc.

Date: 9/5/19

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

**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	Δ	
III.	Initial calibration/ICV	A/A	$1^2$ $CV \leq 20$
IV.	Continuing calibration	Δ	$CV \leq 20$
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 1, 3
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS 10
X.	Field duplicates	ND	D = 4 + 5
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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	ERH856 TB	AZ95186	Water	07/22/19
2	ERH857	AZ95187	Water	07/22/19
3	ERH837 TB	AZ95188	Water	07/22/19
4	ERH838	AZ95189	Water	07/22/19
5	ERH839	AZ95190	Water	07/22/19
6	ERH838MS	AZ95189MS	Water	07/22/19
7	ERH838MSD	AZ95189MSD	Water	07/22/19
8				

Notes:

190727BL				

**Laboratory Data Consultants, Inc.  
Data Validation Report**

**Project/Site Name:** Red Hill Bulk Storage Facility, CTO 18F0126  
**LDC Report Date:** October 11, 2019  
**Parameters:** Total Petroleum Hydrocarbons as Extractables  
**Validation Level:** Level C  
**Laboratory:** APPL, Inc.  
**Sample Delivery Group (SDG):** 89570

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH857	AZ95187	Water	07/22/19
ERH838	AZ95189	Water	07/22/19
ERH839	AZ95190	Water	07/22/19
ERH838MS	AZ95189MS	Water	07/22/19
ERH838MSD	AZ95189MSD	Water	07/22/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds 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 compounds, 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 compounds.

## **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 compounds.

## **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.

## **VII. Matrix Spike/Matrix Spike Duplicates**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

### **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**

Samples ERH838 and ERH839 were identified as field duplicates. No results were detected in any of the samples.

### **X. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **XI. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

### **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -  
SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data  
Qualification Summary - SDG 89570**

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 89570**

No Sample Data Qualified in this SDG

LDC #: 45841A8

# VALIDATION COMPLETENESS WORKSHEET

Date: 9/5/19

SDG #: 89570

Level C

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: [Signature]

2nd Reviewer: [Signature]

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, 1 <sup>2</sup> ICV ≤ 20
III.	Continuing calibration	A	CV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	N	
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	Δ	
VIII.	Laboratory control samples	A	LOS 10
IX.	Field duplicates	ND	D = 2+3
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	Overall assessment of data	Δ	

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	ERH857	AZ95187	Water	07/22/19
2	ERH838	AZ95189	Water	07/22/19
3	ERH839	AZ95190	Water	07/22/19
4	ERH838MS	AZ95189MS	Water	07/22/19
5	ERH838MSD	AZ95189MSD	Water	07/22/19
6				
7				
8				
9				
10				

Notes:

190727A - BIK				

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 9, 2019

**Parameters:** Methane

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89570

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH856	AZ95186	Water	07/22/19
ERH857	AZ95187	Water	07/22/19
ERH837	AZ95188	Water	07/22/19
ERH838	AZ95189	Water	07/22/19
ERH838MS	AZ95189MS	Water	07/22/19
ERH838MSD	AZ95189MSD	Water	07/22/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Methane by Method RSK-175

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## 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 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 ERH856 and ERH837 were identified as trip blanks. No contaminants were found.

## VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
ERH838MS/MSD (ERH838)	Methane	199 (73-125)	200 (73-125)	NA	-

Relative percent differences (RPD) were within QC limits.

## **VII. 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.

## **VIII. Field Duplicates**

No field duplicates were identified in this SDG.

## **IX. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **X. Target Compound Identification**

Raw data were not reviewed for Level C validation.

## **XI. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Laboratory Blank Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Field Blank Data Qualification Summary - SDG 89570**

No Sample Data Qualified in this SDG

LDC #: 45841A51  
 SDG #: 89570  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

**METHOD:** GC Methane (Method RSK-175)

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/D	
II.	Initial calibration/ICV	A/D	r <sup>2</sup> ICV ≤ 20
III.	Continuing calibration	Δ	CV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 1, 3
VI.	Matrix spike/Matrix spike duplicates	SW	
VII.	Laboratory control samples	A	LES 10
VIII.	Field duplicates	N	
IX.	Compound quantitation RL/LOQ/LODs	N	
X.	Target compound identification	N	
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:

	Client ID	Lab ID	Matrix	Date
1	ERH856 TB	AZ95186	Water	07/22/19
2	ERH857	AZ95187	Water	07/22/19
3	ERH837 TB	AZ95188	Water	07/22/19
4	ERH838	AZ95189	Water	07/22/19
5	ERH838MS	AZ95189MS	Water	07/22/19
6	ERH838MSD	AZ95189MSD	Water	07/22/19
7				
8				
9				
10				

Notes:

190725A-B/K				



## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 13, 2019

**Parameters:** Volatiles

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89593

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH845	AZ95328	Water	07/23/19
ERH846**	AZ95329**	Water	07/23/19
ERH847	AZ95330	Water	07/23/19
ERH848	AZ95331	Water	07/22/19
ERH849**	AZ95332**	Water	07/22/19
ERH850	AZ95333	Water	07/23/19
ERH851	AZ95334	Water	07/23/19
ERH852	AZ95335	Water	07/22/19
ERH853	AZ95336	Water	07/22/19
ERH854	AZ95337	Water	07/22/19
ERH855	AZ95338	Water	07/22/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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.

For compounds where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 15.0%

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

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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 ERH845, ERH848, ERH850, ERH852, and ERH854 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 with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
ERH846**	Toluene-d8	86.6 (89-112)	All compounds	UJ (all non-detects)	P
ERH850	1,2-Dichloroethane-d4 Bromofluorobenzene Dibromofluoromethane Toluene-d8	135 (81-118) 129 (85-114) 138 (80-119) 132 (89-112)	All compounds	NA	-

## VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## 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

Samples ERH846\*\* and ERH847 were identified as field duplicates. No results were detected in any of the samples.

## XI. Internal Standards

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

## XII. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### **XIII. Target Compound Identifications**

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### **XIV. System Performance**

The system performance was acceptable for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### **XV. Overall Assessment of Data**

The analysis was conducted within all specifications of the method.

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

No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Data Qualification Summary - SDG 89593**

Sample	Compound	Flag	A or P	Reason (Code)
ERH846**	All compounds	UJ (all non-detects)	P	Surrogates (%R) (S)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Laboratory Blank Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Field Blank Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG

LDC #: 45841B1a  
 SDG #: 89593  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/7/19  
 Page: 1 of 1  
 Reviewer: FJ  
 2nd Reviewer: A

**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 / Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	A / A	% PSD ≤ 15, 12   CV ≤ 20
IV.	Continuing calibration <i>ending</i>	A	CV ≤ 20/SV
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 1, 4, 6, 8, 10
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	A	ERH838 MS 10
IX.	Laboratory control samples	A	cos 10
X.	Field duplicates	ND	D = 2, 3
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	A	Not reviewed for Level C validation
XIII.	Target compound identification	Δ	Not reviewed for Level C validation
XIV.	System performance	Δ	Not reviewed for Level C validation
XV.	Overall assessment of data	Δ	

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

\*\*Indicates samples underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1 2	ERH845	AZ95328	Water	07/23/19
2 2	ERH846** D	AZ95329**	Water	07/23/19
3 1	ERH847** D	AZ95330**	Water	07/23/19
4 1	ERH848	AZ95331	Water	07/22/19
5 1	ERH849**	AZ95332**	Water	07/22/19
6 1	ERH850	AZ95333	Water	07/23/19
7 1	ERH851	AZ95334	Water	07/23/19
8 1	ERH852	AZ95335	Water	07/22/19
9 1	ERH853	AZ95336	Water	07/22/19
10 1	ERH854	AZ95337	Water	07/22/19
11 1	ERH855	AZ95338	Water	07/22/19
12 1	190729BT - BIK			
13 2	190727BL - BIK			



Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
<b>II. GC/MS Instrument performance check</b>				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
<b>IIIa. Initial calibration</b>				
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) $\leq 30\%$ (15%) and relative response factors (RRF) $> 0.05$ ?	✓			
<b>IIIb. Initial Calibration Verification</b>				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) $\leq 20\%$ ?	✓			
<b>IV. Continuing calibration</b>				
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) $\leq 20\%$ and relative response factors (RRF) $\geq 0.05$ ?	✓			
<b>V. Laboratory Blanks</b>				
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?		✓		
<b>VI. Field blanks</b>				
Were field blanks were identified in this SDG?	✓			
Were target compounds detected in the field blanks?		✓		
<b>VII. Surrogate spikes</b>				
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?		✓		

Validation Area	Yes	No	NA	Findings/Comments
<b>VIII. Matrix spike/Matrix spike duplicates</b>				
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?			✓	
<b>IX. Laboratory control samples</b>				
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
<b>X. Field duplicates</b>				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?		✓		
<b>XI. Internal standards</b>				
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?	✓			
<b>XII. Compound quantitation</b>				
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 compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
<b>XIII. Target compound identification</b>				
Were relative retention times (RRT's) within + 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
<b>XIV. System performance</b>				
System performance was found to be acceptable.	✓			
<b>XV. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.	✓			

## TARGET COMPOUND WORKSHEET

### METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane
C. Vinyl chloride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO. 1,1-Difluoroethane	O1. 3-Methylpentane
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3-Trimethylbutane
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methyl cyclohexane	T1. 2-Methylhexane
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.

LDC #: 4584/B/a

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Spikes**

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: 7

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

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

- Y N/A Were all surrogate %R within QC limits?  
Y N/A If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R out of outside of criteria?

#	Sample ID	Surrogate	%Recovery (Limits)		Qualifications	
	2	Tol	86.6	( 89-112 )	J/UJ/P	ND (S)
				( )		
				( )		
	6	DCE	135	( 81-118 )	Jdu/P	ND (S)
		BFB	129	( 85-114 )	↓	
		DFM	138	( 80-119 )		
		TOL	132	( 89-112 )		
				( )		
				( )		
				( )		
				( )		
				( )		
				( )		
				( )		
				( )		
				( )		

SMC1 (TOL) = Toluene-d8  
SMC2 (BFB) = Bromofluorobenzene  
SMC3 (DCE) = 1,2-Dichloroethane-d4  
SMC4 (DFM) = Dibromofluoromethane

LDC #: 45841 B1a

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: AK

METHOD: GCMS 8260B

The calibration factors (RRFF), average RRFF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

$RRF = (Ax)(Cis)/(Ais)(Cx)$

average RRF = sum of the RRFs/number of standards

$\%RSD = 100 * (S/X)$

Where:

Ax = Area of compound

Cx = Concentration of compound

S = Standard deviation of the RRFs

X = Mean of the RRFs

Ais = Area of associated internal standard

Cis = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 10 ug/L std)	Recalculated (RRF 10 ug/L std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL Loki	7/24/2019	V	0.7753	0.7753	0.7219	0.7219	4.5	4.5
			EE	0.8684	0.8684	0.8602	0.8602	13.0	13.0



**VALIDATION FINDINGS WORKSHEET**  
**Continuing Calibration Results 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 =  $100 * (\text{ave. RRF} - \text{RRF}) / \text{ave. RRF}$   
 $\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF  
 RRF = continuing calibration RRF  
 $A_x$  = Area of compound,  $A_{is}$  = Area of associated internal standard  
 $C_x$  = Concentration of compound;  $C_{is}$  = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference internal Standard)	Average RRF (initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	ccv 0727L20 Loki	7/27/19	V (1st internal standard)	0.7219	0.8240	0.8240	14	14
			EE (2nd internal standard)	0.8602	0.9086	0.9086	5.6	5.6
			(3rd internal standard)					
			(4th internal standard)					
2	ccv 0729T21 Thor	7/29/19	V (1st internal standard)	0.7507	<del>0.726</del> FT 0.726 FT	0.7826	4.3	4.3
			EE (2nd internal standard)	0.8916	0.9200	0.9200	3.2	3.2
			(3rd internal standard)					
			(4th internal standard)					
3			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					
4			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					

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

LDC #: 45841B/a

## VALIDATION FINDINGS WORKSHEET

### Surrogate Results Verification

Page: 1 of 1

Reviewer: FT

2nd reviewer: *AT*

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

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

% Recovery: SF/SS \* 100

Where: SF = Surrogate Found  
SS = Surrogate Spiked

Sample ID: #1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane	25.0	26.90601	108	108	0
1,2-Dichloroethane-d4		25.55962	102	102	
Toluene-d8	↓	21.64141	86.6	86.6	↓
Bromofluorobenzene	↓	23.09978	92.4	92.4	↓

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					



LDC #: 45841B/a

**VALIDATION FINDINGS WORKSHEET**  
**Laboratory Control Sample Results Verification**

Page: 1 of 1

Reviewer: FT

2nd Reviewer: 9

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

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 \* SSC/SA

Where: SSC = Spiked sample concentration  
 SA = Spike added

RPD = | LCSC - LCSDC | \* 2 / (LCSC + LCSDC)

LCSC = Laboratory control sample concentration    LCSDC = Laboratory control sample duplicate concentration

LCS ID: 190727BL    LCSD

Compound	Spike Added (ng/L)		Spiked Sample Concentration (ng/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene										
Trichloroethene										
Benzene	10.0	10.0	9.08	10.9	90.8	90.8	109	109	18.2	18.2
Toluene	10.0	10.0	9.48	10.9	94.8	94.8	109	109	13.9	13.9
Chlorobenzene										

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



## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 9, 2019

**Parameters:** Phenol

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89593

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH846**	AZ95329**	Water	07/23/19
ERH847	AZ95330	Water	07/23/19
ERH849	AZ95332	Water	07/22/19
ERH851	AZ95334	Water	07/23/19
ERH853	AZ95336	Water	07/22/19
ERH855	AZ95338	Water	07/22/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Phenol by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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 Compound	Flag	A or P
ERH847	2-Fluorophenol Phenol-d6	138 (19-119) 139 (10-115)	Phenol	NA	-

Surrogate recoveries (%R) were not within QC limits for sample ERH846\*\*. Using professional judgment, no data were qualified when one surrogate %R was outside the QC limits and the %R was greater than or equal to 10%.

### VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

### 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

Samples ERH846\*\* and ERH847 were identified as field duplicates. No results were detected in any of the samples.

### XI. Internal Standards

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

### XII. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### XIV. System Performance

The system performance was acceptable for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.



## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Laboratory Blank Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Field Blank Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG

LDC #: 45841B2a  
 SDG #: 89593  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/7/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

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

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 / Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ / Δ	% PSD ≤ 15      ICI ≤ 20
IV.	Continuing calibration	Δ	ccf ≤ 20 / 50
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	Δ	ERH838 MS/D
IX.	Laboratory control samples	A	100/10
X.	Field duplicates	ND	D = 1, 2
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	Δ	Not reviewed for Level C validation
XIII.	Target compound identification	Δ	Not reviewed for Level C validation
XIV.	System performance	A	Not reviewed for Level C validation
XV.	Overall assessment of data	Δ	

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

\*\*Indicates samples underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH846**      D	AZ95329**	Water	07/23/19
2	ERH847      P	AZ95330	Water	07/23/19
3	ERH849	AZ95332	Water	07/23/19
4	ERH851	AZ95334	Water	07/23/19
5	ERH853	AZ95336	Water	07/22/19
6	ERH855	AZ95338	Water	07/22/19
7				
8				

Notes:

190725A - Blk				

**Method:** Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
<b>II. GC/MS Instrument performance check</b>				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
<b>IIIa. Initial calibration</b>				
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) $\leq$ 15% 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 $> 0.990$ ?			/	
<b>IIIb. Initial Calibration Verification</b>				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) $\leq$ 20%?	/			
<b>IV. Continuing calibration</b>				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) $\leq$ 20% and relative response factors (RRF) within method criteria?	/			
<b>V. Laboratory Blanks</b>				
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? If yes, please see the blanks validation findings worksheet.		/		
<b>VI. Field blanks</b>				
Were field blanks were identified in this SDG?		/		
Were target compounds detected in the field blanks?			/	
<b>VII. Surrogate spikes</b>				
Were all surrogate percent recovery (%R) within QC limits?		/		
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%, was a reanalysis performed to confirm %R?			/	
<b>VIII. Matrix spike/Matrix spike duplicates</b>				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?	/			

LDC #: 45841 B2a

**VALIDATION FINDINGS CHECKLIST**

Page: 2 of 2  
 Reviewer: FJ  
 2nd Reviewer: JA

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>IX. Laboratory control samples</b>				
Was an LCS analyzed per extraction batch?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>X. Field duplicates</b>				
Were field duplicate pairs identified in this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were target compounds detected in the field duplicates?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>XI. Internal standards</b>				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were retention times within + 30 seconds of the associated calibration standard?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>XII. Compound quantitation</b>				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>XIII. Target compound identification</b>				
Were relative retention times (RRT's) within + 0.06 RRT units of the standard?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were chromatogram peaks verified and accounted for?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>XIV. System performance</b>				
System performance was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>XV. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## VALIDATION FINDINGS WORKSHEET

**METHOD: GC/MS SVOA**

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o''-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethylthiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethylthiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methylthiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU.. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU. Benzo(b)thiophene	WWWWW.. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV. Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW. Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine

LDC #: 45841B2a

### VALIDATION FINDINGS WORKSHEET Surrogate Recovery

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: [Signature]

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

Y 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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	1	TBP	37.4 (43-140)	no qual
			( )	
	2	2FP	138 (19-119)	↓ det/P (ND) (S)
		PHL6	139 (10-115)	↓
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	

(NBZ) = Nitrobenzene - d5  
 (FBP) = 2-Fluorobiphenyl  
 (TPH) = Terphenyl - d14  
 (2FP) = 2-Fluorophenol  
 (TBP) = 2,4,6 -Tribromophenol  
 (2CP) = 2-Chlorophenol - d4

LDC #: 4584/B2a

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: [Signature]

METHOD: GCMS 8270D

The calibration factors (RRFF), average RRFF, and relative standard deviation (%RSD) were recalculated for 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

$\%RSD = 100 * (S/X)$

Where:

A<sub>x</sub> = Area of compound

C<sub>x</sub> = Concentration of compound

S = Standard deviation of the RRFs

X = Mean of the RRFs

A<sub>is</sub> = Area of associated internal standard

C<sub>is</sub> = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 50 ppb std)	Recalculated (RRF 50 ppbstd)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL -Yoda	7/22/2019	A	1.860	1.860	1.834	1.834	9.30	9.30



## VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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

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 =  $100 * (\text{ave. RRF} - \text{RRF}) / \text{ave. RRF}$   
 $\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF  
 RRF = continuing calibration RRF  
 $A_x$  = Area of compound,  
 $C_x$  = Concentration of compound,

$A_{is}$  = Area of associated internal standard  
 $C_{is}$  = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Internal Standard)		Average RRF (Initial)	Reported	Recalculated	Reported	Recalculated
						RRF (CC)	RRF (CC)	%D	%D
1	ccv 0722Y121	7/29/19	Pheno I	(1st IS)	1.434	1.735	1.735	5.4	5.4
				(2nd IS)					
				(3rd IS)					
				(4th IS)					
				(5th IS)					
				(6th IS)					
2	ccv 0722Y144	7/31/19	Pheno I	(1st IS)	1.434	1.752	1.752	4.5	4.5
				(2nd IS)					
				(3rd IS)					
				(4th IS)					
				(5th IS)					
				(6th IS)					
3				(1st IS)					
				(2nd IS)					
				(3rd IS)					
				(4th IS)					
				(5th IS)					
				(6th IS)					

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

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Results Verification**

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

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

% Recovery: SF/SS \* 100

Where: SF = Surrogate Found  
SS = Surrogate Spiked

Sample ID: #1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	125	106.36814	85.1	85.1	0
2-Fluorobiphenyl	↓	106.21130	85.0	85.0	↓
Terphenyl-d14	↓	98.66704	78.9	78.9	↓
Phenol-d5	250	159.44724	63.8	63.8	↓
2-Fluorophenol	↓	111.69620	44.7	44.7	↓
2,4,6-Tribromophenol	↓	93.48100	37.4	37.4	↓
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID: \_\_\_\_\_

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID: \_\_\_\_\_

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC #: 4584/B2a

## VALIDATION FINDINGS WORKSHEET

### Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: [Signature]

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

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

% Recovery =  $100 * (SC/SA)$

Where: SSC = Spike concentration  
 SA = Spike added

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

LCS = Laboratory control sample concentration    LCSD = Laboratory control sample duplicate concentration

LCS/LCSD samples: 190725A    KS10

Compound	Spike Added (ug/L)		Spike Concentration (ug/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol	62.5	62.5	56.0	54.9	89.6	89.6	87.8	87.8	2.0	2.0
N-Nitroso-di-n-propylamine										
4-Chloro-3-methylphenol										
Acenaphthene										
Pentachlorophenol										
Pyrene										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

**VALIDATION FINDINGS WORKSHEET**  
**Sample Calculation Verification**

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

Y N N/A  
Y N N/A

Were all reported results recalculated and verified for all level IV samples?

Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

$$\text{Concentration} = \frac{(A_x)(I_s)(V_i)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_t)(\%S)}$$

- A<sub>x</sub> = Area of the characteristic ion (EICP) for the compound to be measured
- A<sub>is</sub> = Area of the characteristic ion (EICP) for the specific internal standard
- I<sub>s</sub> = Amount of internal standard added in nanograms (ng)
- V<sub>o</sub> = Volume or weight of sample extract in milliliters (ml) or grams (g).
- V<sub>i</sub> = Volume of extract injected in microliters (ul)
- V<sub>t</sub> = Volume of the concentrated extract in microliters (ul)
- Df = Dilution Factor.
- %S = Percent solids, applicable to soil and solid matrices only.
- 2.0 = Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 19 0125 A LES Pheno 1

Conc. =  $\frac{567307 (40.0) (1) (1000)}{276356 (1.834) (200)}$

55.96 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration (ug/L)	Qualification
	LES	Pheno 1	56	55.96	

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 9, 2019

**Parameters:** Polynuclear Aromatic Hydrocarbons

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89593

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH846**	AZ95329**	Water	07/23/19
ERH847	AZ95330	Water	07/23/19
ERH849	AZ95332	Water	07/22/19
ERH851	AZ95334	Water	07/23/19
ERH853	AZ95336	Water	07/22/19
ERH855	AZ95338	Water	07/22/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.



## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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.

## VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## 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

Samples ERH846\*\* and ERH847 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)
	ERH846**	ERH847	
1-Methylnaphthalene	12	12	0 (≤50)
2-Methylnaphthalene	11	11	0 (≤50)
Naphthalene	33	34	3 (≤50)

## XI. Internal Standards

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

## XII. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

#### **XIV. System Performance**

The system performance was acceptable for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

#### **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification  
Summary - SDG 89593**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -  
SDG 89593**

No Sample Data Qualified in this SDG

LDC #: 45841B2b  
 SDG #: 89593  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/7/19  
 Page: 1 of 1  
 Reviewer: RA  
 2nd Reviewer: RA

**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 / Δ	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / A	% RSD ≤ 15    ICV ≤ 20
IV.	Continuing calibration <i>ending</i>	A	CV ≤ 20 / 50
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	Δ	ERHB38MS/MSD
IX.	Laboratory control samples	A	LES 10
X.	Field duplicates	SW	D = 1, 2
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	Δ	Not reviewed for Level C validation
XIII.	Target compound identification	Δ	Not reviewed for Level C validation
XIV.	System performance	A	Not reviewed for Level C validation
XV.	Overall assessment of data	Δ	

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

\*\*Indicates samples underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1 <sup>†</sup>	ERH846**      D	AZ95329**	Water	07/23/19
2 <sup>†</sup>	ERH847      D	AZ95330	Water	07/23/19
3 <sup>-</sup>	ERH849	AZ95332	Water	07/23/19
4 <sup>-</sup>	ERH851	AZ95334	Water	07/23/19
5 <sup>-</sup>	ERH853	AZ95336	Water	07/22/19
6 <sup>-</sup>	ERH855	AZ95338	Water	07/22/19
7				
8				

Notes:

190725A - BIK				

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

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
Were all technical holding times met?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was cooler temperature criteria met?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>II. GC/MS Instrument performance check</b>				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all samples analyzed within the 12 hour clock criteria?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>IIIa. Initial calibration</b>				
Did the laboratory perform a 5 point calibration prior to sample analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent relative standard deviations (%RSD) $\leq$ 15% and relative response factors (RRF) within method criteria?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of $> 0.990$ ?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>IIIb. Initial Calibration Verification</b>				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) $< 20\%$ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>IV. Continuing calibration</b>				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) $\leq 20\%$ and relative response factors (RRF) within method criteria?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>V. Laboratory Blanks</b>				
Was a laboratory blank associated with every sample in this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was there contamination in the laboratory blanks? If yes, please see the blanks validation findings worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>VI. Field blanks</b>				
Were field blanks were identified in this SDG?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Were target compounds detected in the field blanks?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>VII. Surrogate spikes</b>				
Were all surrogate percent recovery (%R) within QC limits?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
If any percent recoveries (%R) was less than 10%, was a reanalysis performed to confirm %R?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>VIII. Matrix spike/Matrix spike duplicates</b>				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

LDC #: 45841B2b

**VALIDATION FINDINGS CHECKLIST**

Page: 2 of 2  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
<b>IX. Laboratory control samples</b>				
Was an LCS analyzed per extraction batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
<b>X. Field duplicates</b>				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?	/			
<b>XI. Internal standards</b>				
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?	/			
<b>XII. Compound quantitation</b>				
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 compound?	/			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
<b>XIII. Target compound identification</b>				
Were relative retention times (RRT's) within + 0.06 RRT units of the standard?	/			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	/			
Were chromatogram peaks verified and accounted for?	/			
<b>XIV. System performance</b>				
System performance was found to be acceptable.	/			
<b>XV. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.	/			

## VALIDATION FINDINGS WORKSHEET

**METHOD: GC/MS SVOA**

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o"-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU.. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU. Benzo(b)thiophene	WWWWW.. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV. Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW. Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine



LDC #: 49841826

**VALIDATION FINDINGS WORKSHEET**  
**Field Duplicates**

Page: 1 of 1  
 Reviewer: FT  
 2nd reviewer: AT

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

Y N N/A  
Y N N/A

Were field duplicate pairs identified in this SDG?

Were target compounds identified in the field duplicate pairs?

Compound	Concentration ( <u>ug/L</u> )		RPD ( ≤ 50 % )
	1	2	
TIT	12	12	0
W	11	11	0
S	33	34	3

Compound	Concentration (            )		RPD ( ≤        % )

Compound	Concentration (            )		RPD ( ≤        % )

LDC #: 45841B2b

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: η

METHOD: GCMS 8270D

The calibration factors (RRFF), average RRFF, and relative standard deviation (%RSD) were recalculated for 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

$\%RSD = 100 * (S/X)$

Where:

A<sub>x</sub> = Area of compound

C<sub>x</sub> = Concentration of compound

S = Standard deviation of the RRFs

X = Mean of the RRFs

A<sub>is</sub> = Area of associated internal standard

C<sub>is</sub> = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 5 ppb std)	Recalculated (RRF5 ppb std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL Yoda	7/17/2019	S	1.2510	1.2510	1.3370	1.3370	14.0	14.0

## VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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

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 =  $100 * (\text{ave. RRF} - \text{RRF}) / \text{ave. RRF}$   
 $\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF  
 RRF = continuing calibration RRF  
 $A_x$  = Area of compound,  
 $C_x$  = Concentration of compound,

$A_{is}$  = Area of associated internal standard  
 $C_{is}$  = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Internal Standard)	Average RRF (Initial)	Reported	Recalculated	Reported	Recalculated
					RRF (CC)	RRF (CC)	%D	%D
1	ccv 07174305	7/31/19	S (1st IS)	1.337	1.326	1.326	0.81	0.81
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
2	ccv 07174272	7/30/19	S (1st IS)	1.337	1.251	1.251	6.4	6.4
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
3			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					

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

LDC #: 45041B2b

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Results Verification**

Page: 1 of 1

Reviewer: FT

2nd reviewer: 2

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

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

% Recovery: SF/SS \* 100

Where: SF = Surrogate Found  
SS = Surrogate Spiked

Sample ID: H1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5 <u>W-d10</u>	6.250	6.25616	100	100	0
2-Fluorobiphenyl <u>Y-d10</u>	6.250	6.84560	110	110	0
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID: \_\_\_\_\_

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID: \_\_\_\_\_

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC #: 45841B26

**VALIDATION FINDINGS WORKSHEET**

**Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification**

Reviewer: FT  
 2nd Reviewer: [Signature]

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

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

% Recovery =  $100 * (SC/SA)$

Where: SSC = Spike concentration  
 SA = Spike added

RPD =  $| LCSC - LCSDC | * 2 / (LCSC + LCSDC)$

LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: 190725A 190725B

Compound	Spike Added (ug/L)		Spike Concentration (ug/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol										
N-Nitroso-di-n-propylamine										
4-Chloro-3-methylphenol										
Acenaphthene										
Pentachlorophenol										
Pyrene										
S	6.25	6.25	4.52	4.25	72.3	72.3	68.0	68.0	6.2	6.2

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

### VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

(Y) N N/A  
(Y) N N/A

Were all reported results recalculated and verified for all level IV samples?

Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

$$\text{Concentration} = \frac{(A_x)(I_s)(V_i)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_t)(\%S)}$$

- A<sub>x</sub> = Area of the characteristic ion (EICP) for the compound to be measured
- A<sub>is</sub> = Area of the characteristic ion (EICP) for the specific internal standard
- I<sub>s</sub> = Amount of internal standard added in nanograms (ng)
- V<sub>o</sub> = Volume or weight of sample extract in milliliters (ml) or grams (g).
- V<sub>i</sub> = Volume of extract injected in microliters (ul)
- V<sub>t</sub> = Volume of the concentrated extract in microliters (ul)
- Df = Dilution Factor.
- %S = Percent solids, applicable to soil and solid matrices only.
- 2.0 = Factor of 2 to account for GPC cleanup

Example:

Sample I.D. #1, S:

$$\text{Conc.} = \frac{1185009 (2.5) (1) (1000)}{82724 (1.337) (800)}$$

= 33.4 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration (ug/L)	Qualification
	<u>A1</u>	<u>S</u>	<u>33</u>	<u>33.4</u>	

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 9, 2019

**Parameters:** 2-(2-Methoxyethoxy)-ethanol

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89593

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH846**	AZ95329**	Water	07/23/19
ERH847	AZ95330	Water	07/23/19
ERH849	AZ95332	Water	07/22/19
ERH851	AZ95334	Water	07/23/19
ERH853	AZ95336	Water	07/22/19
ERH855	AZ95338	Water	07/22/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

2-(2-Methoxyethoxy)-ethanol by Environmental Protection Agency (EPA) SW 846 Method 8270D Modified

All sample results were subjected to Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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 not added to all samples as required by the method. Using professional judgment, no data were qualified. Although the LCSD percent recovery was outside the QC limit, the LCS/MS/MSD were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis.

## VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## 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 with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
190726A-LCS/D (All samples in SDG 89593)	2-(2-Methoxyethoxy)-ethanol	-	151 (30-130)	NA	-

Relative percent differences (RPD) were within QC limits.

## X. Field Duplicates

Samples ERH846\*\* and ERH847 were identified as field duplicates. No results were detected in any of the samples.

## XI. Internal Standards

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

## XII. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

#### **XIV. System Performance**

The system performance was acceptable for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

#### **XV. Overall Assessment of Data**

The analysis was conducted within all specifications of the method with the exception noted in Section VII. No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -  
SDG 89593**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG  
89593**

No Sample Data Qualified in this SDG

LDC #: 45841B2c  
 SDG #: 89593  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/7/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-Modified)

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 / Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	A / Δ	% RSD ≤ 15      CV ≤ 20
IV.	Continuing calibration <i>ending</i>	Δ	CV ≤ 20 / 50
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	A	ERH838 MS / D
IX.	Laboratory control samples	SW	LOD ID
X.	Field duplicates	ND	D = 1, 2
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	Δ	Not reviewed for Level C validation
XIII.	Target compound identification	A	Not reviewed for Level C validation
XIV.	System performance	Δ	Not reviewed for Level C validation
XV.	Overall assessment of data	A	

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

\*\*Indicates samples underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH846**      D	AZ95329**	Water	07/23/19
2	ERH847      P	AZ95330	Water	07/23/19
3	ERH849	AZ95332	Water	07/23/19
4	ERH851	AZ95334	Water	07/23/19
5	ERH853	AZ95336	Water	07/22/19
6	ERH855	AZ95338	Water	07/22/19
7				

Notes:

190726A-BLK				

**Method:** Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
<b>II. GC/MS Instrument performance check</b>				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
<b>IIIa. Initial calibration</b>				
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) $\leq$ 15% 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 $> 0.990$ ?			/	
<b>IIIb. Initial Calibration Verification</b>				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) $< 20\%$ ?	/			
<b>IV. Continuing calibration</b>				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) $\leq 20\%$ and relative response factors (RRF) within method criteria?	/			
<b>V. Laboratory Blanks</b>				
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? If yes, please see the blanks validation findings worksheet.		/		
<b>VI. Field blanks</b>				
Were field blanks were identified in this SDG?		/	/	
Were target compounds detected in the field blanks?			/	
<b>VII. Surrogate spikes</b>				
Were all surrogate percent recovery (%R) within QC limits?		*	/	
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%, was a reanalysis performed to confirm %R ?			/	
<b>VIII. Matrix spike/Matrix spike duplicates</b>				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?	/			



LDC #: 45041 B2C

**VALIDATION FINDINGS CHECKLIST**

Page: 2 of 2  
 Reviewer: FJ  
 2nd Reviewer: AL

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>IX. Laboratory control samples</b>				
Was an LCS analyzed per extraction batch?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>X. Field duplicates</b>				
Were field duplicate pairs identified in this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were target compounds detected in the field duplicates?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>XI. Internal standards</b>				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were retention times within + 30 seconds of the associated calibration standard?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>XII. Compound quantitation</b>				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>XIII. Target compound identification</b>				
Were relative retention times (RRT's) within + 0.06 RRT units of the standard?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Were chromatogram peaks verified and accounted for?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>XIV. System performance</b>				
System performance was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>XV. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## VALIDATION FINDINGS WORKSHEET

**METHOD: GC/MS SVOA**

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o''-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU.. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU. Benzo(b)thiophene	WWWW.. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV. Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW. Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine





LDC #: 45841B2c

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: [Signature]

METHOD: GCMS 8270D Modified

The calibration factors (RRFF), average RRFF, and relative standard deviation (%RSD) were recalculated for 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

$\%RSD = 100 * (S/X)$

Where:

A<sub>x</sub> = Area of compound

C<sub>x</sub> = Concentration of compound

S = Standard deviation of the RRFs

X = Mean of the RRFs

A<sub>is</sub> = Area of associated internal standard

C<sub>is</sub> = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 400ppb std)	Recalculated (RRF400ppb std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	7/30/2019	2-(2-Methoxyethoxy) Ethanol	0.0603	0.0603	0.0534	0.0534	12.00	12.00
	Linus								

## VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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

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 =  $100 * (\text{ave. RRF} - \text{RRF}) / \text{ave. RRF}$   
 $\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF  
 RRF = continuing calibration RRF  
 $A_x$  = Area of compound,  
 $C_x$  = Concentration of compound,

$A_{is}$  = Area of associated internal standard  
 $C_{is}$  = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Internal Standard)	Average RRF (Initial)	Reported	Recalculated	Reported	Recalculated
					RRF (CC)	RRF (CC)	%D	%D
1	ccv 07302011	7/30/19	2-(2-Methoxyethoxy) (1st IS)	0.0534	0.0617	0.0617	16	16
			Ethanol (2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
2			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
3			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					

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

LDC #: 4584/B2C

**VALIDATION FINDINGS WORKSHEET**  
**Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification**

Page: 1 of 1

Reviewer: FT  
 2nd Reviewer: [Signature]

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

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

% Recovery =  $100 * (SC/SA)$

Where: SSC = Spike concentration  
 SA = Spike added

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

LCS = Laboratory control sample concentration    LCSD = Laboratory control sample duplicate concentration

LCS/LCSD samples: 190726A    lcs 1D

Compound	Spike Added (ug/L)		Spike Concentration (ug/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol										
N-Nitroso-di-n-propylamine										
4-Chloro-3-methylphenol										
Acenaphthene										
Pentachlorophenol										
Pyrene										
<u>2-(2-MEE)</u>	<u>80.0</u>	<u>80.0</u>	<u>103</u>	<u>121</u>	<u>129</u>	<u>129</u>	<u>151</u>	<u>151</u>	<u>16.1</u>	<u>16.1</u>

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

**VALIDATION FINDINGS WORKSHEET**  
**Sample Calculation Verification**

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

Y / N / N/A  
Y / N / N/A

Were all reported results recalculated and verified for all level IV samples?  
 Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

$$\text{Concentration} = \frac{(A_x)(I_s)(V_i)(DF)(2.0)}{(A_s)(RRF)(V_o)(V_i)(\%S)}$$

- A<sub>x</sub> = Area of the characteristic ion (EICP) for the compound to be measured
- A<sub>s</sub> = Area of the characteristic ion (EICP) for the specific internal standard
- I<sub>s</sub> = Amount of internal standard added in nanograms (ng)
- V<sub>o</sub> = Volume or weight of sample extract in milliliters (ml) or grams (g).
- V<sub>i</sub> = Volume of extract injected in microliters (ul)
- V<sub>t</sub> = Volume of the concentrated extract in microliters (ul)
- Df = Dilution Factor.
- %S = Percent solids, applicable to soil and solid matrices only.
- 2.0 = Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 190726A L2 : 2(2-MEE)  
 Conc. =  $\frac{174716 (40.0)}{1275338 (0.0534)}$   
 = 102.6 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration (ug/L)	Qualification
			<u>103</u>	<u>102.6</u>	



## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 5, 2019

**Parameters:** Wet Chemistry

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89593

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH846**	AZ95329**	Water	07/23/19
ERH849	AZ95332	Water	07/23/19
ERH851	AZ95334	Water	07/23/19
ERH853	AZ95336	Water	07/22/19
ERH855	AZ95338	Water	07/22/19
ERH846MS	AZ95329MS	Water	07/23/19
ERH846MSD	AZ95329MSD	Water	07/23/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Alkalinity by Standard Method 2320B

Chloride, Nitrate, and Sulfate by Environmental Protection Agency (EPA) Method 300.0

Ferrous Iron by Standard Method 3500-Fe B

Nitrate/Nitrite as Nitrogen by EPA Method 353.2

Total Organic Carbon by EPA SW 846 Method 9060A

All sample results were subjected to Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is  $<0.995$ .
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

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

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
ERH855	Nitrate as N	49 hours	48 hours	J (all detects)	P

## II. Initial Calibration

All criteria for the initial calibration of each method were met.

## III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable.

## IV. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Limit of Quantitation	Associated Samples
PB (prep blank)	Bicarbonate alkalinity Total alkalinity	1.2 mg/L 1.2 mg/L	2.0 mg/L 2.0 mg/L	ERH846** ERH851 ERH853 ERH855
PB (prep blank)	Total alkalinity	3.5 mg/L	2.0 mg/L	ERH849

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

## V. Field Blanks

No field blanks were identified in this SDG.

## VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## 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 with the following exceptions:

LCS ID (Associated Samples)	Analyte	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
LCS/D (ERH846** ERH849 ERH851 ERH853)	Total organic carbon	116 (90-110)	114 (90-110)	J (all detects)	P

Relative percent differences (RPD) were within QC limits.

## IX. Field Duplicates

No field duplicates were identified in this SDG.

## X. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods.

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

No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Data Qualification Summary - SDG 89593**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH855	Nitrate as N	J (all detects)	P	Technical holding times (H)
ERH846** ERH849 ERH851 ERH853	Total organic carbon	J (all detects)	P	Laboratory control samples (%R) (L)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Field Blank Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG

LDC #: 45841B6  
 SDG #: 89593  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/15/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD: (Analyte)** Alkalinity (SM2320B), Chloride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B), Nitrate/Nitrite-N (EPA Method 353.2), TOC (EPA SW 846 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 SW	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	SW	LCSD
IX.	Field duplicates	N	
X.	Sample result verification	A	Not reviewed for Level C validation
XI.	Overall assessment of data	A	

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

\*\*Indicates samples underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH846**	AZ95329**	Water	07/23/19
2	ERH849	AZ95332	Water	07/23/19
3	ERH851	AZ95334	Water	07/23/19
4	ERH853	AZ95336	Water	07/22/19
5	ERH855	AZ95338	Water	07/22/19
6	ERH846MS	AZ95329MS	Water	07/23/19
7	ERH846MSD	AZ95329MSD	Water	07/23/19
8				
9				
10				

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



Method: Inorganics (EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
All technical holding times were met.	✓			
<b>II. Calibration</b>				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients $> 0.995$ ?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)			✓	
Were balance checks performed as required? (Level IV only)			✓	
<b>III. Blanks</b>				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
<b>IV. Matrix spike/Matrix spike duplicates and Duplicates</b>				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) $\leq 20\%$ for waters and $\leq 35\%$ for soil samples? A control limit of $\leq \text{CRDL}$ ( $\leq 2\text{X CRDL}$ for soil) was used for samples that were $\leq 5\text{X}$ the CRDL, including when only one of the duplicate sample values were $< 5\text{X}$ the CRDL.	✓			
<b>V. Laboratory control samples</b>				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
<b>VI. Regional Quality Assurance and Quality Control</b>				
Were performance evaluation (PE) samples performed?			✓	
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

LDC #: 45841B6

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2  
 Reviewer: a  
 2nd Reviewer: R

Validation Area	Yes	No	NA	Findings/Comments
<b>VII. Sample Result Verification</b>				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			NA
Were detection limits < RL?	✓			
<b>VIII. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.	✓			
<b>IX. Field duplicates</b>				
Field duplicate pairs were identified in this SDG.		/		
Target analytes were detected in the field duplicates.			/	
<b>X. Field blanks</b>				
Field blanks were identified in this SDG.		/	/	
Target analytes were detected in the field blanks.			/	

**VALIDATION FINDINGS WORKSHEET**  
**Sample Specific Analysis Reference**

All circled methods are applicable to each sample.

Sample ID	Parameter
1-5	pH TDS <u>Cl</u> <u>F</u> <u>NO<sub>3</sub></u> <u>NO<sub>2</sub></u> <u>SO<sub>4</sub></u> O-PO <sub>4</sub> <del>Alk</del> CN NH <sub>3</sub> TKN <u>TOC</u> Cr6+ <u>ClO<sub>4</sub></u> <u>NO<sub>3</sub>/NO<sub>2</sub>-N</u> <u>Fe<sup>3+</sup></u> <u>Alk</u>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
<del>13-5</del>	<del>pH TDS Cl F NO<sub>3</sub> NO<sub>2</sub> SO<sub>4</sub> O-PO<sub>4</sub> <u>Alk</u> CN NH<sub>3</sub> TKN TOC Cr6+ ClO<sub>4</sub></del>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
<u>Q: 6,7</u>	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub> <u>Fe<sup>3+</sup></u>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
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	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>

Comments: \_\_\_\_\_

VALIDATION FINDINGS WORKSHEET  
Technical Holding Times

All circled dates have exceeded the technical holding time.

Y  N  N/A Were all samples preserved as applicable to each method? (H)

Y  N  N/A Were all cooler temperatures within validation criteria?

Method:		300.0					
Parameters:		NO <sub>3</sub> -N					
Technical holding time:		48 hrs					
Sample ID	Sampling date	Analysis date	Total Time	Qualifier	Analysis date	Total Time	Qualifier
5 (Det)	7/22/19 14:15	7/24/19 16:00	49 hrs	J/USP			

## VALIDATION FINDINGS WORKSHEET

### Blanks

METHOD: Inorganics, Method See Cover

Conc. units: mg/L Associated Samples: 1, 3-5

Analyte	Blank ID	Blank ID	Blank Action Limit													
	PB	ICB/CCB (mg/L)		No qualifiers												
Bicarbonate Alkalinity	1.2															
Total Alkalinity	1.2															

Conc. units: mg/L Associated Samples: 2

Analyte	Blank ID	Blank ID	Blank Action Limit													
	PB	ICB/CCB (mg/L)		No qualifiers												
Total Alkalinity	3.5															

LDC #: 4584(B6)

**VALIDATION FINDINGS WORKSHEET**  
**Laboratory Control Samples (LCS)**

Page: 1 of 1  
Reviewer: [Signature]  
2nd Reviewer: [Signature]

METHOD: Inorganics, Method see cal

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

N N/A Was a laboratory control sample (LCS) analyzed for each matrix in this SDG?  
 N N/A Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?

**LEVEL IV ONLY:**

N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

(L)

#	LCS/LCSD ID	Matrix	Analyte	LCS %R (limits)	LCSD %R (limits)	RPD (limits)	Associated Samples	Qualifications
	LCS/D		TOC	116 (90-110)	114		1-4	5det / PC Det

Comments: \_\_\_\_\_

LDC #: 4584B6

**Validation Findings Worksheet  
Initial and Continuing Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

Method: Inorganics, Method seecar

The correlation coefficient (r) for the calibration of Cl was recalculated. Calibration date: 6/21/19

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	Standard	Conc. (mg/l)	Area	Recalculated	Reported	Acceptable (Y/N)
					r or r <sup>2</sup>	r or r <sup>2</sup>	
Initial calibration	Cl	s1	0.4	0.031	0.99724	0.99421	Y
		s2	1	0.076			
		s3	2.5	0.192			
		s4	5	0.395			
		s5	10	0.841			
		s6	25	2.385			
		s7	35	3.51			
		s8	50	5.304			
Calibration verification	NO <sub>3</sub>	ICV	5	4.87	97.4	97.4	Y
Calibration verification	NO <sub>3</sub> /NO <sub>2</sub> -N	CCV	3	2.7201	90.7	90.7	
Calibration verification	Fe <sup>3+</sup>	CCV	4	4.09	102.3	102.4	

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 #: 4584136

**VALIDATION FINDINGS WORKSHEET**  
**Level IV Recalculation Worksheet**

Page: 1 of 1  
Reviewer: [Signature]  
2nd Reviewer: [Signature]

**METHOD:** Inorganics, Method see cover

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

$\%R = \frac{\text{Found}}{\text{True}} \times 100$       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 (units)	True / D (units)	Recalculated	Reported	Acceptable (Y/N)
					%R / RPD	%R / RPD	
4CS	Laboratory control sample	TOC	2.89	2.5	116	116	Y
6	Matrix spike sample	Fe <sup>3+</sup>	(SSR-SR) 2.89	3	96.3	97.7	↓
6/7	Duplicate sample	↓	5.43	5.51	1.5	1.5	↓

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



LDC #: LF581136

**VALIDATION FINDINGS WORKSHEET**  
**Sample Calculation Verification**

Page: 1 of 1  
Reviewer: OL  
2nd reviewer: RL

**METHOD:** Inorganics, Method see cal

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 SO<sub>4</sub> reported with a positive detect were recalculated and verified using the following equation:

Concentration =  $y = 0.065x - 0.011$

Recalculation:  $\frac{0.026 + 0.011}{0.065} = 0.569 \text{ mg/L}$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
	<u>1</u>	<u>Cl</u>	<u>43.6</u>	<u>43.8</u>	<u>Y</u>
		<u>SO<sub>4</sub></u>	<u>0.57</u>	<u>0.57</u>	
		<u>Alk</u>	<u>2.0</u>	<u>2.0</u>	
		<u>Fe<sup>3+</sup></u>	<u>2.5</u>	<u>2.5</u>	
		<u>TOC</u>	<u>4.1</u>	<u>4.4</u>	

Note: \_\_\_\_\_

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 13, 2019

**Parameters:** Gasoline Range Organics

**Validation Level:** Level C & D

**Laboratory:** APPL. Inc

**Sample Delivery Group (SDG):** 89593

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH845	AZ95328	Water	07/23/19
ERH846**	AZ95329**	Water	07/23/19
ERH847	AZ95330	Water	07/23/19
ERH848	AZ95331	Water	07/22/19
ERH849**	AZ95332**	Water	07/22/19
ERH850	AZ95333	Water	07/23/19
ERH851	AZ95334	Water	07/23/19
ERH852	AZ95335	Water	07/22/19
ERH853	AZ95336	Water	07/22/19
ERH854	AZ95337	Water	07/22/19
ERH855	AZ95338	Water	07/22/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## 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 ERH845, ERH848, ERH850, ERH852, and ERH854 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 with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
ERH850	4-Bromofluorobenzene	129 (85-114)	Gasoline range organics	NA	-

## VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

### 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

Samples ERH846\*\* and ERH847 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)
	ERH846**	ERH847	
Gasoline range organics	79	18.0U	200 (≤50)

### X. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### XI. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### XII. Overall Assessment of Data

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Laboratory Blank Data Qualification Summary - SDG  
89593**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Field Blank Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG



LDC #: 45841B7  
 SDG #: 89593  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/1/19  
 Page: 1 of 1  
 Reviewer: FA  
 2nd Reviewer: RA

**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, Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	A, Δ	r <sup>2</sup>   CV ≤ 20
IV.	Continuing calibration	Δ	CW ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 1, 4, 6, 8, 10
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	A	ERH838 MS/D
IX.	Laboratory control samples	Δ	LCS 10
X.	Field duplicates	SW	D = 2, 3
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	Δ	Not reviewed for Level C validation
XIII.	Target compound identification	Δ	Not reviewed for Level C validation
XIV.	System performance	Δ	Not reviewed for Level C validation
XV.	Overall assessment of data	Δ	

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

\*\*Indicates samples underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH845 TB	AZ95328	Water	07/23/19
2	ERH846** D	AZ95329**	Water	07/23/19
3	ERH847** D	AZ95330**	Water	07/23/19
4	ERH848 TB	AZ95331	Water	07/23/19
5	ERH849**	AZ95332**	Water	07/23/19
6	ERH850 TB	AZ95333	Water	07/23/19
7	ERH851	AZ95334	Water	07/23/19
8	ERH852 TB	AZ95335	Water	07/22/19
9	ERH853	AZ95336	Water	07/22/19
10	ERH854 TB	AZ95337	Water	07/22/19
11	ERH855	AZ95338	Water	07/22/19
12	190727 BL - BIK			
13	190729 BT - BIK			

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
Were all technical holding times met?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was cooler temperature criteria met?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>II. GC/MS Instrument performance check</b>				
Were the BFB performance results reviewed and found to be within the specified criteria?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all samples analyzed within the 12 hour clock criteria?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>IIIa. Initial calibration</b>				
Did the laboratory perform a 5 point calibration prior to sample analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of $\geq 0.990$ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent relative standard deviations (%RSD) $\leq 30\%/15\%$ and relative response factors (RRF) $\geq 0.05$ ?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>IIIb. Initial Calibration Verification</b>				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) $\leq 20\%$ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>IV. Continuing calibration</b>				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Were all percent differences (%D) $\leq 20\%$ and relative response factors (RRF) $\geq 0.05$ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>V. Laboratory Blanks</b>				
Was a laboratory blank associated with every sample in this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was there contamination in the laboratory blanks?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>VI. Field blanks</b>				
Were field blanks were identified in this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were target compounds detected in the field blanks?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>VII. Surrogate spikes</b>				
Were all surrogate percent recovery (%R) within QC limits?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
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?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

LDC #: 45841B7

## VALIDATION FINDINGS CHECKLIST

Page: 2 of 2  
Reviewer: FT  
2nd Reviewer: AE

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

## TARGET COMPOUND WORKSHEET

### METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane
C. Vinyl chloride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO. 1,1-Difluoroethane	O1. 3-Methylpentane
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3-Trimethylbutane
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methyl cyclohexane	T1. 2-Methylhexane
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWWW. Ethyl methacrylate	W1. Methanol
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.

LDC #: 4584187

**VALIDATION FINDINGS WORKSHEET**

Page: 1 of 1

**Surrogate Recovery**

Reviewer: FT

2nd Reviewer: ↑

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
	<u>6</u>		<u>B</u>	<u>129</u>	<u>( 85 - 114 )</u>	<u>Just / P ND (3)</u>
				( )	( )	
				( )	( )	
				( )	( )	
				( )	( )	
				( )	( )	
				( )	( )	
				( )	( )	
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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	2-Bromonaphthalene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Triphenyltin	AA	Chloro-octadecane
D	Bromochlorobenzene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin	BB	2,4-Dichlorophenylacetic acid
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate	CC	2,5-Dibromotoluene
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 4584187

## VALIDATION FINDINGS WORKSHEET

### Field Duplicates

Page: 1 of 1  
 Reviewer: FT  
 2nd reviewer: [Signature]

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

Y N N/A     Were field duplicate pairs identified in this SDG?  
Y N N/A     Were target compounds detected in the field duplicate pairs?

Compound	Concentration ( $\mu\text{g/L}$ )		RPD ( $\leq 20$ %)	QUAL
	2	3		
Gasoline Range Organics	79	18.04	200	/

Compound	Concentration ( )		RPD ( $\leq$ %)	QUAL

LDC#: 45841B7  
 SDG#: per cover

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: F7  
 2nd Reviewer: A

Method: GRO (8260B)

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
7/17/2019	GCMS Loki	Gasoline Range Organics (C6-C10)	1	9.764238	0.8
			2	9.376755	2
			3	9.876691	4
			4	13.45767	12
			5	17.87205	24
			6	20.38878	32
			7	25.133341	40

**Regression Output**

**Reported**

Constant	8.727571	8.730000
Std Err of Y Est		
R Squared	0.990859	0.997000
Degrees of Freedom		
X Coefficient(s)	0.390039	0.390000
Std Err of Coef.		
Correlation Coefficient	0.995419	
Coefficient of Determination (r <sup>2</sup> )	0.990859	

LDC#: 45841B7  
 SDG#: see cover

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: F7  
 2nd Reviewer: ef

Method: GRO (8260B)

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
7/29/2019	GCMS Thor	Gasoline Range Organics	1	9.76424	0.8
			2	9.37676	2
			3	9.87669	4
			4	13.45767	12
			5	17.87205	24
			6	20.38878	32
			7	25.13334	40

**Regression Output**

**Reported**

Constant	8.727572	8.730000
Std Err of Y Est		
R Squared	0.990859	0.991000
Degrees of Freedom		
X Coefficient(s)	0.390039	0.390000
Std Err of Coef.		
Correlation Coefficient	0.995419	
Coefficient of Determination (r <sup>2</sup> )	0.990859	



## VALIDATION FINDINGS WORKSHEET Continuing Calibration Results 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 =  $100 * (\text{ave. RRF} - \text{RRF}) / \text{ave. RRF}$   
 $\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF  
 RRF = continuing calibration RRF

A<sub>x</sub> = Area of compound,  
 C<sub>x</sub> = Concentration of compound;

A<sub>is</sub> = Area of associated internal standard  
 C<sub>is</sub> = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference internal Standard)	Average RRF (initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	ccv 0727223  Loki	7/27/19	gasoline <i>q</i> -CID (1st internal standard)	300	284.468	284.468	5.2	5.2
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					
2	ccv 16:11 0729717  Thor	7/29/19	↓ (1st internal standard)	300	255.13065	255.13065	15	15
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					
3			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					
4			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					

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

LDC #: 45841B7

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Results Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd reviewer: X

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

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

% Recovery: SF/SS \* 100

Where: SF = Surrogate Found  
 SS = Surrogate Spiked

Sample ID: #2

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene	<u>25.0</u>	<u>23.09978</u>	<u>92.4</u>	<u>92.4</u>	<u>0</u>

Sample ID: \_\_\_\_\_

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID: \_\_\_\_\_

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID: \_\_\_\_\_

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID: \_\_\_\_\_

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 45841B7

**VALIDATION FINDINGS WORKSHEET**  
**Laboratory Control Sample Results Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: P

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

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 \* SSC/SA

Where: SSC = Spiked sample concentration  
 SA = Spike added

RPD = | LCSC - LCSDC | \* 2 / (LCSC + LCSDC)

LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: 190727BL lcs 1D

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
<del>GRD</del> <del>1,1-Dichloroethene</del>	300	300	273	293	91.0	91.0	97.7	97.7	7.1	7.1
Trichloroethene										
Benzene										
Toluene										
Chlorobenzene										

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

LDC #: 4584/B

## VALIDATION FINDINGS WORKSHEET

### Sample Calculation Verification

Page: 1 of 1  
 Reviewer: FT  
 2nd reviewer: π

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

- Y N N/A Were all reported results recalculated and verified for all level IV samples?  
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

$$\text{Concentration} = \frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$$

- $A_x$  = Area of the characteristic ion (EICP) for the compound to be measured
- $A_{is}$  = Area of the characteristic ion (EICP) for the specific internal standard
- $I_s$  = Amount of internal standard added in nanograms (ng)
- RRF = Relative response factor of the calibration standard.
- $V_o$  = Volume or weight of sample pruged in milliliters (ml) or grams (g).
- Df = Dilution factor.
- %S = Percent solids, applicable to soils and solid matrices only.

Example:

Sample I.D. #2, GRU

$$\text{Conc.} = \frac{(3201311 - 8.73)(25)}{321496}$$

= 0.39

78.6 ug/l

#	Sample ID	Compound	Reported Concentration (ug/l)	Calculated Concentration (ug/l)	Qualification
	#2	GRU	79	78.6	

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 17, 2019

**Parameters:** Total Petroleum Hydrocarbons as Extractables

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89593

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH846**	AZ95329**	Water	07/23/19
ERH847	AZ95330	Water	07/23/19
ERH849	AZ95332	Water	07/22/19
ERH851	AZ95334	Water	07/23/19
ERH853	AZ95336	Water	07/22/19
ERH855	AZ95338	Water	07/22/19
ERH846(SGCU)**	AZ95329(SGCU)**	Water	07/23/19
ERH847(SGCU)	AZ95330(SGCU)	Water	07/23/19
ERH849(SGCU)	AZ95332(SGCU)	Water	07/23/19

\*\*Indicates sample underwent Level D validation  
Samples appended with "SGCU" underwent Silica Gel Clean Up

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.



## **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 compounds 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 compounds, 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 compounds.

## **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 compounds.

## **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.

## **VII. Matrix Spike/Matrix Spike Duplicates**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

**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**

Samples ERH846\*\* and ERH847 and samples ERH846(SGCU)\*\* and ERH847(SGCU) were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)
	ERH846**	ERH847	
Diesel (C10-C24)	2400	2600	8 (≤50)
Oil (C24-C40)	190	200	5 (≤50)

Compound	Concentration (ug/L)		RPD (Limits)
	ERH846(SGCU)**	ERH847(SGCU)	
Diesel (C10-C24)	690	480	36 (≤50)

**X. Compound Quantitation**

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

**XI. Target Compound Identifications**

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

**XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -  
SDG 89593**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data  
Qualification Summary - SDG 89593**

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 89593**

No Sample Data Qualified in this SDG

LDC #: 45841B8  
 SDG #: 89593  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/7/19  
 Page: 1 of 1  
 Reviewer: FJ  
 2nd Reviewer: [Signature]

**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	Δ Δ	
II.	Initial calibration/ICV	A Δ	% PSD = 20, 12 ICV = 20
III.	Continuing calibration	A	CCV = 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	N	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	A	ERH838 MS/D
VIII.	Laboratory control samples	Δ	LCB ID
IX.	Field duplicates	SW	D = 1, 2 3, 8
X.	Compound quantitation RL/LOQ/LODs	Δ	Not reviewed for Level C validation
XI.	Target compound identification	Δ	Not reviewed for Level C validation
XII.	Overall assessment of data	Δ	

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

\*\*Indicates samples underwent Level D validation / Samples appended with SGCU underwent Silica Gel Clean Up

+	Client ID	Lab ID	Matrix	Date
1	ERH846** D	AZ95329**	Water	07/23/19
2	ERH847 D	AZ95330	Water	07/23/19
3	ERH849	AZ95332	Water	07/23/19
4	ERH851	AZ95334	Water	07/23/19
5	ERH853	AZ95336	Water	07/22/19
6	ERH855	AZ95338	Water	07/22/19
7	ERH846(SGCU)**	AZ95329(SGCU)**	Water	07/23/19
8	ERH847(SGCU)	AZ95330(SGCU)	Water	07/23/19
9	ERH849(SGCU)	AZ95332(SGCU)	Water	07/23/19
10				

Notes:

190727A - BIK				
190727A1 - BIK				

Method:  GC  HPLC

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
<b>IIa. Initial calibration</b>				
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?	/			
<b>IIb. Initial calibration verification</b>				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) < 20%?	/			
<b>III. Continuing calibration</b>				
Was a continuing calibration analyzed daily?	/			
Were all percent differences (%D) < 20%?	/			
Were all the retention times within the acceptance windows?	/			
<b>IV. Laboratory Blanks</b>				
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?		/		
<b>V. Field Blanks</b>				
Were field blanks identified in this SDG?		/		
Were target compounds detected in the field blanks?			/	
<b>VI. Surrogate spikes</b>				
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?			/	
<b>VII. Matrix spike/Matrix spike duplicates</b>				
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?	/			
<b>VIII. Laboratory control samples</b>				
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
<b>IX. Field duplicates</b>				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?	/			
<b>X. Compound quantitation</b>				
Did the laboratory LOQs/RLs meet the QAPP LOQs/RLs?	/			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
<b>XI. Target compound identification</b>				
Were the retention times of reported detects within the RT windows?	/			
<b>XIII. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.	/			

LDC #: 45841B8

**VALIDATION FINDINGS WORKSHEET**  
**Field Duplicates**

Page: 1 of 1  
Reviewer: FT  
2nd reviewer: 4

METHOD:  GC  HPLC  
 Y  N  N/A Were field duplicate pairs identified in this SDG?  
 Y  N  N/A Were target compounds detected in the field duplicate pairs?

Compound	Concentration ( <u>ug/L</u> )		%RPD Limit (≤ <u>50</u> %)	Qualification (Parent only)
	<u>1</u>	<u>2</u>		
Diesel (C10-C24)	2400	FT <del>690</del> 2600	8.	/
Oil (C24-C40)	190	FT <del>404</del> 200	5	

Compound	Concentration ( <u>ug/L</u> )		%RPD Limit (≤ <u>50</u> %)	Qualification (Parent only)
	<u>7</u>	<u>8</u>		
Diesel (C10-C24)	690	480	36	/

Compound	Concentration ( )		%RPD Limit (≤ _____ %)	Qualification (Parent only)

LDC #: 45841 B8

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: AC

METHOD: GC X HPLC \_\_\_\_\_

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C  
average CF = sum of the CF/number of standards  
%RSD = 100 \* (S/X)

Where: A = Area of compound  
C = Concentration of compound  
S = Standard deviation of calibration factors  
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported ( std=250ppb)	Recalculated ( std=250ppb)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	6/17/2019	Motor Oil (C24-C40)	865251	865251	916522	916522	19.0	19.0
	Apollo								



LDC#: 45841B8  
 SDG#: pu cover

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

Method: TPH 8015B

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
6/17/2019	GC-Apollo Loki	Diesel C10-C24	1	53806066	10
			2	111685733	50
			3	543816041	250
			4	2102569494	1000
			5	3176057733	1500
			6	4405297136	2000

**Regression Output**

**Reported**

Constant	-3056139.620482	-3060000.0
Std Err of Y Est		
R Squared	0.999035	0.999000
Degrees of Freedom		
X Coefficient(s)	2164567.368134	2160000.0
Std Err of Coef.		
Correlation Coefficient	0.999517	
Coefficient of Determination (r <sup>2</sup> )	0.999035	

LDC #: 45841B8

**VALIDATION FINDINGS WORKSHEET**  
**Continuing Calibration Results Verification**

Page: 1 of 1

Reviewer: FT

2nd Reviewer: [Signature]

METHOD: GC   /   HPLC       

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

% Difference = 100 \* (ave. CF - CF)/ave.CF      Where: ave. CF = initial calibration average CF  
 CF = continuing calibration CF  
 A = Area of compound  
 C = Concentration of compound

#	Standard ID	Calibration Date	Compound	Average CF(ICAL)/ CCV Conc.	Reported	Recalculated	Reported	Recalculated
					CF/ Conc. CCV	CF/ Conc. CCV	%D	%D
1	CCV 713253	7/30/19	Motor oil (C24-C24)	916522	836519	836519	8.7	8.7
2	CCV 814148	8/20/19	↓	↓	953724	953724	4.1	4.1
3								
4								

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

LDC #: 4584138

## VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page: 1 of 1

Reviewer: FT

2nd reviewer: AK

METHOD:  GC  HPLC

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

% Recovery: SF/SS \* 100

Where: SF = Surrogate Found  
SS = Surrogate Spiked

Sample ID: # 1

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
octane		93.750	97.741	104	104	0
o-Terphenyl		↓	76.764	81.9	81.9	0

Sample ID:

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

	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	2-Bromonaphthalene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Triphenyltin	AA	Chloro-octadecane
D	Bromochlorobenene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin	BB	2,4-Dichlorophenylacetic acid
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate	CC	2,5-Dibromotoluene
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 4584/BX

**VALIDATION FINDINGS WORKSHEET**

Page: 1 of 1

**Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification**

Reviewer: FT

2nd Reviewer: [Signature]

METHOD: GC HPLC

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

$\% \text{Recovery} = 100 * (\text{SSC}/\text{SA})$

$\text{RPD} = ((\text{SSCLCS} - \text{SSCLCSD}) * 2) / (\text{SSCLCS} + \text{SSCLCSD}) * 100$

Where SSC = Spiked sample concentration  
LCS = Laboratory Control Sample

SA = Spike added  
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: 190727A LCSD

Compound	Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel <u>C10-C24</u> (8015)	<u>1250</u>	<u>1250</u>	<u>1140</u>	<u>1140</u>	<u>91.2</u>	<u>91.2</u>	<u>91.2</u>	<u>91.2</u>	<u>0</u>	<u>0</u>
Benzene (8021B)										
Methane (RSK-175)										
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)										
2,4,6-Trinitrotoluene (8330)										
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.



## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 9, 2019

**Parameters:** Methane

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89593

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH845	AZ95328	Water	07/23/19
ERH846**	AZ95329**	Water	07/23/19
ERH846DL**	AZ95329DL**	Water	07/23/19
ERH847	AZ95330	Water	07/23/19
ERH847DL	AZ95330DL	Water	07/23/19
ERH848	AZ95331	Water	07/22/19
ERH849	AZ95332	Water	07/22/19
ERH850	AZ95333	Water	07/23/19
ERH851	AZ95334	Water	07/23/19
ERH852	AZ95335	Water	07/22/19
ERH853	AZ95336	Water	07/22/19
ERH854	AZ95337	Water	07/22/19
ERH855	AZ95338	Water	07/22/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Methane by Method RSK-175

All sample results were subjected to Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## 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.

Retention time windows were established as required by the method for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

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 required frequencies.

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

Retention times of all compounds in the calibration standards were within the established retention time windows for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## IV. Laboratory Blanks

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

## V. Field Blanks

Samples ERH845, ERH848, ERH850, ERH852, and ERH854 were identified as trip blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Limit of Quantitation	Associated Samples
ERH848	07/22/19	Methane	5.2 ug/L	5.0 ug/L	ERH849

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

## 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. 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.

## VIII. Field Duplicates

Samples ERH846\*\* and ERH847 and samples ERH846DL\*\* and ERH847DL were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)
	ERH846**	ERH847	
Methane	2400	3000	22 (≤50)

Compound	Concentration (ug/L)		RPD (Limits)
	ERH846DL**	ERH847DL	
Methane	4600	4900	6 (≤50)

## IX. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## X. Target Compound Identification

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## XI. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

The overall assessment of data was acceptable. In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Compound	Reason	Flag	A or P
ERH846** ERH847	Methane	Results exceeded calibration range.	R	A

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Data Qualification Summary - SDG 89593**

Sample	Compound	Flag	A or P	Reason (Code)
ERH846** ERH847	Methane	R	A	Overall assessment of data (D)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Laboratory Blank Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Field Blank Data Qualification Summary - SDG 89593**

No Sample Data Qualified in this SDG

LDC #: 45841B51  
 SDG #: 89593  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/17/19  
 Page: 1 of 1  
 Reviewer: F7  
 2nd Reviewer: R

**METHOD:** GC Methane (Method RSK-175)

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	1 <sup>2</sup> ICV ≤ 20
III.	Continuing calibration	A	CCV ≤ 20
IV.	Laboratory Blanks	A	* * * *
V.	Field blanks	SW	TB = 1, 6, 8, 10, 12
VI.	Matrix spike/Matrix spike duplicates	N	
VII.	Laboratory control samples	A	105 IP
VIII.	Field duplicates	SW	D = 2, 4 3, 5
IX.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level C validation
X.	Target compound identification	A	Not reviewed for Level C validation
XI.	Overall assessment of data	SW	

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

\*\*Indicates samples underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH845 TB	AZ95328	Water	07/23/19
2 <sup>+</sup>	ERH846** D	AZ95329**	Water	07/23/19
3 <sup>+</sup>	ERH846DL** D <sub>1</sub>	AZ95329DL**	Water	07/23/19
4 <sup>+</sup>	ERH847 D	AZ95330	Water	07/23/19
5 <sup>+</sup>	ERH847DL D <sub>1</sub>	AZ95330DL	Water	07/23/19
6	ERH848 TB	AZ95331	Water	07/23/19
7	ERH849	AZ95332	Water	07/23/19
8	ERH850 TB	AZ95333	Water	07/23/19
9	ERH851	AZ95334	Water	07/23/19
10	ERH852 TB	AZ95335	Water	07/22/19
11	ERH853	AZ95336	Water	07/22/19
12	ERH854 TB	AZ95337	Water	07/22/19
13	ERH855	AZ95338	Water	07/22/19
14				

Notes:

190729 A - B11K				
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Method:  GC  HPLC

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

LDC #: 49841BS1

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2  
Reviewer: FT  
2nd Reviewer: [Signature]

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



LDC #: 45841BS/

### VALIDATION FINDINGS WORKSHEET Field Blanks

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: TC

METHOD:  GC  HPLC  
Y N N/A Were field blanks identified in this SDG?  
Y N N/A Were target compounds detected in the field blanks?  
Blank units: ug/L Associated sample units: ug/L  
Sampling date: 7/28/19  
Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank  
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: TB

Associated Samples: 7 (ND)

Compound	Blank ID	Blank ID	Sample Identification							
	<u>6</u>									
<u>Methane</u>	<u>5.2</u>									
CRQL										

Blank units: \_\_\_\_\_ Associated sample units: \_\_\_\_\_  
Sampling date: \_\_\_\_\_  
Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank  
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: \_\_\_\_\_

Associated Samples: \_\_\_\_\_

Compound	Blank ID	Blank ID	Sample Identification							
CRQL										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:  
Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC #: 45841BS/

**VALIDATION FINDINGS WORKSHEET**  
**Field Duplicates**

Page: 1 of 1  
Reviewer: FT  
2nd reviewer: [Signature]

METHOD:  GC  HPLC  
 Y  N  N/A Were field duplicate pairs identified in this SDG?  
 Y  N  N/A Were target compounds detected in the field duplicate pairs?

Compound	Concentration ( <u>ug/L</u> )		%RPD Limit ( ≤ <u>50</u> % )	Qualification (Parent only)
	<u>2</u>	<u>4</u>		
Methane	2400	3000	22	/

Compound	Concentration ( <u>ug/L</u> )		%RPD Limit ( ≤ <u>50</u> % )	Qualification (Parent only)
	<u>3</u>	<u>5</u>		
Methane	4600	4900	6	/

Compound	Concentration ( )		%RPD Limit ( ≤ _____ % )	Qualification (Parent only)

LDC #: 4584/B51

### VALIDATION FINDINGS WORKSHEET Compound Quantitation and Reported CRQLs

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: [Signature]

METHOD: GC HPLC

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

**Level IV/D Only**

Y N N/A

Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?

Y N N/A

Did the reported results for detected target compounds agree within 10.0% of the recalculated results?

#	Associated Samples	Compound Name	Findings	Qualifications
	2, 4	Methane	x'd cal Range	Jdu/A (Y)

Comments: See sample calculation verification worksheet for recalculations

LDC #: 4584/135/

VALIDATION FINDINGS WORKSHEET  
Overall Assessment of Data

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: AC

METHOD:  GC  HPLC

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

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

N  N/A Was the overall quality and usability of the data acceptable?

#	Associated samples	Compounds	Findings	Qualifications
	2, 4	Methane	x'd cal Range	R/A (D)

Comments: \_\_\_\_\_  
\_\_\_\_\_

LDC#: 45841BS1  
 SDG#: per cover

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: FJ  
 2nd Reviewer: AC

Method: RSK 175

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
6/18/2019	Ints 7890	Methane	1	15338	2.080
			2	21752	4.160
			3	29757	8.340
			4	101573	20.850
			5	435711	83.400
			6	1167694	208.500
			7	4416985	834.000

**Regression Output**

**Reported**

Constant	3638.647460	3640.00
Std Err of Y Est		
R Squared	0.999738	1.000000
Degrees of Freedom		
X Coefficient(s)	5307.138770	5310.00
Std Err of Coef.		
Correlation Coefficient	0.999869	
Coefficient of Determination (r <sup>2</sup> )	0.999738	1.000000

LDC #: 4584/BS/

## VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: TC

METHOD: GC   /   HPLC       

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

$$\% \text{ Difference} = 100 * (\text{ave. CF} - \text{CF}) / \text{ave. CF}$$

Where: ave. CF = initial calibration average CF  
 CF = continuing calibration CF  
 A = Area of compound  
 C = Concentration of compound

#	Standard ID	Calibration Date	Compound	Average CF(ICAL)/ CCV Conc.	Reported	Recalculated	Reported	Recalculated
					CF/ Conc. CCV	CF/ Conc. CCV	%D	%D
1	CCV 19612900	7/29/19	Methane	83.4	78.267	78.267	6.2	6.2
2								
3								
4								

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

LDC #: 45841 B5 /

**VALIDATION FINDINGS WORKSHEET**

Page: 1 of 1

**Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification**

Reviewer: FT

2nd Reviewer: [Signature]

METHOD: GC HPLC

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

$\% \text{Recovery} = 100 * (\text{SSC}/\text{SA})$

$\text{RPD} = ((\text{SSCLCS} - \text{SSCLCSD}) * 2) / (\text{SSCLCS} + \text{SSCLCSD}) * 100$

Where SSC = Spiked sample concentration  
LCS = Laboratory Control Sample

SA = Spike added  
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: 190729A LCSD

Compound	Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)										
Benzene (8021B)										
Methane (RSK-175)	83.4	83.4	78.3	68.9	93.9	93.9	82.6	82.6	12.8	12.8
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)										
2,4,6-Trinitrotoluene (8330)										
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.





## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 9, 2019

**Parameters:** Volatiles

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89607

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH843	AZ95418	Water	07/23/19
ERH844	AZ95419	Water	07/23/19
ERH860	AZ95420	Water	07/23/19
ERH861	AZ95421	Water	08/23/19
ERH864	AZ95422	Water	07/24/19
ERH865	AZ95423	Water	07/24/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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 ERH843, ERH860, and ERH864 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 with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
ERH865	1,2-Dichloroethane-d4 Bromofluorobenzene Dibromofluoromethane Toluene-d8	133 (81-118) 127 (85-114) 135 (80-119) 131 (89-112)	All compounds	NA	-

## 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. Compound Quantitation

Raw data were not reviewed for Level C validation.

## XIII. Target Compound Identifications

Raw data were not reviewed for Level C validation.

## XIV. System Performance

Raw data were not reviewed for Level C validation.

## XV. Overall Assessment of Data

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Laboratory Blank Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Field Blank Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG

LDC #: 45841C1a  
 SDG #: 89607  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/5/19  
 Page: 1 of 1  
 Reviewer: \_\_\_\_\_  
 2nd Reviewer: R

**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	% PSD $\leq 15$   CV $\leq 20$
IV.	Continuing calibration <i>ending</i>	A	CV $\leq 20$   SD
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1, 3, 5
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LC > ID
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH843 , TB	AZ95418	Water	07/23/19
2	ERH844	AZ95419	Water	07/23/19
3	ERH860 , TB	AZ95420	Water	07/23/19
4	ERH861	AZ95421	Water	08/23/19
5	ERH864 , TB	AZ95422	Water	07/24/19
6	ERH865	AZ95423	Water	07/24/19
7				
8				

Notes:

190730AT				



LDC #: 45841c/a

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Spikes**

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: AK

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

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

Y (N) N/A Were all surrogate %R within QC limits?

Y (N) N/A If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R out of outside of criteria?

#	Sample ID	Surrogate	%Recovery (Limits)		Qualifications
	6	DCE	133	( 81-118 )	↓ det / P all ND (S)
		BFB	127	( 85-114 )	
		DFM	135	( 80-119 )	
		Tol	131	( 89-112 )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

- SMC1 (TOL) = Toluene-d8
- SMC2 (BFB) = Bromofluorobenzene
- SMC3 (DCE) = 1,2-Dichloroethane-d4
- SMC4 (DFM) = Dibromofluoromethane

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 9, 2019

**Parameters:** Phenol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89607

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH844	AZ95419	Water	07/23/19
ERH861	AZ95421	Water	07/23/19
ERH865	AZ95423	Water	07/24/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Phenol by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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.

### **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

### **XIV. System Performance**

Raw data were not reviewed for Level C validation.

### **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Laboratory Blank Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Field Blank Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG



LDC #: 45841C2a  
 SDG #: 89607  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/5/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

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

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	% PSD ≤ 15      1W ≤ 20
IV.	Continuing calibration /ending	A	CW ≤ 20 /SD
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS ID
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound 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	ERH844	AZ95419	Water	07/23/19
2	ERH861	AZ95421	Water	07/23/19
3	ERH865	AZ95423	Water	07/24/19
4				
5				
6				
7				
8				

Notes:

190729A-BIK				

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 9, 2019

**Parameters:** Polynuclear Aromatic Hydrocarbons

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89607

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH844	AZ95419	Water	07/23/19
ERH861	AZ95421	Water	07/23/19
ERH865	AZ95423	Water	07/24/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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.

## **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification  
Summary - SDG 89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -  
SDG 89607**

No Sample Data Qualified in this SDG



LDC #: 45841C2b

**VALIDATION COMPLETENESS WORKSHEET**

Date: 9/5/19

SDG #: 89607

Level C

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: [Signature]

2nd Reviewer: [Signature]

**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/Δ	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/Δ	% RSD ≤ 15    ICV ≤ 20
IV.	Continuing calibration <i>pending</i>	A	COV ≤ 20/50
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LOS/D
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound 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	ERH844	AZ95419	Water	07/23/19
2	ERH861	AZ95421	Water	07/23/19
3	ERH865	AZ95423	Water	07/24/19
4				
5				
6				
7				
8				

Notes:

190129A - BIK				

**Laboratory Data Consultants, Inc.**  
**Data Validation Report**

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

**LDC Report Date:** September 9, 2019

**Parameters:** 2-(2-Methoxyethoxy)-ethanol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89607

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH844	AZ95419	Water	07/23/19
ERH861	AZ95421	Water	07/23/19
ERH865	AZ95423	Water	07/24/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

2-(2-Methoxyethoxy)-ethanol by Environmental Protection Agency (EPA) SW 846 Method 8270D Modified

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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 not added to all samples as required by the method. Using professional judgment, no data were qualified. Although the LCSD percent recovery was outside the QC limit, the LCS/MS/MSD were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis.

## VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## 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 with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
190726A-LCS/D (All samples in SDG 89607)	2-(2-Methoxyethoxy)-ethanol	-	151 (30-130)	NA	-

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. Compound Quantitation

Raw data were not reviewed for Level C validation.

## XIII. Target Compound Identifications

Raw data were not reviewed for Level C validation.

## XIV. System Performance

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

The analysis was conducted within all specifications of the method with the exception noted in Section VII. No results were rejected in this SDG.



**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -  
SDG 89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG  
89607**

No Sample Data Qualified in this SDG

LDC #: 45841C2c  
 SDG #: 89607  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/5/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-Modified)

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	Δ	
III.	Initial calibration/ICV	Δ/A	% PSD ≤ 15      PCV ≤ 20
IV.	Continuing calibration <i>ending</i>	Δ	CV ≤ 20 / SD
V.	Laboratory Blanks	Δ	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	A	ERH838 MS/D
IX.	Laboratory control samples	SW	LCs ID
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH844	AZ95419	Water	07/23/19
2	ERH861	AZ95421	Water	07/23/19
3	ERH865	AZ95423	Water	07/24/19
4				
5				
6				
7				
8				

Notes:

190726A - B/K				





## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 5, 2019

**Parameters:** Wet Chemistry

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89607

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH844	AZ95419	Water	07/23/19
ERH861	AZ95421	Water	07/23/19
ERH865	AZ95423	Water	07/24/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Alkalinity by Standard Method 2320B

Chloride, Nitrate, and Sulfate by Environmental Protection Agency (EPA) Method 300.0

Ferrous Iron by Standard Method 3500-Fe B

Nitrate/Nitrite as Nitrogen by EPA Method 353.2

Total Organic Carbon by EPA SW 846 Method 9060A

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is  $<0.995$ .
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.



## I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

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

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
ERH844	Nitrate as N	11 days	2 days	R (all non-detects)	P
ERH861	Nitrate as N	11 days	2 days	J (all detects)	P
ERH865	Nitrate as N	10 days	2 days	J (all detects)	P

## II. Initial Calibration

All criteria for the initial calibration of each method were met.

## III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable with the following exceptions:

Date	Lab. Reference/ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
08/05/19	CCV (09:51PM)	Total organic carbon	113.6 (90-110)	All samples in SDG 89607	J (all detects)	P

## IV. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Limit of Quantitation	Associated Samples
PB (prep blank)	Bicarbonate alkalinity Total alkalinity Total organic carbon	1.2 mg/L 1.2 mg/L 0.18 mg/L	2.0 mg/L 2.0 mg/L 0.93 mg/L	All samples in SDG 89607

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. 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	Limit of Quantitation	Modified Final Concentration
ERH844	Total organic carbon	0.91 mg/L	0.93 mg/L	0.91U mg/L
ERH861	Total organic carbon	0.39 mg/L	0.93 mg/L	0.39U mg/L

## 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. Sample Result Verification

Raw data were not reviewed for Level C validation.

## XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods.

Due to technical holding time, data were rejected in one sample.

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

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Data Qualification Summary - SDG 89607**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH844 ERH861 ERH865	Nitrate as N	J (all detects) R (all non-detects)	P	Technical holding times (H)
ERH844 ERH861 ERH865	Total organic carbon	J (all detects)	P	Continuing calibration (%R) (R)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 89607**

Sample	Analyte	Modified Final Concentration	A or P	Code
ERH844	Total organic carbon	0.91U mg/L	A	B
ERH861	Total organic carbon	0.39U mg/L	A	B

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Field Blank Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG

LDC #: 45841C6  
 SDG #: 89607  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/5/19  
 Page: 1 of 1  
 Reviewer: CR  
 2nd Reviewer: R

**METHOD: (Analyte)** Alkalinity (SM2320B), Chloride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B), Nitrate/Nitrite-N (EPA Method 353.2), TOC (EPA SW 846 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 SW	
II	Initial calibration	A	
III.	Calibration verification	SW	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS/D
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH844	AZ95419	Water	07/23/19
2	ERH861	AZ95421	Water	07/23/19
3	ERH865	AZ95423	Water	07/24/19
4				
5				
6				
7				
8				
9				
10				

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
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**VALIDATION FINDINGS WORKSHEET**  
**Calibration**

**METHOD:** Inorganics, EPA Method See cover

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

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

**LEVEL IV/D ONLY:**

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

(CR)

#	Date	Calibration ID	Analyte	%R	Associated Samples	Qualifications
	8/5/19	CCV (09:51 PM)	TOC	113.6	Full	Jdot/P (Oct)

Comments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

LDC #: 45841C6

### VALIDATION FINDINGS WORKSHEET Blanks

Page: 1 of 1  
Reviewer: [Signature]  
2nd Reviewer: [Signature]

METHOD: Inorganics, Method See Cover

Conc. units: mg/L

Associated Samples: All

(B)

Analyte	Blank ID	Blank ID	Blank Action Limit											
	PB	ICB/CCB (mg/L)		1	2									
Bicarbonate Alkalinity	1.2													
Total Alkalinity	1.2													
TOC	0.18			0.91	0.39									



## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 9, 2019

**Parameters:** Gasoline Range Organics

**Validation Level:** Level C

**Laboratory:** APPL. Inc

**Sample Delivery Group (SDG):** 89607

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH843	AZ95418	Water	07/23/19
ERH844	AZ95419	Water	07/23/19
ERH860	AZ95420	Water	07/23/19
ERH861	AZ95421	Water	07/23/19
ERH864	AZ95422	Water	07/24/19
ERH865	AZ95423	Water	07/24/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## 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 ERH843, ERH860, and ERH864 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 with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
ERH865	4-Bromofluorobenzene	127 (85-114)	Gasoline range organics	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. Relative percent differences (RPD) were within QC limits.

### **IX. Field Duplicates**

No field duplicates were identified in this SDG.

### **X. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **XI. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

### **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Laboratory Blank Data Qualification Summary - SDG  
89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Field Blank Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG

LDC #: 45841C7  
 SDG #: 89607  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/5/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**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	Δ	
III.	Initial calibration/ICV	Δ/A	r <sup>2</sup> 10N ≤ 20
IV.	Continuing calibration	Δ	20N ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 1, 3, 5
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS 10
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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	ERH843 TB	AZ95418	Water	07/23/19
2	ERH844	AZ95419	Water	07/23/19
3	ERH860 TB	AZ95420	Water	07/23/19
4	ERH861	AZ95421	Water	07/23/19
5	ERH864 TB	AZ95422	Water	07/24/19
6	ERH865	AZ95423	Water	07/24/19
7				
8				

Notes:

190730AT				



LDC #: 45841c7

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Spikes**

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: ↑

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

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

- Y N N/A Were all surrogate %R within QC limits?
- Y N N/A If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R out of outside of criteria?

#	Sample ID	Surrogate	%Recovery (Limits)	Qualifications
	6	BFB	127 ( 85-114 )	Just / P ND (s)
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	
			( )	

SMC1 (TOL) = Toluene-d8  
 SMC2 (BFB) = Bromofluorobenzene  
 SMC3 (DCE) = 1,2-Dichloroethane-d4  
 SMC4 (DFM) = Dibromofluoromethane

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 9, 2019

**Parameters:** Total Petroleum Hydrocarbons as Extractables

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89607

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH844	AZ95419	Water	07/23/19
ERH861	AZ95421	Water	07/23/19
ERH865	AZ95423	Water	07/24/19
ERH844(SGCU)	AZ95419(SGCU)	Water	07/23/19
ERH865(SGCU)	AZ95423(SGCU)	Water	07/24/19

Samples appended with "SGCU" underwent Silica Gel Clean Up

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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% for all compounds.

## **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 compounds.

## **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.

## **VII. Matrix Spike/Matrix Spike Duplicates**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **XI. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

### **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -  
SDG 89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data  
Qualification Summary - SDG 89607**

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 89607**

No Sample Data Qualified in this SDG



LDC #: 45841C8  
 SDG #: 89607  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/3/19  
 Page: 1 of 1  
 Reviewer: \_\_\_\_\_  
 2nd Reviewer: ER

**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/D	
II.	Initial calibration/ICV	A/D	r <sup>2</sup> 1.4V ≤ 20
III.	Continuing calibration	A	CCV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	D	
VII.	Matrix spike/Matrix spike duplicates	A	↳ ERH838 MS/D
VIII.	Laboratory control samples	A	LCS 1P
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	Overall assessment of data	A	

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

Samples appended with SGCU underwent Silica Gel Clean Up

	Client ID	Lab ID	Matrix	Date
1 <sup>+</sup>	ERH844	AZ95419	Water	07/23/19
2 <sup>-</sup>	ERH861	AZ95421	Water	07/23/19
3 <sup>+</sup>	ERH865	AZ95423	Water	07/24/19
4 <sup>-</sup>	ERH844(SGCU)	AZ95419(SGCU)	Water	07/23/19
5 <sup>-</sup>	ERH865(SGCU)	AZ95423(SGCU)	Water	07/24/19
6				
7				
8				
9				
10				

Notes:

	190727A - BIK				
	190727A1 - BIK				

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 9, 2019

**Parameters:** Methane

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89607

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH843	AZ95418	Water	07/23/19
ERH844	AZ95419	Water	07/23/19
ERH860	AZ95420	Water	07/23/19
ERH861	AZ95421	Water	07/23/19
ERH864	AZ95422	Water	07/24/19
ERH865	AZ95423	Water	07/24/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Methane by Method RSK-175

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
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- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 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 ERH843, ERH860, and ERH864 were identified as trip blanks. No contaminants were found.

## **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. 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.

## **VIII. Field Duplicates**

No field duplicates were identified in this SDG.

### **IX. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **X. Target Compound Identification**

Raw data were not reviewed for Level C validation.

### **XI. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Laboratory Blank Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Field Blank Data Qualification Summary - SDG 89607**

No Sample Data Qualified in this SDG



LDC #: 45841C51  
 SDG #: 89607  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/5/19  
 Page: 1 of 1  
 Reviewer: F7  
 2nd Reviewer: M

**METHOD:** GC Methane (Method RSK-175)

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 / Δ	
II.	Initial calibration/ICV	Δ / Δ	ICV ≤ 20
III.	Continuing calibration	Δ	CCV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 1, 3, 5
VI.	Matrix spike/Matrix spike duplicates	N	CS
VII.	Laboratory control samples	A	LCS 10
VIII.	Field duplicates	N	
IX.	Compound quantitation RL/LOQ/LODs	N	
X.	Target compound identification	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH843 TB	AZ95418	Water	07/23/19
2	ERH844	AZ95419	Water	07/23/19
3	ERH860 TB	AZ95420	Water	07/23/19
4	ERH861	AZ95421	Water	07/23/19
5	ERH864 TB	AZ95422	Water	07/24/19
6	ERH865	AZ95423	Water	07/24/19
7				
8				
9				
10				

Notes:

190730A BIK				

LDC #: 45841

**EDD POPULATION COMPLETENESS WORKSHEET**

Date: 9/13  
 Page: 1 of 1  
 2<sup>nd</sup> Reviewer: FM

The LDC job number listed above was entered by FE.  
 Entered from Body or Summary

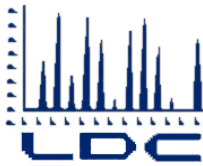
	EDD Process		Comments/Action
I.	EDD Completeness	-	
Ia.	- All methods present?	Y	
Ib.	- All samples present/match report?	Y	
Ic.	- All reported analytes present?	Y	
Id.	- 10% or <u>100%</u> verification of EDD?	Y	
II.	EDD Preparation/Entry	-	
IIa.	- Carryover U/J?	Y	
IIb.	- Reason Codes used? If so, note which codes.	Y	
IIc.	- Additional Information (QC Level, Validator, Validated Y/N, etc.)	Y	
III.	Reasonableness Checks	-	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	Y	
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	Y	
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	Y	
IIId.	-Does the detect flag require changing for blank qualifier? If so, are all U results marked ND?	Y/Y	
IIIe.	- Do blank concentrations in report match EDD where data was qualified due to blank contamination?	Y	
IIIf.	- Were multiple results reported due to dilutions/reanalysis? If so, were results qualified appropriately?	Y/Y	
IIIg.	-Are there any discrepancies between the data packet and the EDD?	N	

Notes: \*see discrepancy sheet

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## 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. Margie Pascua  
[Margie.Pascua@aecom.com](mailto:Margie.Pascua@aecom.com)

September 23, 2019

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

Dear Ms. Pascua

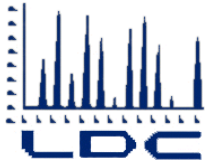
Enclosed are the final validation reports for the fractions listed below. This SDG was received on September 3, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

### LDC Project #45873:

<u>SDG #</u>	<u>Fraction</u>
89624	Volatiles, Phenol, Polynuclear Aromatic Hydrocarbons, 2-(2-Methoxyethoxy)-ethanol, Wet Chemistry, Gasoline Range Organics, Total Petroleum Hydrocarbons as Extractables, Methane

The data validation was performed under Level C validation guidelines. The analyses were validated using the following documents and variances, as applicable to each 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
- Project Procedures Manual U.S. Naval Facilities Engineering Command Environmental Restoration Program, NAVFAC Pacific; DON 2015
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.1; 2017
- 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; IIB, November 2004; update IV, February 2007; update V, July 2014



**LABORATORY DATA CONSULTANTS, INC.**

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

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

Sincerely,

Stella Cuenco

[scuenco@lab-data.com](mailto:scuenco@lab-data.com)

Operations Manager/Senior Chemist



## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 12, 2019

**Parameters:** Volatiles

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89624

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH862	AZ95510	Water	07/24/19
ERH863	AZ95511	Water	07/24/19
ERH866	AZ95512	Water	07/25/19
ERH867	AZ95513	Water	07/25/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r,  $r^2$  or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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.

For compounds where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 15.0%.

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

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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 ERH862 and ERH866 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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Laboratory Blank Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Field Blank Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

LDC #: 45873A1a  
 SDG #: 89624  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/11/19

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

**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	Δ	
III.	Initial calibration/ICV	A/A	% PSD ≤ 15, 12 ICV ≤ 20
IV.	Continuing calibration / ending	Δ	COV ≤ 20/50
V.	Laboratory Blank s	A	
VI.	Field blanks	ND	TB = 1, 3
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LES 10
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound 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	ERH862 TB	AZ95510	Water	07/24/19
2	ERH863	AZ95511	Water	07/24/19
3	ERH866 TB	AZ95512	Water	07/25/19
4	ERH867	AZ95513	Water	07/25/19
5				
6				
7				
8				

Notes:

190730BL - BLK				

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 12, 2019

**Parameters:** Phenol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89624

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH863	AZ95511	Water	07/24/19
ERH867	AZ95513	Water	07/25/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Phenol by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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.

### **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

### **XIV. System Performance**

Raw data were not reviewed for Level C validation.

### **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Laboratory Blank Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Field Blank Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

LDC #: 45873A2a  
 SDG #: 89624  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/11/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

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

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/D	% PSD ≤ 15      ICV ≤ 20
IV.	Continuing calibration <i>ending</i>	A	CCV ≤ 20 / 50
V.	Laboratory Blank s	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	CCV HP
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH863	AZ95511	Water	07/24/19
2	ERH867	AZ95513	Water	07/25/19
3				
4				
5				
6				
7				
8				

Notes:

19 0729A - B11C					

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 12, 2019

**Parameters:** Polynuclear Aromatic Hydrocarbons

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89624

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH863	AZ95511	Water	07/24/19
ERH867	AZ95513	Water	07/25/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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.

## **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification  
Summary - SDG 89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -  
SDG 89624**

No Sample Data Qualified in this SDG

LDC #: 45873A2b  
 SDG #: 89624  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/11/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**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	Δ	
III.	Initial calibration/ICV	A/A	% PSD ≤ 15      ICV ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20 / 50
V.	Laboratory Blanks	Δ	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LED ID
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH863	AZ95511	Water	07/24/19
2	ERH867	AZ95513	Water	07/25/19
3				
4				
5				
6				
7				
8				

Notes:

190729A-BIK					

TTT, W, S

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 12, 2019

**Parameters:** 2-(2-Methoxyethoxy)-ethanol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89624

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH863	AZ95511	Water	07/24/19
ERH867	AZ95513	Water	07/25/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

2-(2-Methoxyethoxy)-ethanol by Environmental Protection Agency (EPA) SW 846 Method 8270D Modified

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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 not added to all samples as required by the method. Using professional judgment, no data were qualified, since the LCS/LCSD percent recoveries were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis.

## **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

The analysis was conducted within all specifications of the method with the exception noted in Section VII. No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -  
SDG 89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG  
89624**

No Sample Data Qualified in this SDG

LDC #: 45873A2c  
 SDG #: 89624  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/11/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-Modified)

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	Δ	
III.	Initial calibration/ICV	A A	% PSD ≤ 15      ICV ≤ 20
IV.	Continuing calibration <i>ending</i>	Δ	CW ≤ 20/50
V.	Laboratory Blanks	Δ	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	CS/ID
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH863	AZ95511	Water	07/24/19
2	ERH867	AZ95513	Water	07/25/19
3				
4				
5				
6				
7				
8				

Notes:

190730A - BJK				

**VALIDATION FINDINGS WORKSHEET  
Surrogate Recovery**

**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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	all	Surrogates were not added to all samples as required by the method. Using professional judgment, no data were qualified, since the LCS/LCSD percent recoveries were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis.		Text
			( )	
			( )	
			( )	
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(NBZ) = Nitrobenzene - d5      (2FP) = 2-Fluorophenol  
 (FBP) = 2-Fluorobiphenyl      (TBP) = 2,4,6-Tribromophenol  
 (TPH) = Terphenyl - d14      (2CP) = 2-Chlorophenol - d4

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 23, 2019

**Parameters:** Wet Chemistry

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89624

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH863	AZ95511	Water	07/24/19
ERH867	AZ95513	Water	07/25/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Alkalinity by Standard Method 2320B

Chloride, Nitrate as Nitrogen, and Sulfate by Environmental Protection Agency (EPA) Method 300.0

Ferrous Iron by Standard Method 3500-Fe B

Nitrate/Nitrite as Nitrogen by EPA Method 353.2

Total Organic Carbon by EPA SW 846 Method 9060A

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UU (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is  $<0.995$ .
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

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

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
ERH863	Nitrate as N	10 days	2 days	J (all detects)	P
ERH867	Nitrate as N	9 days	2 days	J (all detects)	P

## II. Initial Calibration

All criteria for the initial calibration of each method were met.

## III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable with the following exceptions:

Date	Lab. Reference/ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
08/06/19	CCV (11:37)	Total organic carbon	115.5 (90-110)	All samples in SDG 89624	J (all detects)	P

## IV. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Limit of Quantitation	Associated Samples
PB (prep blank )	Total organic carbon	0.18 mg/L	0.93 mg/L	All samples in SDG 89624

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. 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	Limit of Quantitation	Modified Final Concentration
ERH863	Total organic carbon	0.35 mg/L	0.93 mg/L	0.35U mg/L
ERH867	Total organic carbon	0.37 mg/L	0.93 mg/L	0.37U mg/L

## 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 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. Sample Result Verification

Raw data were not reviewed for Level C validation.

## XI. Overall Assessment of Data

The analysis was conducted within all specifications of the methods.

Due to technical holding time and continuing calibration %R, data were qualified as estimated in two samples.

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

No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Data Qualification Summary - SDG 89624**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH863 ERH867	Nitrate as N	J (all detects)	P	Technical holding times (H)
ERH863 ERH867	Total organic carbon	J (all detects)	P	Continuing calibration (%R) (R)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 89624**

Sample	Analyte	Modified Final Concentration	A or P	Code
ERH863	Total organic carbon	0.35U mg/L	A	B
ERH867	Total organic carbon	0.37U mg/L	A	B

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Field Blank Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

LDC #: 45873A6  
 SDG #: 89624  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/9/19

Page: 1 of 1

Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD: (Analyte)** Alkalinity (SM2320B), Chloride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B), Nitrate/Nitrite-N (EPA Method 353.2), TOC (EPA SW 846 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 SW	
II	Initial calibration	A	
III.	Calibration verification	ASW	
IV	Laboratory Blanks	ASW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS/D
IX.	Field duplicates	N	
X.	Sample result verification	ASW	
XI.	Overall assessment of data	A SW 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	ERH863	AZ95511	Water	07/24/19
2	ERH867	AZ95513	Water	07/25/19
3	<del>ERH867</del>			
4				
5				
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7				
8				
9				
10				

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

LDC #: 4587316

**VALIDATION FINDINGS WORKSHEET**  
**Sample Specific Analysis Reference**

Page: 1 of 1  
 Reviewer: CR  
 2nd reviewer: R

All circled methods are applicable to each sample.

Sample ID	Parameter
1,2	pH TDS <u>Cl</u> <u>F</u> <u>NO<sub>3</sub></u> <u>NO<sub>2</sub></u> <u>SO<sub>4</sub></u> O-PO <sub>4</sub> <u>Alk</u> CN NH <sub>3</sub> TKN <u>TOC</u> Cr6+ ClO <sub>4</sub> <u>NO<sub>3</sub>/NO<sub>2</sub>-N</u> <u>Fe<sup>3+</sup></u>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
3	pH TDS <u>Cl</u> F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>

Comments: \_\_\_\_\_

### VALIDATION FINDINGS WORKSHEET

#### Technical Holding Times

All circled dates have exceeded the technical holding time.  
 Y/N N/A Were all samples preserved as applicable to each method?  
 Y/N N/A Were all cooler temperatures within validation criteria?

Method:		300.0					
Parameters:		NO <sub>3</sub> -N					
Technical holding time:		2 days					
Sample ID	Sampling date	Analysis date	Total Time	Qualifier	Analysis date	Total Time	Qualifier
1 (A)	7/24/19	8/3/19	10 days	J/R/P			
2 (A)	7/25/19	↓	9 days	↓			



**VALIDATION FINDINGS WORKSHEET**  
**Calibration**

**METHOD:** Inorganics, EPA Method see call

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  $\geq 0.995$  ?

**LEVEL IV/D ONLY:**

- Y N N/A Were recalculated results acceptable? See Level IV Initial and Continuing Calibration Recaluculation Worksheet for recalculations.
- 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
	8/6/19	CCV (11:37)	TOC	115.5 (90-110)	<del>A</del> 1,2	5det / PC Det

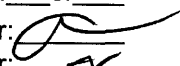
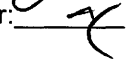
Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

LDC #: 45873A6

# VALIDATION FINDINGS WORKSHEET

## Blanks

Page: 1 of 1

Reviewer:   
2nd Reviewer: 

METHOD: Inorganics, Method See Cover

Conc. units: mg/L

Associated Samples: All

Reason Code: B

Analyte	Blank ID	Blank ID	Blank Action Limit											
	PB	ICB/CCB (mg/L)		1	2									
TOC	0.18			0.35	0.37									

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 12, 2019

**Parameters:** Gasoline Range Organics

**Validation Level:** Level C

**Laboratory:** APPL. Inc

**Sample Delivery Group (SDG):** 89624

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH862	AZ95510	Water	07/24/19
ERH863	AZ95511	Water	07/24/19
ERH866	AZ95512	Water	07/25/19
ERH867	AZ95513	Water	07/25/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 ERH862 and ERH866 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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XI. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XII. Overall Assessment of Data**

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



**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Laboratory Blank Data Qualification Summary - SDG  
89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Field Blank Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

LDC #: 45873A7  
 SDG #: 89624  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/11/19  
 Page: 1 of 1  
 Reviewer: F7  
 2nd Reviewer: ae

**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, Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	A, Δ	12 ICV ≤ 20 CV ≤ 20
IV.	Continuing calibration	A	
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 1.3
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LOS IP
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH862	AZ95510	Water	07/24/19
2	ERH863	AZ95511	Water	07/24/19
3	ERH866	AZ95512	Water	07/25/19
4	ERH867	AZ95513	Water	07/25/19
5				
6				
7				
8				

Notes:

190730 BL - Blank				

**Laboratory Data Consultants, Inc.**  
**Data Validation Report**

**Project/Site Name:** Red Hill Bulk Storage Facility, CTO 18F0126  
**LDC Report Date:** September 12, 2019  
**Parameters:** Total Petroleum Hydrocarbons as Extractables  
**Validation Level:** Level C  
**Laboratory:** APPL, Inc.  
**Sample Delivery Group (SDG):** 89624

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH863	AZ95511	Water	07/24/19
ERH867	AZ95513	Water	07/25/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds 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 compounds, 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 compounds.

## **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 compounds.

## **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.

## **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **XI. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

### **XII. Overall Assessment of Data**

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



**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -  
SDG 89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data  
Qualification Summary - SDG 89624**

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 89624**

No Sample Data Qualified in this SDG

LDC #: 45873A8  
 SDG #: 89624  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/11/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**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 Δ	
II.	Initial calibration/ICV	A Δ	% PSD ≤ 20, 12 ICV ≤ 20
III.	Continuing calibration	Δ	CV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	N	
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	Δ	res ID
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH863	AZ95511	Water	07/24/19
2	ERH867	AZ95513	Water	07/25/19
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

190731A - Blk				

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 12, 2019

**Parameters:** Methane

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89624

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH862	AZ95510	Water	07/24/19
ERH863	AZ95511	Water	07/24/19
ERH866	AZ95512	Water	07/25/19
ERH867	AZ95513	Water	07/25/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Methane by Method RSK-175

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 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 ERH862 and ERH866 were identified as trip blanks. No contaminants were found.

## **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. 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.

## **VIII. Field Duplicates**

No field duplicates were identified in this SDG.

### **IX. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **X. Target Compound Identification**

Raw data were not reviewed for Level C validation.

### **XI. Overall Assessment of Data**

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



**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Laboratory Blank Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Field Blank Data Qualification Summary - SDG 89624**

No Sample Data Qualified in this SDG

LDC #: 45873A51  
 SDG #: 89624  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/11/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC Methane (Method RSK-175)

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	F7
II.	Initial calibration/ICV	A/A	<del>% RSD ≤ 20</del> , $\gamma^2$ ICV ≤ 20
III.	Continuing calibration	A	CV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	TB = 1, 3
VI.	Matrix spike/Matrix spike duplicates	N	CS
VII.	Laboratory control samples	A	100% ID
VIII.	Field duplicates	N	
IX.	Compound quantitation RL/LOQ/LODs	N	
X.	Target compound identification	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH862 TB	AZ95510	Water	07/24/19
2	ERH863	AZ95511	Water	07/24/19
3	ERH866 TB	AZ95512	Water	07/25/19
4	ERH867	AZ95513	Water	07/25/19
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10				

Notes:


**Red Hill Bulk Storage Facility, CTO 18F0126 - SDG 89624  
LDC 45873**

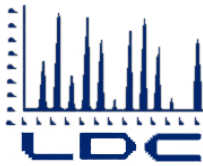
AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 2320B</b>													
ERH863	AZ95511	1	ALKALINITY, TOTAL (AS CaCO3)	7/24/2019 5:00:00 PM	8/1/2019 4:56:00 PM	C	64.0	MG_L		2.0	1.70		
ERH863	AZ95511	1	BICARBONATE	7/24/2019 5:00:00 PM	8/1/2019 4:56:00 PM	C	64.0	MG_L		2.0	1.70		
ERH863	AZ95511	1	CARBONATE (AS CO3)	7/24/2019 5:00:00 PM	8/1/2019 4:56:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH867	AZ95513	1	ALKALINITY, TOTAL (AS CaCO3)	7/25/2019 9:37:00 AM	8/1/2019 5:01:00 PM	C	46.3	MG_L		2.0	1.70		
ERH867	AZ95513	1	BICARBONATE	7/25/2019 9:37:00 AM	8/1/2019 5:01:00 PM	C	46.3	MG_L		2.0	1.70		
ERH867	AZ95513	1	CARBONATE (AS CO3)	7/25/2019 9:37:00 AM	8/1/2019 5:01:00 PM	C	1.70	MG_L	U	2.0	1.70		U
<b>METHOD: 300.0</b>													
ERH863	AZ95511	1	CHLORIDE (AS CL)	7/24/2019 5:00:00 PM	8/3/2019 10:00:00 AM	C	41.8	MG_L		1.0	0.20		
ERH863	AZ95511	1	NITROGEN, NITRATE (AS N)	7/24/2019 5:00:00 PM	8/3/2019 10:00:00 AM	C	0.54	MG_L		0.2	0.04	J	h
ERH863	AZ95511	1	SULFATE (AS SO4)	7/24/2019 5:00:00 PM	8/3/2019 10:00:00 AM	C	6.8	MG_L		1.0	0.20		
ERH867	AZ95513	2	CHLORIDE (AS CL)	7/25/2019 9:37:00 AM	8/15/2019 12:00:00 PM	C	87.2	MG_L	D	2.0	0.40		
ERH867	AZ95513	1	NITROGEN, NITRATE (AS N)	7/25/2019 9:37:00 AM	8/3/2019 10:07:00 AM	C	0.35	MG_L		0.2	0.04	J	h
ERH867	AZ95513	1	SULFATE (AS SO4)	7/25/2019 9:37:00 AM	8/3/2019 10:07:00 AM	C	28.5	MG_L		1.0	0.20		
<b>METHOD: 3500-FE-B</b>													
ERH863	AZ95511	1	Iron, Ion (Fe2+)	7/24/2019 5:00:00 PM	7/27/2019 1:12:00 PM	C	0.32	MG_L	U	1.0	0.32		U
ERH867	AZ95513	1	Iron, Ion (Fe2+)	7/25/2019 9:37:00 AM	7/27/2019 1:11:00 PM	C	0.85	MG_L	J	1.0	0.32	J	
<b>METHOD: 353.2</b>													
ERH863	AZ95511	1	NITROGEN, NITRATE-NITRITE	7/24/2019 5:00:00 PM	7/31/2019 7:00:00 PM	C	0.39	MG_L		0.10	0.090		
ERH867	AZ95513	1	NITROGEN, NITRATE-NITRITE	7/25/2019 9:37:00 AM	7/31/2019 7:01:00 PM	C	0.16	MG_L		0.10	0.090		
<b>METHOD: 8015B_E</b>													
ERH863	AZ95511	1	C10-C24 DIESEL RANGE ORGANICS	7/24/2019 5:00:00 PM	8/5/2019 10:55:00 AM	C	25.00	UG_L	U	40.0	25.00		U
ERH863	AZ95511	1	C24-C40 TOTAL PETROLEUM HYDROCARBONS, OIL RANGE	7/24/2019 5:00:00 PM	8/5/2019 10:55:00 AM	C	40.00	UG_L	U	40.0	40.00		U
ERH867	AZ95513	1	C10-C24 DIESEL RANGE ORGANICS	7/25/2019 9:37:00 AM	8/5/2019 11:15:00 AM	C	25.00	UG_L	U	40.0	25.00		U
ERH867	AZ95513	1	C24-C40 TOTAL PETROLEUM HYDROCARBONS, OIL RANGE	7/25/2019 9:37:00 AM	8/5/2019 11:15:00 AM	C	40.00	UG_L	U	40.0	40.00		U
<b>METHOD: 8260B</b>													
ERH862	AZ95510	1	BENZENE	7/24/2019 3:30:00 PM	7/31/2019 7:46:00 AM	C	0.30	UG_L	U	1.0	0.30		U
ERH862	AZ95510	1	ETHYLBENZENE	7/24/2019 3:30:00 PM	7/31/2019 7:46:00 AM	C	0.50	UG_L	U	1.0	0.50		U

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 8260B</b>													
ERH862	AZ95510	1	PETROLEUM HYDROCARBONS C6-C10	7/24/2019 3:30:00 PM	7/31/2019 7:45:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH862	AZ95510	1	TOLUENE	7/24/2019 3:30:00 PM	7/31/2019 7:46:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH862	AZ95510	1	Xylenes	7/24/2019 3:30:00 PM	7/31/2019 7:46:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH863	AZ95511	1	BENZENE	7/24/2019 5:00:00 PM	7/31/2019 8:14:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH863	AZ95511	1	ETHYLBENZENE	7/24/2019 5:00:00 PM	7/31/2019 8:14:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH863	AZ95511	1	PETROLEUM HYDROCARBONS C6-C10	7/24/2019 5:00:00 PM	7/31/2019 8:13:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH863	AZ95511	1	TOLUENE	7/24/2019 5:00:00 PM	7/31/2019 8:14:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH863	AZ95511	1	Xylenes	7/24/2019 5:00:00 PM	7/31/2019 8:14:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH866	AZ95512	1	BENZENE	7/25/2019 8:10:00 AM	7/31/2019 8:43:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH866	AZ95512	1	ETHYLBENZENE	7/25/2019 8:10:00 AM	7/31/2019 8:43:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH866	AZ95512	1	PETROLEUM HYDROCARBONS C6-C10	7/25/2019 8:10:00 AM	7/31/2019 8:42:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH866	AZ95512	1	TOLUENE	7/25/2019 8:10:00 AM	7/31/2019 8:43:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH866	AZ95512	1	Xylenes	7/25/2019 8:10:00 AM	7/31/2019 8:43:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH867	AZ95513	1	BENZENE	7/25/2019 9:37:00 AM	7/31/2019 9:12:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH867	AZ95513	1	ETHYLBENZENE	7/25/2019 9:37:00 AM	7/31/2019 9:12:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH867	AZ95513	1	PETROLEUM HYDROCARBONS C6-C10	7/25/2019 9:37:00 AM	7/31/2019 9:11:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH867	AZ95513	1	TOLUENE	7/25/2019 9:37:00 AM	7/31/2019 9:12:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH867	AZ95513	1	Xylenes	7/25/2019 9:37:00 AM	7/31/2019 9:12:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
<b>METHOD: 8270D</b>													
ERH863	AZ95511	1	2-(2-METHOXY ETHOXY)-ETHANOL	7/24/2019 5:00:00 PM	8/1/2019 12:02:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH863	AZ95511	1	PHENOL	7/24/2019 5:00:00 PM	8/1/2019 2:54:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH867	AZ95513	1	2-(2-METHOXY ETHOXY)-ETHANOL	7/25/2019 9:37:00 AM	8/1/2019 12:26:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH867	AZ95513	1	PHENOL	7/25/2019 9:37:00 AM	8/1/2019 3:22:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
<b>METHOD: 8270DSIM</b>													
ERH863	AZ95511	1	1-METHYLNAPHTHALENE	7/24/2019 5:00:00 PM	7/31/2019 7:12:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH863	AZ95511	1	2-METHYLNAPHTHALENE	7/24/2019 5:00:00 PM	7/31/2019 7:12:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH863	AZ95511	1	NAPHTHALENE	7/24/2019 5:00:00 PM	7/31/2019 7:12:00 PM	C	0.10	UG_L	U	0.2	0.10	U	

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 8270DSIM</b>													
ERH867	AZ95513	1	1-METHYLNAPHTHALENE	7/25/2019 9:37:00 AM	7/31/2019 7:35:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH867	AZ95513	1	2-METHYLNAPHTHALENE	7/25/2019 9:37:00 AM	7/31/2019 7:35:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH867	AZ95513	1	NAPHTHALENE	7/25/2019 9:37:00 AM	7/31/2019 7:35:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
<b>METHOD: 9060A</b>													
ERH863	AZ95511	1	TOTAL ORGANIC CARBON	7/24/2019 5:00:00 PM	8/6/2019 9:01:00 AM	C		MG_L	J	0.93	0.350	UJ	b,r
ERH867	AZ95513	1	TOTAL ORGANIC CARBON	7/25/2019 9:37:00 AM	8/6/2019 9:32:00 AM	C		MG_L	J	0.93	0.37	UJ	b,r
<b>METHOD: RSK175</b>													
ERH862	AZ95510	1	METHANE	7/24/2019 3:30:00 PM	7/30/2019 3:39:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH863	AZ95511	1	METHANE	7/24/2019 5:00:00 PM	7/30/2019 3:41:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH866	AZ95512	1	METHANE	7/25/2019 8:10:00 AM	7/30/2019 3:43:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH867	AZ95513	1	METHANE	7/25/2019 9:37:00 AM	7/30/2019 3:46:00 PM	C	1.00	UG_L	U	5.0	1.00	U	

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## 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. Margie Pascua  
[Margie.Pascua@aecom.com](mailto:Margie.Pascua@aecom.com)

September 19, 2019

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

Dear Ms. Pascua

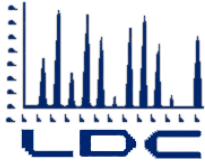
Enclosed are the final validation reports for the fractions listed below. This SDG was received on September 10, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

### **LDC Project #45918:**

<b><u>SDG #</u></b>	<b><u>Fraction</u></b>
89674	Volatiles, Phenol, Polynuclear Aromatic Hydrocarbons, 2-(2-Methoxyethoxy)-Ethanol, Metals, Wet Chemistry, Gasoline Range Organics, Total Petroleum Hydrocarbons as Extractables, Ethylene Dibromide, Methane

The data validation was performed under Level C validation guidelines. The analyses were validated using the following documents and variances, as applicable to each 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
- Project Procedures Manual U.S. Naval Facilities Engineering Command Environmental Restoration Program, NAVFAC Pacific; DON 2015
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.1; 2017
- 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; IIB, November 2004; update IV, February 2007; update V, July 2014



**LABORATORY DATA CONSULTANTS, INC.**

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

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

Sincerely,

Stella Cuenco

[scuenco@lab-data.com](mailto:scuenco@lab-data.com)

Operations Manager/Senior Chemist





**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 18, 2019

**Parameters:** Volatiles

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89674

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH881	AZ95859	Water	07/29/19
ERH880	AZ95860	Water	07/29/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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), and 1,2-Dichloroethane by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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**

Sample ERH881 was identified as a trip blank. 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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126**  
**Volatiles - Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126**  
**Volatiles - Laboratory Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126**  
**Volatiles - Field Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG



LDC #: 45918A1a  
 SDG #: 89674  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/18/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC/MS BTEX & 1,2-DCA (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	% PSD ≤ 15       CV ≤ 20
IV.	Continuing calibration <i>ending</i>	A	CV ≤ 20   52
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS 10
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH881      TB	AZ95859	Water	07/29/19
2	ERH880	AZ95860	Water	07/29/19
3				
4				
5				
6				
7				
8				

Notes:

190803AT-BIK				

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 18, 2019

**Parameters:** Phenol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89674

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH880	AZ95860	Water	07/29/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Phenol by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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.

### **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

### **XIV. System Performance**

Raw data were not reviewed for Level C validation.

### **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Laboratory Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Field Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG



LDC #: 45918A2a  
 SDG #: 89674  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/18/19  
 Page: 1 of 1  
 Reviewer: \_\_\_\_\_  
 2nd Reviewer: \_\_\_\_\_

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

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	Δ	
III.	Initial calibration/ICV	A, Δ	% PSD ≤ 15      ICV ≤ 20
IV.	Continuing calibration <u>dosing</u>	Δ	CW ≤ 20/50
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	Les ID
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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

	Client ID	Lab ID	Matrix	Date
1	ERH880	AZ95860	Water	07/29/19
2				
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Notes:

190805A - BIK				

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 18, 2019

**Parameters:** Polynuclear Aromatic Hydrocarbons

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89674

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH880	AZ95860	Water	07/29/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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.

## **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification  
Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -  
SDG 89674**

No Sample Data Qualified in this SDG



LDC #: 45918A2b  
 SDG #: 89674  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/18/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**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, Δ	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A, Δ	% PSD ≤ 15    ICV ≤ 20
IV.	Continuing calibration <i>ending</i>	Δ	COV ≤ 20/50
V.	Laboratory Blanks	Δ	
VI.	Field blanks	N	
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LOS 10
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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

	Client ID	Lab ID	Matrix	Date
1	ERH880	AZ95860	Water	07/29/19
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Notes:

190805A-DIK				

TTT, W, S

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 18, 2019

**Parameters:** 2-(2-Methoxyethoxy)-ethanol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89674

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH880	AZ95860	Water	07/29/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

2-(2-Methoxyethoxy)-ethanol by Environmental Protection Agency (EPA) SW 846 Method 8270D Modified

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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 not added to all samples as required by the method. Using professional judgment, no data were qualified, since the LCS/LCSD percent recoveries were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis.

## 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 with the following exceptions:

LCS ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
190805A LCS/D (All samples in SDG 89674)	2-(2-Methoxyethoxy)-ethanol	22.9 (≤20)	UJ (all non-detects)	P

## 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. Compound Quantitation

Raw data were not reviewed for Level C validation.

## XIII. Target Compound Identifications

Raw data were not reviewed for Level C validation.

## XIV. System Performance

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

The analysis was conducted within all specifications of the method with the exception noted in Section VII.

Due to LCS/LCSD RPD, data were qualified as estimated in one sample.

No results were rejected in this SDG.



**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 89674**

Sample	Compound	Flag	A or P	Reason (Code)
ERH880	2-(2-Methoxyethoxy)-ethanol	UJ (all non-detects)	P	Laboratory control samples (RPD) (L)

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

LDC #: 45918A2c  
 SDG #: 89674  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/18/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-Modified)

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	0% PSD ≤ 15    ICV ≤ 20
IV.	Continuing calibration / ending	A	CV ≤ 20 / 50
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	SW	LOS ID
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH880	AZ95860	Water	07/29/19
2				
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Notes:

19085A - BIK				

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Recovery**

**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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	all	Surrogates were not added to all samples as required by the method. Using professional judgment, no data were qualified, although the %RPD for LCS/LCSD, percent recoveries were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis.		Text
			( )	
			( )	
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(NBZ) = Nitrobenzene - d5      (2FP) = 2-Fluorophenol



**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 18, 2019

**Parameters:** Metals

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89674

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH880	AZ95860	Water	07/29/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Calcium, Magnesium, Manganese, Potassium, and Sodium by Environmental Protection Agency (EPA) SW 846 Method 6010C

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is <0.995.
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.



## **I. Sample Receipt and Technical Holding Times**

All samples were received in good condition.

All technical holding time requirements were met.

## **II. Instrument Calibration**

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

## **III. ICP Interference Check Sample Analysis**

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

## **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. Serial Dilution**

Serial dilution was 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. Sample Result Verification**

Raw data were not reviewed for Level C validation.

## **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Metals - Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Metals - Laboratory Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Metals - Field Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

LDC #: 45918A4b  
 SDG #: 89674  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/18/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** Metals (EPA SW 846 Method 6010C)

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.	Instrument Calibration	A	
III.	ICP Interference Check Sample (ICS) Analysis	A	
IV.	Laboratory Blanks	A	
V.	Field Blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS
VII.	Duplicate sample analysis	N	
VIII.	Serial Dilution	N	
IX.	Laboratory control samples	A	LCS/D
X.	Field Duplicates	N	
XI.	Sample Result Verification	N	
XII.	Overall Assessment of Data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH880	AZ95860	Water	07/29/19
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 18, 2019

**Parameters:** Wet Chemistry

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89674

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH880	AZ95860	Water	07/29/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Alkalinity by Standard Method 2320B

Bromide, Chloride, Fluoride, Nitrate as Nitrogen, and Sulfate by Environmental Protection Agency (EPA) Method 300.0

Ferrous Iron by Standard Method 3500-Fe B

Nitrate/Nitrite as Nitrogen by EPA Method 353.2

Silica and Dissolved Silica by Standard Method 4500-Si D

Total Organic Carbon by EPA SW 846 Method 9060A

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
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- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is <0.995.
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

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

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
ERH880	Nitrate as N	80 hours	48 hours	J (all detects)	P

## II. Initial Calibration

All criteria for the initial calibration of each method were met.

## III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable with the following exceptions:

Date	Lab. Reference/ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
08/01/19	CCV (17:09)	Fluoride	112 (90-110)	All samples in SDG 89674	J (all detects)	P
08/06/19	CCV (19:09)	Total organic carbon	113.4 (90-110)	All samples in SDG 89674	J (all detects)	P
08/07/19	CCV (03:46)	Total organic carbon	115.9 (90-110)	All samples in SDG 89674	J (all detects)	P

## IV. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Limit of Quantitation	Associated Samples
PB (prep blank)	Bicarbonate alkalinity Total alkalinity Total organic carbon	3.6 mg/L 3.6 mg/L 0.18 mg/L	2.0 mg/L 2.0 mg/L 0.93 mg/L	All samples in SDG 89674

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. 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	Limit of Quantitation	Modified Final Concentration
ERH880	Total organic carbon	0.47 mg/L	0.93 mg/L	0.47U mg/L

## 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 with the following exceptions:

LCS ID (Associated Samples)	Analyte	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
LCS/D (All samples in SDG 89674)	Total organic carbon	65.6 (80-120)	-	J (all detects)	P

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

LCS ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LCS/D (All samples in SDG 89674)	Total organic carbon	54.5 (≤20)	J (all detects)	P

## **IX. Field Duplicates**

No field duplicates were identified in this SDG.

## **X. Sample Result Verification**

Raw data were not reviewed for Level C validation.

## **XI. Overall Assessment of Data**

The analysis was conducted within all specifications of the methods.

Due to technical holding time, continuing calibration %R, and LCS/LCSD %R and RPD, data were qualified as estimated in one sample.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Data Qualification Summary - SDG 89674**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH880	Nitrate as N	J (all detects)	P	Technical holding times (H)
ERH880	Fluoride Total organic carbon	J (all detects) J (all detects)	P	Continuing calibration (%R) (R)
ERH880	Total organic carbon	J (all detects)	P	Laboratory control samples (%R)(RPD) (L)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 89674**

Sample	Analyte	Modified Final Concentration	A or P	Code
ERH880	Total organic carbon	0.47U mg/L	A	B

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Field Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

LDC #: 45918A6

### VALIDATION COMPLETENESS WORKSHEET

Date: 9/18/19

SDG #: 89674

Level C

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: [Signature]

2nd Reviewer: [Signature]

**METHOD: (Analyte)** Alkalinity (SM2320B), Bromide, Chloride, Fluoride, Nitrate as N, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B), Nitrate/Nitrite-N (EPA Method 353.2), Silica (SM 4500-Si D), Dissolved Silica (SM 4500-SiD), TOC (EPA SW 846 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 SW	
II	Initial calibration	A	
III.	Calibration verification	SW	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	SW	LCS/D
IX.	Field duplicates	N	
X.	Sample result verification	N	
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:

	Client ID	Lab ID	Matrix	Date
1	ERH880	AZ95860	Water	07/29/19
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### VALIDATION FINDINGS WORKSHEET Sample Specific Analysis Reference

All circled methods are applicable to each sample.

Sample ID	Parameter
1	pH TDS <u>C</u> <u>F</u> <u>NO<sub>3</sub></u> <u>NO<sub>2</sub></u> <u>SO<sub>4</sub></u> O-PO <sub>4</sub> <u>Alk</u> CN NH <sub>3</sub> TKN <u>TOC</u> Cr6+ ClO <sub>4</sub> <u>B<sub>1</sub></u> <u>NO<sub>3</sub></u> <u>NH<sub>3</sub></u> <u>SiO<sub>2</sub></u>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub> <u>Diss. SiO<sub>2</sub></u> <u>Fe<sup>3+</sup></u>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
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	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
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Comments: \_\_\_\_\_





**VALIDATION FINDINGS WORKSHEET**  
**Calibration**

METHOD: Inorganics, EPA Method see call

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? 1
- 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  $\geq 0.995$ ?

**LEVEL IV/D ONLY:**

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

R

#	Date	Calibration ID	Analyte	%R	Associated Samples	Qualifications
	8/11/19	CCV (17:09)	F	112	All	<del>Fides</del> Fides (P (Det))
	8/6/19	CV (19:09)	TOC	113.4	All	↓
	8/7/19	CCV (03:46)	TOC	115.9	All	↓

Comments: \_\_\_\_\_

\_\_\_\_\_

**VALIDATION FINDINGS WORKSHEET**  
**Blanks**

**METHOD:** Inorganics, Method See Cover

**Conc. units:** mg/L

**Associated Samples:** All

**Reason code:** B

Analyte	Blank ID	Blank ID	Blank Action Limit														
	PB	ICB/CCB (mg/L)		1													
Bicarbonate Alkalinity	3.6		18														
Total Alkalinity	3.6		18														
TOC	0.18			0.47													

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".



## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 18, 2019

**Parameters:** Gasoline Range Organics

**Validation Level:** Level C

**Laboratory:** APPL. Inc

**Sample Delivery Group (SDG):** 89674

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH881	AZ95859	Water	07/29/19
ERH880	AZ95860	Water	07/29/19

## **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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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**

Sample ERH881 was identified as a trip blank. 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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **XI. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

### **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Laboratory Blank Data Qualification Summary - SDG  
89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Field Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

LDC #: 45918A7

### VALIDATION COMPLETENESS WORKSHEET

Date: 9/18/19

SDG #: 89674

Level C

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: [Signature]

2nd Reviewer: [Signature]

**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	A	
III.	Initial calibration/ICV	A/A	r <sup>2</sup> ICV ≤ 20
IV.	Continuing calibration	Δ	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 1
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	Les ID
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound 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	ERH881	AZ95859	Water	07/29/19
2	ERH880	AZ95860	Water	07/29/19
3				
4				
5				
6				
7				
8				

Notes:

190803A J				

**Laboratory Data Consultants, Inc.  
Data Validation Report**

**Project/Site Name:** Red Hill Bulk Storage Facility, CTO 18F0126  
**LDC Report Date:** September 18, 2019  
**Parameters:** Total Petroleum Hydrocarbons as Extractables  
**Validation Level:** Level C  
**Laboratory:** APPL, Inc.  
**Sample Delivery Group (SDG):** 89674

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH880	AZ95860	Water	07/29/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## 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 compounds 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 compounds, 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 compounds.

## 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 compounds.

## 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 Compound	Flag	A or P
ERH880	Octacosane	156 (60-142)	TPH as extractables	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)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
190805A-LCS (All samples in SDG 89674)	Oil (C24-C40)	-	123 (41-113)	NA	-

Relative percent differences (RPD) were within QC limits.

## IX. Field Duplicates

No field duplicates were identified in this SDG.

## X. Compound Quantitation

Raw data were not reviewed for Level C validation.

## XI. Target Compound Identifications

Raw data were not reviewed for Level C validation.

## XII. Overall Assessment of Data

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -  
SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data  
Qualification Summary - SDG 89674**

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 89674**

No Sample Data Qualified in this SDG

LDC #: 45918A8

### VALIDATION COMPLETENESS WORKSHEET

Date: 9/18/19

SDG #: 89674

Level C

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: FJ

2nd Reviewer: AE

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	<sup>FJ</sup> <del>%RSD</del> $r^2$ , %RSD $\leq 20$ CV $\leq 20$
III.	Continuing calibration	A	CV $\leq 20$
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	SW	CS ID
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound 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	ERH880	AZ95860	Water	07/29/19
2				
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10				

Notes:

190805A BIK				





## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 18, 2019

**Parameters:** Ethylene Dibromide

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89674

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH881	AZ95859	Water	07/29/19
ERH880	AZ95860	Water	07/29/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Ethylene Dibromide by Environmental Protection Agency (EPA) SW 846 Method 8011

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

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 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**

Sample ERH881 was identified as a trip blank. 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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XI. Target Compound Identification**

Raw data were not reviewed for Level C validation.

## **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Ethylene Dibromide - Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Ethylene Dibromide - Laboratory Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Ethylene Dibromide - Field Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

LDC #: 45918A10  
 SDG #: 89674  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/18/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC Ethylene Dibromide (EPA SW846 Method 8011)

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	% PSD / ICV = W CW = W
III.	Continuing calibration	A	
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	FB = 1
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	CS ID
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH881 TB	AZ95859	Water	07/29/19
2	ERH880	AZ95860	Water	07/29/19
3				
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Notes:

1	190805A - BIK			

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 18, 2019

**Parameters:** Methane

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89674

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH881	AZ95859	Water	07/29/19
ERH880	AZ95860	Water	07/29/19

## Introduction

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The analyses were performed by the following method:

Methane by Method RSK-175

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD, r, r<sup>2</sup> or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 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**

Sample ERH881 was identified as a trip blank. No contaminants were found.

## **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. 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.

## **VIII. Field Duplicates**

No field duplicates were identified in this SDG.

### **IX. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **X. Target Compound Identification**

Raw data were not reviewed for Level C validation.

### **XI. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Laboratory Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Field Blank Data Qualification Summary - SDG 89674**

No Sample Data Qualified in this SDG

LDC #: 45918A51  
 SDG #: 89674  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/18/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC Methane (Method RSK-175)

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	✓✓ ICV ≤ 20
III.	Continuing calibration	A	D ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 1
VI.	Matrix spike/Matrix spike duplicates	N	CS
VII.	Laboratory control samples	A	res ID
VIII.	Field duplicates	N	
IX.	Compound quantitation RL/LOQ/LODs	N	
X.	Target compound identification	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH881      TB	AZ95859	Water	07/29/19
2	ERH880	AZ95860	Water	07/29/19
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

190806A				

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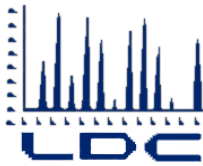
**Red Hill Bulk Storage Facility, CTO 18F0126 - SDG 89674  
LDC 45918**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 2320B</b>													
ERH880	AZ95860	1	ALKALINITY, TOTAL (AS CaCO3)	7/29/2019 10:40:00 AM	8/11/2019 9:47:00 PM	C	62.5	MG_L		2.0	1.70		
ERH880	AZ95860	1	BICARBONATE	7/29/2019 10:40:00 AM	8/11/2019 9:47:00 PM	C	62.5	MG_L		2.0	1.70		
ERH880	AZ95860	1	CARBONATE (AS CO3)	7/29/2019 10:40:00 AM	8/11/2019 9:47:00 PM	C	1.70	MG_L	U	2.0	1.70		U
<b>METHOD: 300.0</b>													
ERH880	AZ95860	1	BROMIDE	7/29/2019 10:40:00 AM	8/1/2019 6:47:00 PM	C	0.43	MG_L	J	0.5	0.16		J
ERH880	AZ95860	1	CHLORIDE (AS CL)	7/29/2019 10:40:00 AM	8/1/2019 6:47:00 PM	C	43.3	MG_L		1.0	0.20		
ERH880	AZ95860	1	FLUORIDE	7/29/2019 10:40:00 AM	8/1/2019 6:47:00 PM	C	0.42	MG_L		0.1	0.09		J r
ERH880	AZ95860	1	NITROGEN, NITRATE (AS N)	7/29/2019 10:40:00 AM	8/1/2019 6:47:00 PM	C	0.45	MG_L		0.2	0.04		J h
ERH880	AZ95860	1	SULFATE (AS SO4)	7/29/2019 10:40:00 AM	8/1/2019 6:47:00 PM	C	11.4	MG_L		1.0	0.20		
<b>METHOD: 3500-FE-B</b>													
ERH880	AZ95860	1	Iron, Ion (Fe2+)	7/29/2019 10:40:00 AM	7/31/2019 4:08:00 PM	C	0.32	MG_L	U	1.0	0.32		U
<b>METHOD: 353.2</b>													
ERH880	AZ95860	1	NITROGEN, NITRATE-NITRITE	7/29/2019 10:40:00 AM	8/7/2019 8:27:00 PM	C	0.33	MG_L		0.10	0.090		
<b>METHOD: 4500-SIO2-C</b>													
ERH880	AZ95860	5	SILICA	7/29/2019 10:40:00 AM	8/16/2019 10:38:00 AM	C	56.6	MG_L		5.0	4.00		
ERH880	AZ95860	5	SILICA	7/29/2019 10:40:00 AM	8/16/2019 10:46:00 AM	C	55.3	MG_L		5.0	4.00		
<b>METHOD: 6010C</b>													
ERH880	AZ95860	1	CALCIUM	7/29/2019 10:40:00 AM	8/7/2019 2:40:00 PM	C	7780	UG_L		1000	75.0		
ERH880	AZ95860	1	MAGNESIUM	7/29/2019 10:40:00 AM	8/7/2019 2:40:00 PM	C	8840	UG_L		500	30.0		
ERH880	AZ95860	1	MANGANESE	7/29/2019 10:40:00 AM	8/7/2019 2:40:00 PM	C	4.00	UG_L	U	10.0	4.00		U
ERH880	AZ95860	1	POTASSIUM	7/29/2019 10:40:00 AM	8/7/2019 2:40:00 PM	C	1480	UG_L	J	3000	500.0		J
ERH880	AZ95860	1	SODIUM	7/29/2019 10:40:00 AM	8/7/2019 2:40:00 PM	C	32100	UG_L		5000	500.0		
<b>METHOD: 8011</b>													
ERH881	AZ95859	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	7/29/2019 8:45:00 AM	8/6/2019 8:54:00 PM	C	0.019	UG_L	U	0.02	0.019		U
ERH880	AZ95860	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	7/29/2019 10:40:00 AM	8/6/2019 9:14:00 PM	C	0.019	UG_L	U	0.02	0.019		U
<b>METHOD: 8015B_E</b>													
ERH880	AZ95860	1	C10-C24 DIESEL RANGE ORGANICS	7/29/2019 10:40:00 AM	8/23/2019 2:15:00 PM	C	25.00	UG_L	U	40.0	25.00		U

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 8015B_E</b>													
ERH880	AZ95860	1	C24-C40 TOTAL PETROLEUM HYDROCARBONS, OIL RANGE	7/29/2019 10:40:00 AM	8/23/2019 2:15:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
<b>METHOD: 8260B</b>													
ERH881	AZ95859	1	1,2-DICHLOROETHANE	7/29/2019 8:45:00 AM	8/3/2019 3:35:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH881	AZ95859	1	BENZENE	7/29/2019 8:45:00 AM	8/3/2019 3:35:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH881	AZ95859	1	ETHYLBENZENE	7/29/2019 8:45:00 AM	8/3/2019 3:35:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH881	AZ95859	1	PETROLEUM HYDROCARBONS C6-C10	7/29/2019 8:45:00 AM	8/3/2019 3:34:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH881	AZ95859	1	TOLUENE	7/29/2019 8:45:00 AM	8/3/2019 3:35:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH881	AZ95859	1	Xylenes	7/29/2019 8:45:00 AM	8/3/2019 3:35:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH880	AZ95860	1	1,2-DICHLOROETHANE	7/29/2019 10:40:00 AM	8/3/2019 4:04:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH880	AZ95860	1	BENZENE	7/29/2019 10:40:00 AM	8/3/2019 4:04:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH880	AZ95860	1	ETHYLBENZENE	7/29/2019 10:40:00 AM	8/3/2019 4:04:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH880	AZ95860	1	PETROLEUM HYDROCARBONS C6-C10	7/29/2019 10:40:00 AM	8/3/2019 4:03:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH880	AZ95860	1	TOLUENE	7/29/2019 10:40:00 AM	8/3/2019 4:04:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH880	AZ95860	1	Xylenes	7/29/2019 10:40:00 AM	8/3/2019 4:04:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
<b>METHOD: 8270D</b>													
ERH880	AZ95860	1	2-(2-METHOXY ETHOXY)-ETHANOL	7/29/2019 10:40:00 AM	8/6/2019 4:52:00 PM	C	80.0	UG_L	U	100	80.0	UJ	1
ERH880	AZ95860	1	PHENOL	7/29/2019 10:40:00 AM	8/9/2019 7:42:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
<b>METHOD: 8270DSIM</b>													
ERH880	AZ95860	1	1-METHYLNAPHTHALENE	7/29/2019 10:40:00 AM	8/13/2019 4:35:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH880	AZ95860	1	2-METHYLNAPHTHALENE	7/29/2019 10:40:00 AM	8/13/2019 4:35:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH880	AZ95860	1	NAPHTHALENE	7/29/2019 10:40:00 AM	8/13/2019 4:35:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
<b>METHOD: 9060A</b>													
ERH880	AZ95860	1	TOTAL ORGANIC CARBON	7/29/2019 10:40:00 AM	8/6/2019 10:55:00 PM	C		MG_L	J	0.93	0.47	UJ	b,r,l
<b>METHOD: RSK175</b>													
ERH881	AZ95859	1	METHANE	7/29/2019 8:45:00 AM	8/6/2019 1:54:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH880	AZ95860	1	METHANE	7/29/2019 10:40:00 AM	8/6/2019 2:00:00 PM	C	1.00	UG_L	U	5.0	1.00	U	





## 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. Margie Pascua  
[Margie.Pascua@aecom.com](mailto:Margie.Pascua@aecom.com)

October 14, 2019

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

Dear Ms. Pascua

Enclosed are the revised validation reports for the fractions listed below. This SDG was received on September 17, 2019. Attachment 1 is a summary of the samples that were reviewed for each analysis.

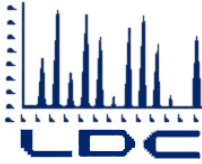
- Added ERH876 as Level D for Phenol, PAH, 2-(2-Methoxyethoxy)-ethanol, and TPHE. ST updated.

### LDC Project #45972\_RV1:

<u>SDG #</u>	<u>Fraction</u>
89682, 89702 89749, 89785	Volatiles, Phenol, Polynuclear Aromatic Hydrocarbons, 2-(2-Methoxyethoxy)-ethanol, Metals, Wet Chemistry, Gasoline Range Organics, Total Petroleum Hydrocarbons as Extractables, Ethylene Dibromide, Methane

The data validation was performed under Level C & D validation guidelines. The analyses were validated using the following documents and variances, as applicable to each 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
- Project Procedures Manual U.S. Naval Facilities Engineering Command Environmental Restoration Program, NAVFAC Pacific; DON 2015
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.1; 2017



## LABORATORY DATA CONSULTANTS, INC.

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

- 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; IIB, November 2004; update IV, February 2007; update V, July 2014

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

Sincerely,

Stella Cuenco

[scuenco@lab-data.com](mailto:scuenco@lab-data.com)

Operations Manager/Senior Chemist



## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 19, 2019

**Parameters:** Volatiles

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89682

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH879	AZ95986	Water	07/30/19
ERH882	AZ95987	Water	07/30/19
ERH883	AZ95988	Water	07/30/19
ERH882MS	AZ95987MS	Water	07/30/19
ERH882MSD	AZ95987MSD	Water	07/30/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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), and 1,2-Dichloroethane by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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**

Sample ERH879 was identified as a trip blank. No contaminants were found.

Sample ERH870 (from SDG 89749) was identified as an equipment blank. 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

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
ERH882MS/MSD (ERH882)	Xylenes, total	77.7 (79-121)	-	UJ (all non-detects)	A

Relative percent differences (RPD) were within QC limits.

## 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

Samples ERH882 and ERH883 were identified as field duplicates. No results were detected in any of the samples.

## XI. Internal Standards

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

## XII. Compound Quantitation

Raw data were not reviewed for Level C validation.

## XIII. Target Compound Identifications

Raw data were not reviewed for Level C validation.

## XIV. System Performance

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

The analysis was conducted within all specifications of the method.

Due to MS/MSD %R, data were qualified as estimated in one sample.

No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Data Qualification Summary - SDG 89682**

<b>Sample</b>	<b>Compound</b>	<b>Flag</b>	<b>A or P</b>	<b>Reason (Code)</b>
ERH882	Xylenes, total	UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R) (Q)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Laboratory Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Field Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

LDC #: 45972A1a  
 SDG #: 89682  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: FJ  
 2nd Reviewer: AE

**METHOD:** GC/MS BTEX & 1,2-DCA (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 / Δ	% PSD ≤ 15      CV ≤ 20
IV.	Continuing calibration <i>ending</i>	A	CV ≤ 20 / 50
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 1    EB = ERH870 (89749)
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples	A	LOS/D
X.	Field duplicates	ND	D = 2, 3
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH879    TB	AZ95986	Water	07/30/19
2	ERH882    D	AZ95987	Water	07/30/19
3	ERH883    D	AZ95988	Water	07/30/19
4	ERH882MS	AZ95987MS	Water	07/30/19
5	ERH882MSD	AZ95987MSD	Water	07/30/19
6				
7				
8				

Notes:

190808 BM - BIK				



**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 19, 2019

**Parameters:** Phenol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89682

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH882	AZ95987	Water	07/30/19
ERH883	AZ95988	Water	07/30/19
ERH882MS	AZ95987MS	Water	07/30/19
ERH882MSD	AZ95987MSD	Water	07/30/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Phenol by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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**

Sample ERH870 (from SDG 89749) was identified as an equipment blank. 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**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## **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**

Samples ERH882 and ERH883 were identified as field duplicates. No results were detected in any of the samples.

## **XI. Internal Standards**

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

## **XII. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Laboratory Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Field Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

LDC #: 45972A2a  
 SDG #: 89682  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: FJ  
 2nd Reviewer: PC

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

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 / Δ	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / Δ	% PSD ≤ 15        CV ≤ 20
IV.	Continuing calibration <i>ending</i>	Δ	CV ≤ 20 / SD
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	EB = ERH870 (89749)
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	Δ	LOQ ND
X.	Field duplicates	ND	D = 1, 2
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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	ERH882	AZ95987	Water	07/30/19
2	ERH883	AZ95988	Water	07/30/19
3	ERH882MS	AZ95987MS	Water	07/30/19
4	ERH882MSD	AZ95987MSD	Water	07/30/19
5				
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Notes:

	190805A BIK			

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 19, 2019

**Parameters:** Polynuclear Aromatic Hydrocarbons

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89682

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH882	AZ95987	Water	07/30/19
ERH883	AZ95988	Water	07/30/19
ERH882MS	AZ95987MS	Water	07/30/19
ERH882MSD	AZ95987MSD	Water	07/30/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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**

Sample ERH870 (from SDG 89749) was identified as an equipment blank. 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**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## **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**

Samples ERH882 and ERH883 were identified as field duplicates. No results were detected in any of the samples.

## **XI. Internal Standards**

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

## **XII. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification  
Summary - SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -  
SDG 89682**

No Sample Data Qualified in this SDG

LDC #: 45972A2b  
 SDG #: 89682  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: FJ  
 2nd Reviewer: FJ

**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	% PSD $\leq 20$ , <sup>15</sup> <del>20</del> ICV $\leq 20$
IV.	Continuing calibration <i>ending</i>	A	CCV $\leq 20/50$
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	EB = ERH 870 (89749)
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	ICS/D
X.	Field duplicates	ND	D = 1, 2
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH882	AZ95987	Water	07/30/19
2	ERH883	AZ95988	Water	07/30/19
3	ERH882MS	AZ95987MS	Water	07/30/19
4	ERH882MSD	AZ95987MSD	Water	07/30/19
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6				
7				
8				

Notes:

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**Laboratory Data Consultants, Inc.**  
**Data Validation Report**

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

**LDC Report Date:** September 19, 2019

**Parameters:** 2-(2-Methoxyethoxy)-ethanol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89682

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH882	AZ95987	Water	07/30/19
ERH883	AZ95988	Water	07/30/19
ERH882MS	AZ95987MS	Water	07/30/19
ERH882MSD	AZ95987MSD	Water	07/30/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

2-(2-Methoxyethoxy)-ethanol by Environmental Protection Agency (EPA) SW 846 Method 8270D Modified

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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**

Sample ERH870 (from SDG 89749) was identified as an equipment blank. No contaminants were found.

## VII. Surrogates

Surrogates were not added to all samples as required by the method. Using professional judgment, no data were qualified, since the LCS/LCSD and MS/MSD percent recoveries were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis.

## VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## 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 with the following exceptions:

LCS ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
190805A LCS/D (All samples in SDG 89682)	2-(2-Methoxyethoxy)-ethanol	22.9 ( $\leq 20$ )	UJ (all non-detects)	P

## X. Field Duplicates

Samples ERH882 and ERH883 were identified as field duplicates. No results were detected in any of the samples.

## XI. Internal Standards

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

## XII. Compound Quantitation

Raw data were not reviewed for Level C validation.

## XIII. Target Compound Identifications

Raw data were not reviewed for Level C validation.

## XIV. System Performance

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

The analysis was conducted within all specifications of the method with the exception noted in Section VII.

Due to LCS/LCSD RPD, data were qualified as estimated in two samples.

No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 89682**

Sample	Compound	Flag	A or P	Reason (Code)
ERH882 ERH883	2-(2-Methoxyethoxy)-ethanol	UJ (all non-detects)	P	Laboratory control samples (RPD) (L)

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -  
SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG  
89682**

No Sample Data Qualified in this SDG

LDC #: 45972A2c  
 SDG #: 89682  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-Modified)

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	% PSD ≤ 15    ICV ≤ 20
IV.	Continuing calibration <i>ending</i>	A	CCV ≤ 20/50
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	EB = ERH870 (89749)
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	SW	
X.	Field duplicates	ND	D = 1,2 ✓
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH882	AZ95987	Water	07/30/19
2	ERH883	AZ95988	Water	07/30/19
3	ERH882MS	AZ95987MS	Water	07/30/19
4	ERH882MSD	AZ95987MSD	Water	07/30/19
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Notes:

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## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 19, 2019

**Parameters:** Metals

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89682

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH882	AZ95987	Water	07/30/19
ERH882MS	AZ95987MS	Water	07/30/19
ERH882MSD	AZ95987MSD	Water	07/30/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Calcium, Magnesium, Manganese, Potassium, and Sodium by Environmental Protection Agency (EPA) SW 846 Method 6010C

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is <0.995.
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **I. Sample Receipt and Technical Holding Times**

All samples were received in good condition.

All technical holding time requirements were met.

## **II. Instrument Calibration**

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

## **III. ICP Interference Check Sample Analysis**

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

## **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**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## **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. Serial Dilution**

Serial dilution was 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. Sample Result Verification**

Raw data were not reviewed for Level C validation.

## **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Metals - Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Metals - Laboratory Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Metals - Field Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

LDC #: 45972A4b  
 SDG #: 89682  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** Metals (EPA SW 846 Method 6010C)

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.	Instrument Calibration	A	
III.	ICP Interference Check Sample (ICS) Analysis	A	
IV.	Laboratory Blanks	A	
V.	Field Blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	N	
VIII.	Serial Dilution	N	
IX.	Laboratory control samples	A	LCS/D
X.	Field Duplicates	N	
XI.	Sample Result Verification	N	
XII.	Overall Assessment of Data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH882	AZ95987	Water	07/30/19
2	ERH882MS	AZ95987MS	Water	07/30/19
3	ERH882MSD	AZ95987MSD	Water	07/30/19
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Notes: \_\_\_\_\_  
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## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 19, 2019

**Parameters:** Wet Chemistry

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89682

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH882	AZ95987	Water	07/30/19
ERH882MS	AZ95987MS	Water	07/30/19
ERH882MSD	AZ95987MSD	Water	07/30/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Alkalinity by Standard Method 2320B

Bromide, Chloride, Fluoride, Nitrate as Nitrogen, and Sulfate by Environmental Protection Agency (EPA) Method 300.0

Dissolved Organic Carbon and Total Organic Carbon by EPA SW 846 Method 9060A

Ferrous Iron by Standard Method 3500-Fe B

Nitrate/Nitrite as Nitrogen by EPA Method 353.2

Silica and Dissolved Silica by Standard Method 4500-Si D

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is <0.995.
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

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

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
ERH882	Nitrate as N	80 hours	48 hours	J (all detects)	P

## II. Initial Calibration

All criteria for the initial calibration of each method were met.

## III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable with the following exceptions:

Date	Lab. Reference/ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
08/07/19	CCV (03:46)	Total organic carbon	115.9 (90-110)	All samples in SDG 89682	J (all detects)	P
08/07/19	CCV (15:06)	Total organic carbon	111.7 (90-110)	All samples in SDG 89682	J (all detects)	P

## IV. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Limit of Quantitation	Associated Samples
PB (prep blank)	Bicarbonate alkalinity Total alkalinity Total organic carbon	3.6 mg/L 3.6 mg/L 0.18 mg/L	2.0 mg/L 2.0 mg/L 0.93 mg/L	All samples in SDG 89682

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. 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	Limit of Quantitation	Modified Final Concentration
ERH882	Total organic carbon	0.63 mg/L	0.93 mg/L	0.63U mg/L

## V. Field Blanks

No field blanks were identified in this SDG.

## VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. For ERH882MS/MSD, no data were qualified for dissolved silica percent recoveries (%R) outside the QC limits since the parent sample results were greater than 4X the spike concentration. Relative percent differences (RPD) were within QC limits.

## 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 with the following exceptions:

LCS ID (Associated Samples)	Analyte	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
LCS/D (All samples in SDG 89682)	Total organic carbon	65.6 (80-120)	-	J (all detects)	P

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

LCS ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
LCS/D (All samples in SDG 89682)	Total organic carbon	54.5 (≤20)	J (all detects)	P

## IX. Field Duplicates

No field duplicates were identified in this SDG.

## **X. Sample Result Verification**

Raw data were not reviewed for Level C validation.

## **XI. Overall Assessment of Data**

The analysis was conducted within all specifications of the methods.

Due to technical holding time, continuing calibration %R, and LCS/LCSD %R and RPD, data were qualified as estimated in one sample.

Due to laboratory blank contamination, data were qualified as not detected in one sample.

No results were rejected in this SDG.



**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Data Qualification Summary - SDG 89682**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH882	Nitrate as N	J (all detects)	P	Technical holding times (H)
ERH882	Total organic carbon	J (all detects)	P	Continuing calibration (%R) (R)
ERH882	Total organic carbon	J (all detects)	P	Laboratory control samples (%R)(RPD) (L)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 89682**

Sample	Analyte	Modified Final Concentration	A or P	Code
ERH882	Total organic carbon	0.63U mg/L	A	B

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Field Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

LDC #: 45972A6

# VALIDATION COMPLETENESS WORKSHEET

Date: 9/19/19

SDG #: 89682

Level C

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: [Signature]

2nd Reviewer: [Signature]

**METHOD: (Analyte)** Alkalinity (SM2320B), Bromide, Chloride, Fluoride, Nitrate as N, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B), Nitrate/Nitrite-N (EPA Method 353.2), Silica (SM 4500-Si D), Dissolved Silica (SM 4500-SiD), DOC (EPA SW 846 Method 9060A), TOC (EPA SW 846 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	ASW	
II.	Initial calibration	A	
III.	Calibration verification	SW	
IV.	Laboratory Blanks	SW	
V.	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	2/3: Dissolved Silica >4X
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	SW	LES/D
IX.	Field duplicates	N	
X.	Sample result verification	N	
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:

	Client ID	Lab ID	Matrix	Date
1	ERH882	AZ95987	Water	07/30/19
2	ERH882MS	AZ95987MS	Water	07/30/19
3	ERH882MSD	AZ95987MSD	Water	07/30/19
4				
5				
6				
7				
8				
9				
10				

Notes:







## VALIDATION FINDINGS WORKSHEET

### Blanks

**METHOD:** Inorganics, Method See Cover

**Conc. units:** mg/L

**Associated Samples:** All

Analyte	Blank ID	Blank ID	Blank Action Limit													
	PB	ICB/CCB (mg/L)		1												
Bicarbonate Alkalinity	3.6		18													
Total Alkalinity	3.6		18													
TOC	0.18			0.63												



**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 19, 2019

**Parameters:** Gasoline Range Organics

**Validation Level:** Level C

**Laboratory:** APPL. Inc

**Sample Delivery Group (SDG):** 89682

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH879	AZ95986	Water	07/30/19
ERH882	AZ95987	Water	07/30/19
ERH883	AZ95988	Water	07/30/19
ERH882MS	AZ95987MS	Water	07/30/19
ERH882MSD	AZ95987MSD	Water	07/30/19



## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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**

Sample ERH879 was identified as a trip blank. No contaminants were found.

Sample ERH870 (from SDG 89749) was identified as an equipment blank. 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**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
ERH882MS/MSD (ERH882)	Gasoline range organics	67.0 (78-122)	72.0 (78-122)	UJ (all non-detects)	A

Relative percent differences (RPD) were within QC limits.

### 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

Samples ERH882 and ERH883 were identified as field duplicates. No results were detected in any of the samples.

### X. Compound Quantitation

Raw data were not reviewed for Level C validation.

### XI. Target Compound Identifications

Raw data were not reviewed for Level C validation.

### XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to MS/MSD %R, data were qualified as estimated in one sample.

No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Data Qualification Summary - SDG 89682**

<b>Sample</b>	<b>Compound</b>	<b>Flag</b>	<b>A or P</b>	<b>Reason (Code)</b>
ERH882	Gasoline range organics	UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R) (Q)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Laboratory Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Field Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

LDC #: 45972A7  
 SDG #: 89682  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**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	A	
III.	Initial calibration/ICV	A/A	ICV ≤ 20
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB=1 EB = ERH870 (89749)
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples	A	LCSD
X.	Field duplicates	ND	D = 2, 3
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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

	Client ID	Lab ID	Matrix	Date
1	ERH879 TB	AZ95986	Water	07/30/19
2	ERH882	AZ95987	Water	07/30/19
3	ERH883	AZ95988	Water	07/30/19
4	ERH882MS	AZ95987MS	Water	07/30/19
5	ERH882MSD	AZ95987MSD	Water	07/30/19
6				
7				
8				

Notes:

1908080M	B/K				





**Laboratory Data Consultants, Inc.  
Data Validation Report**

**Project/Site Name:** Red Hill Bulk Storage Facility, CTO 18F0126  
**LDC Report Date:** September 20, 2019  
**Parameters:** Total Petroleum Hydrocarbons as Extractables  
**Validation Level:** Level C  
**Laboratory:** APPL, Inc.  
**Sample Delivery Group (SDG):** 89682

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH882	AZ95987	Water	07/30/19
ERH883	AZ95988	Water	07/30/19
ERH882MS	AZ95987MS	Water	07/30/19
ERH882MSD	AZ95987MSD	Water	07/30/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## 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 compounds 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 compounds, 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 compounds.

## 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 compounds.

## IV. Laboratory Blanks

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

## V. Field Blanks

Sample ERH870 (from SDG 89749) was identified as an equipment blank. 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 with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
ERH883	Octacosane	153 (60-142)	TPH as extractables	NA	-

## VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
ERH882MS/MSD (ERH882)	Oil (C24-C40)	121 (41-113)	121 (41-113)	NA	-

Relative percent differences (RPD) were within QC limits.

## 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)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
190805A-LCS/D (All samples in SDG 89682)	Oil (C24-C40)	-	123 (41-113)	NA	-

Relative percent differences (RPD) were within QC limits.

## IX. Field Duplicates

Samples ERH882 and ERH883 were identified as field duplicates. No results were detected in any of the samples.

## X. Compound Quantitation

Raw data were not reviewed for Level C validation.

## XI. Target Compound Identifications

Raw data were not reviewed for Level C validation.

## XII. Overall Assessment of Data

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -  
SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data  
Qualification Summary - SDG 89682**

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 89682**

No Sample Data Qualified in this SDG

LDC #: 45972A8  
 SDG #: 89682  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: bf 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**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	% PSD ≤ 20, r <sup>2</sup> 1CV ≤ 20
III.	Continuing calibration	Δ	CV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	EB = ERH870 (89749)
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	SW	LOS ID
IX.	Field duplicates	ND	D = 1, 2
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH882	AZ95987	Water	07/30/19
2	ERH883	AZ95988	Water	07/30/19
3	ERH882MS	AZ95987MS	Water	07/30/19
4	ERH882MSD	AZ95987MSD	Water	07/30/19
5				
6				
7				
8				
9				
10				

Notes:

190805A - BIK				









## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 20, 2019

**Parameters:** Ethylene Dibromide

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89682

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH879	AZ95986	Water	07/30/19
ERH882	AZ95987	Water	07/30/19
ERH883	AZ95988	Water	07/30/19
ERH882MS	AZ95987MS	Water	07/30/19
ERH882MSD	AZ95987MSD	Water	07/30/19

## Introduction

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The analyses were performed by the following method:

Ethylene Dibromide by Environmental Protection Agency (EPA) SW 846 Method 8011

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

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 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**

Sample ERH879 was identified as a trip blank. No contaminants were found.

Sample ERH870 (from SDG 89749) was identified as an equipment blank. 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**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.



### **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**

Samples ERH882 and ERH883 were identified as field duplicates. No results were detected in any of the samples.

### **X. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **XI. Target Compound Identification**

Raw data were not reviewed for Level C validation.

### **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Ethylene Dibromide - Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Ethylene Dibromide - Laboratory Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Ethylene Dibromide - Field Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

LDC #: 45972A10  
 SDG #: 89682  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: E7  
 2nd Reviewer: AE

**METHOD:** GC Ethylene Dibromide (EPA SW846 Method 8011)

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	% PSD / CV ≤ 20
III.	Continuing calibration	Δ	CV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	EB = ERH870 (89749) TB = 1
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	100/0
IX.	Field duplicates	ND	D = 2, 3
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	Overall assessment of data	Δ	

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

	Client ID	Lab ID	Matrix	Date
1	ERH879 TB	AZ95986	Water	07/30/19
2	ERH882	AZ95987	Water	07/30/19
3	ERH883	AZ95988	Water	07/30/19
4	ERH882MS	AZ95987MS	Water	07/30/19
5	ERH882MSD	AZ95987MSD	Water	07/30/19
6				
7				
8				
9				
10				
11				

Notes:

190805A - BIK				

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 20, 2019

**Parameters:** Methane

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89682

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH879	AZ95986	Water	07/30/19
ERH882	AZ95987	Water	07/30/19
ERH882MS	AZ95987MS	Water	07/30/19
ERH882MSD	AZ95987MSD	Water	07/30/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Methane by Method RSK-175

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## 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 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

Sample ERH879 was identified as a trip blank. No contaminants were found.

## VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
ERH882MS/MSD (ERH882)	Methane	146 (73-125)	135 (73-125)	NA	-

Relative percent differences (RPD) were within QC limits.



## **VII. 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.

## **VIII. Field Duplicates**

No field duplicates were identified in this SDG.

## **IX. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **X. Target Compound Identification**

Raw data were not reviewed for Level C validation.

## **XI. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Laboratory Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Field Blank Data Qualification Summary - SDG 89682**

No Sample Data Qualified in this SDG

LDC #: 45972A51

**VALIDATION COMPLETENESS WORKSHEET**

SDG #: 89682

Level C

Laboratory: APPL, Inc.

Date: 9/19/19

Page: of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

**METHOD:** GC Methane (Method RSK-175)

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	r <sup>2</sup> 10 v ≤ 20
III.	Continuing calibration	Δ	10 v ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 1
VI.	Matrix spike/Matrix spike duplicates	SW	
VII.	Laboratory control samples	A	10 v ID
VIII.	Field duplicates	N	
IX.	Compound quantitation RL/LOQ/LODs	N	
X.	Target compound identification	N	
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:

	Client ID	Lab ID	Matrix	Date
1	ERH879	AZ95986	Water	07/30/19
2	ERH882	AZ95987	Water	07/30/19
3	ERH882MS	AZ95987MS	Water	07/30/19
4	ERH882MSD	AZ95987MSD	Water	07/30/19
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Notes:

	190806B BIK				



**Red Hill Bulk Storage Facility, CTO 18F0126 - SDG 89682  
LDC 45972**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 2320B</b>													
ERH882	AZ95987	1	ALKALINITY, TOTAL (AS CaCO3)	7/30/2019 8:15:00 AM	8/11/2019 10:59:00 PM	C	61.7	MG_L		2.0	1.70		
ERH882	AZ95987	1	BICARBONATE	7/30/2019 8:15:00 AM	8/11/2019 10:59:00 PM	C	61.7	MG_L		2.0	1.70		
ERH882	AZ95987	1	CARBONATE (AS CO3)	7/30/2019 8:15:00 AM	8/11/2019 10:59:00 PM	C	1.70	MG_L	U	2.0	1.70		U
<b>METHOD: 300.0</b>													
ERH882	AZ95987	1	BROMIDE	7/30/2019 8:15:00 AM	8/2/2019 4:18:00 PM	C	0.41	MG_L	J	0.5	0.16		J
ERH882	AZ95987	1	CHLORIDE (AS CL)	7/30/2019 8:15:00 AM	8/2/2019 4:18:00 PM	C	46.2	MG_L		1.0	0.20		
ERH882	AZ95987	1	FLUORIDE	7/30/2019 8:15:00 AM	8/2/2019 4:18:00 PM	C	0.42	MG_L		0.1	0.09		
ERH882	AZ95987	1	NITROGEN, NITRATE (AS N)	7/30/2019 8:15:00 AM	8/2/2019 4:18:00 PM	C	2.1	MG_L		0.5	0.18		J h
ERH882	AZ95987	1	SULFATE (AS SO4)	7/30/2019 8:15:00 AM	8/2/2019 4:18:00 PM	C	7.6	MG_L		1.0	0.20		
<b>METHOD: 3500-FE-B</b>													
ERH882	AZ95987	1	Iron, Ion (Fe2+)	7/30/2019 8:15:00 AM	8/2/2019 5:16:00 PM	C	0.32	MG_L	U	1.0	0.32		U
<b>METHOD: 353.2</b>													
ERH882	AZ95987	1	NITROGEN, NITRATE-NITRITE	7/30/2019 8:15:00 AM	8/7/2019 8:28:00 PM	C	0.35	MG_L		0.10	0.090		
<b>METHOD: 4500-SIO2-C</b>													
ERH882	AZ95987	5	SILICA	7/30/2019 8:15:00 AM	8/16/2019 10:40:00 AM	C	45.3	MG_L		5.0	4.00		
ERH882	AZ95987	5	SILICA	7/30/2019 8:15:00 AM	8/16/2019 10:47:00 AM	C	44.2	MG_L		5.0	4.00		
<b>METHOD: 6010C</b>													
ERH882	AZ95987	1	CALCIUM	7/30/2019 8:15:00 AM	8/7/2019 2:44:00 PM	C	8360	UG_L		1000	75.0		
ERH882	AZ95987	1	MAGNESIUM	7/30/2019 8:15:00 AM	8/7/2019 2:44:00 PM	C	9530	UG_L		500	30.0		
ERH882	AZ95987	1	MANGANESE	7/30/2019 8:15:00 AM	8/7/2019 2:44:00 PM	C	24.9	UG_L		10.0	4.00		
ERH882	AZ95987	1	POTASSIUM	7/30/2019 8:15:00 AM	8/7/2019 2:44:00 PM	C	1840	UG_L	J	3000	500.0		J
ERH882	AZ95987	1	SODIUM	7/30/2019 8:15:00 AM	8/7/2019 2:44:00 PM	C	36200	UG_L		5000	500.0		
<b>METHOD: 8011</b>													
ERH879	AZ95986	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	7/30/2019 7:45:00 AM	8/6/2019 9:34:00 PM	C	0.019	UG_L	U	0.02	0.019		U
ERH882	AZ95987	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	7/30/2019 8:15:00 AM	8/6/2019 10:35:00 PM	C	0.019	UG_L	U	0.02	0.019		U
ERH883	AZ95988	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	7/30/2019 8:15:00 AM	8/6/2019 10:55:00 PM	C	0.019	UG_L	U	0.02	0.019		U
<b>METHOD: 8015B_E</b>													

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 8015B_E</b>													
ERH882	AZ95987	1	C10-C24 DIESEL RANGE ORGANICS	7/30/2019 8:15:00 AM	8/23/2019 3:16:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH882	AZ95987	1	C24-C40 TOTAL PETROLEUM HYDROCARBONS, OIL RANGE	7/30/2019 8:15:00 AM	8/23/2019 3:16:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH883	AZ95988	1	C10-C24 DIESEL RANGE ORGANICS	7/30/2019 8:15:00 AM	8/23/2019 3:36:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH883	AZ95988	1	C24-C40 TOTAL PETROLEUM HYDROCARBONS, OIL RANGE	7/30/2019 8:15:00 AM	8/23/2019 3:36:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
<b>METHOD: 8260B</b>													
ERH879	AZ95986	1	1,2-DICHLOROETHANE	7/30/2019 7:45:00 AM	8/9/2019 2:11:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH879	AZ95986	1	BENZENE	7/30/2019 7:45:00 AM	8/9/2019 2:11:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH879	AZ95986	1	ETHYLBENZENE	7/30/2019 7:45:00 AM	8/9/2019 2:11:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH879	AZ95986	1	PETROLEUM HYDROCARBONS C6-C10	7/30/2019 7:45:00 AM	8/9/2019 2:10:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH879	AZ95986	1	TOLUENE	7/30/2019 7:45:00 AM	8/9/2019 2:11:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH879	AZ95986	1	Xylenes	7/30/2019 7:45:00 AM	8/9/2019 2:11:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH882	AZ95987	1	1,2-DICHLOROETHANE	7/30/2019 8:15:00 AM	8/9/2019 3:08:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH882	AZ95987	1	BENZENE	7/30/2019 8:15:00 AM	8/9/2019 3:08:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH882	AZ95987	1	ETHYLBENZENE	7/30/2019 8:15:00 AM	8/9/2019 3:08:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH882	AZ95987	1	PETROLEUM HYDROCARBONS C6-C10	7/30/2019 8:15:00 AM	8/9/2019 3:07:00 PM	C	18.0	UG_L	U	20	18.0	UJ	q
ERH882	AZ95987	1	TOLUENE	7/30/2019 8:15:00 AM	8/9/2019 3:08:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH882	AZ95987	1	Xylenes	7/30/2019 8:15:00 AM	8/9/2019 3:08:00 PM	C	0.30	UG_L	U	2.0	0.30	UJ	q
ERH883	AZ95988	1	1,2-DICHLOROETHANE	7/30/2019 8:15:00 AM	8/9/2019 2:40:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH883	AZ95988	1	BENZENE	7/30/2019 8:15:00 AM	8/9/2019 2:40:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH883	AZ95988	1	ETHYLBENZENE	7/30/2019 8:15:00 AM	8/9/2019 2:40:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH883	AZ95988	1	PETROLEUM HYDROCARBONS C6-C10	7/30/2019 8:15:00 AM	8/9/2019 2:39:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH883	AZ95988	1	TOLUENE	7/30/2019 8:15:00 AM	8/9/2019 2:40:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH883	AZ95988	1	Xylenes	7/30/2019 8:15:00 AM	8/9/2019 2:40:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
<b>METHOD: 8270D</b>													
ERH882	AZ95987	1	2-(2-METHOXY ETHOXY)-ETHANOL	7/30/2019 8:15:00 AM	8/6/2019 6:02:00 PM	C	80.0	UG_L	U	100	80.0	UJ	1
ERH882	AZ95987	1	PHENOL	7/30/2019 8:15:00 AM	8/9/2019 9:06:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH883	AZ95988	1	2-(2-METHOXY ETHOXY)-ETHANOL	7/30/2019 8:15:00 AM	8/6/2019 6:25:00 PM	C	80.0	UG_L	U	100	80.0	UJ	1

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 8270D</b>													
ERH883	AZ95988	1	PHENOL	7/30/2019 8:15:00 AM	8/9/2019 9:34:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
<b>METHOD: 8270DSIM</b>													
ERH882	AZ95987	1	1-METHYLNAPHTHALENE	7/30/2019 8:15:00 AM	8/13/2019 5:42:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH882	AZ95987	1	2-METHYLNAPHTHALENE	7/30/2019 8:15:00 AM	8/13/2019 5:42:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH882	AZ95987	1	NAPHTHALENE	7/30/2019 8:15:00 AM	8/13/2019 5:42:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH883	AZ95988	1	1-METHYLNAPHTHALENE	7/30/2019 8:15:00 AM	8/13/2019 6:05:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH883	AZ95988	1	2-METHYLNAPHTHALENE	7/30/2019 8:15:00 AM	8/13/2019 6:05:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH883	AZ95988	1	NAPHTHALENE	7/30/2019 8:15:00 AM	8/13/2019 6:05:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
<b>METHOD: 9060A</b>													
ERH882	AZ95987	1	DISSOLVED ORGANIC CARBON	7/30/2019 8:15:00 AM	8/19/2019 2:33:00 AM	C	0.79	MG_L	J	0.93	0.350	J	
ERH882	AZ95987	1	TOTAL ORGANIC CARBON	7/30/2019 8:15:00 AM	8/7/2019 5:21:00 AM	C		MG_L	J	0.93	0.63	UJ	b,r,l
<b>METHOD: RSK175</b>													
ERH879	AZ95986	1	METHANE	7/30/2019 7:45:00 AM	8/6/2019 2:04:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH882	AZ95987	1	METHANE	7/30/2019 8:15:00 AM	8/6/2019 2:08:00 PM	C	1.00	UG_L	U	5.0	1.00	U	

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 19, 2019

**Parameters:** Volatiles

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89702

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH871	AZ96148	Water	07/31/19
ERH872	AZ96149	Water	07/31/19
ERH877	AZ96151	Water	08/01/19
ERH878	AZ96152	Water	08/01/19



## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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), and 1,2-Dichloroethane by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## 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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## 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 compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
08/11/19	Toluene	61	ERH877 ERH878	UJ (all non-detects)	A

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

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 ERH871 and ERH877 were identified as trip blanks. No contaminants were found.

Sample ERH870 (from SDG 89749) was identified as an equipment blank. 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

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were not within QC limits. No data were qualified since there were no associated samples in this SDG. Relative percent differences (RPD) were within QC limits.

## 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 with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
190811AMLCS/D (ERH877 ERH878)	Toluene	141 (80-121)	135 (80-121)	NA	-

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. Compound Quantitation

Raw data were not reviewed for Level C validation.

### **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

### **XIV. System Performance**

Raw data were not reviewed for Level C validation.

### **XV. Overall Assessment of Data**

The analysis was conducted within all specifications of the method.

Due to continuing calibration %D, data were qualified as estimated in two samples.

No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Data Qualification Summary - SDG 89702**

<b>Sample</b>	<b>Compound</b>	<b>Flag</b>	<b>A or P</b>	<b>Reason (Code)</b>
ERH877 ERH878	Toluene	UJ (all non-detects)	A	Continuing calibration (%D) (C)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Laboratory Blank Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Field Blank Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

LDC #: 45972B1a  
 SDG #: 89702  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC/MS BTEX & 1,2-DCA (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	Δ	
III.	Initial calibration/ICV	A/A	% PSD ≤ 15   CI ≤ 20
IV.	Continuing calibration <i>(ending)</i>	SW	CV ≤ 20/SD
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	EB = ERH870 (89749) TB = 1, 3
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	SW	ERH882 MS10 (%R no Assoc sample)
IX.	Laboratory control samples	SW	LES 10
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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

	Client ID	Lab ID	Matrix	Date
1	ERH871 <sup>+</sup> TB	AZ96148	Water	07/31/19
2	ERH872	AZ96149	Water	07/31/19
3	ERH877 TB	AZ96151	Water	08/01/19
4	ERH878	AZ96152	Water	08/01/19
5				
6				
7				
8				

Notes:

1	190808BM - BIK				
2	190811AM - BIK				

1, 2 + 1,2-DCA



## TARGET COMPOUND WORKSHEET

### METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane
C. Vinyl chloride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO. 1,1-Difluoroethane	O1. 3-Methylpentane
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3-Trimethylbutane
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methyl cyclohexane	T1. 2-Methylhexane
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1. 2-Propanol
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.





**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 19, 2019

**Parameters:** Phenol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89702

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH872	AZ96149	Water	07/31/19
ERH878	AZ96152	Water	08/01/19

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The analyses were performed by the following method:

Phenol by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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**

Sample ERH870 (from SDG 89749) was identified as an equipment blank. 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**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Laboratory Blank Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Field Blank Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

LDC #: 45972B2a  
 SDG #: 89702  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

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

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	Δ	
III.	Initial calibration/ICV	A Δ	% PSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration <u>ending</u>	Δ	CV ≤ 20/50
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	EB = ERH870 (89749)
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	ERH 882 MS10
IX.	Laboratory control samples	A	MS 10
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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

	Client ID	Lab ID	Matrix	Date
1	ERH872	AZ96149	Water	07/31/19
2	ERH878	AZ96152	Water	08/01/19
3				
4				
5				
6				
7				
8				

Notes:

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## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 19, 2019

**Parameters:** Polynuclear Aromatic Hydrocarbons

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89702

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH872	AZ96149	Water	07/31/19
ERH878	AZ96152	Water	08/01/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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**

Sample ERH870 (from SDG 89749) was identified as an equipment blank. 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**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification  
Summary - SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -  
SDG 89702**

No Sample Data Qualified in this SDG

LDC #: 45972B2b  
 SDG #: 89702  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**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	% PSD ≤ 15      ICV ≤ 20
IV.	Continuing calibration <i>pending</i>	A	CV ≤ 20/SD
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	EB = ERH870 (29749)
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	ERH882MS/D
IX.	Laboratory control samples	A	LES/D
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH872	AZ96149	Water	07/31/19
2	ERH878	AZ96152	Water	08/01/19
3				
4				
5				
6				
7				
8				

Notes:

190805A B/L				

TTT, W, S

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 19, 2019

**Parameters:** Metals

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89702

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH872	AZ96149	Water	07/31/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Calcium, Magnesium, Manganese, Potassium, and Sodium by Environmental Protection Agency (EPA) SW 846 Method 6010C

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is  $<0.995$ .
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **I. Sample Receipt and Technical Holding Times**

All samples were received in good condition.

All technical holding time requirements were met.

## **II. Instrument Calibration**

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

## **III. ICP Interference Check Sample Analysis**

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

## **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. Serial Dilution**

Serial dilution was 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. Sample Result Verification**

Raw data were not reviewed for Level C validation.

## **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Metals - Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Metals - Laboratory Blank Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Metals - Field Blank Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

LDC #: 45972B4b  
 SDG #: 89702  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** Metals (EPA SW 846 Method 6010C)

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.	Instrument Calibration	A	
III.	ICP Interference Check Sample (ICS) Analysis	A	
IV.	Laboratory Blanks	A	
V.	Field Blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Serial Dilution	N	
IX.	Laboratory control samples	A	LCS/D
X.	Field Duplicates	N	
XI.	Sample Result Verification	A	
XII.	Overall Assessment of Data		

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

	Client ID	Lab ID	Matrix	Date
1	ERH872	AZ96149	Water	07/31/19
2				
3				
4				
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6				
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9				
10				
11				
12				
13				
14				

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

LDC #: 45972RB

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Page: 1 of 1
Reviewer: CR
2nd reviewer: [Signature]

All circled elements are applicable to each sample.

Table with columns: Sample ID, Matrix, Target Analyte List (TAL). The first row shows a sample ID of 1 and a TAL list including Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn, Mo, B, Sn, Ti. Several elements (Ca, Mg, Mn, K) are circled in the original image.

Analysis Method

Table with columns: Analysis Method, Target Analyte List (TAL). Rows include ICP, ICP-MS, and GFAA, each followed by the same TAL list as the main table.

Comments: Mercury by CVAA if performed

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 19, 2019

**Parameters:** 2-(2-Methoxyethoxy)-ethanol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89702

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH872	AZ96149	Water	07/31/19
ERH878	AZ96152	Water	08/01/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

2-(2-Methoxyethoxy)-ethanol by Environmental Protection Agency (EPA) SW 846 Method 8270D Modified

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.



## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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**

Sample ERH870 (from SDG 89749) was identified as an equipment blank. No contaminants were found.

## VII. Surrogates

Surrogates were not added to all samples as required by the method. Using professional judgment, no data were qualified, since the LCS/LCSD and MS/MSD percent recoveries were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis.

## VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

## 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 with the following exceptions:

LCS ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
190805A LCS/D (All samples in SDG 89702)	2-(2-Methoxyethoxy)-ethanol	22.9 (≤20)	UJ (all non-detects)	P

## 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. Compound Quantitation

Raw data were not reviewed for Level C validation.

## XIII. Target Compound Identifications

Raw data were not reviewed for Level C validation.

## XIV. System Performance

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

The analysis was conducted within all specifications of the method with the exception noted in Section VII.

Due to LCS/LCSD RPD, data were qualified as estimated in two samples.

No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 89702**

<b>Sample</b>	<b>Compound</b>	<b>Flag</b>	<b>A or P</b>	<b>Reason (Code)</b>
ERH872 ERH878	2-(2-Methoxyethoxy)-ethanol	UJ (all non-detects)	P	Laboratory control samples (RPD) (L)

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -  
SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG  
89702**

No Sample Data Qualified in this SDG

LDC #: 45972B2c  
 SDG #: 89702  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-Modified)

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	% PSD ≤ 15 CW ≤ 20
IV.	Continuing calibration <u>ending</u>	A	CV ≤ 20/50
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	EB = ERH870 (89749)
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	A	ERH882 MS ID
IX.	Laboratory control samples	SW	LC2 ID
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH872	AZ96149	Water	07/31/19
2	ERH878	AZ96152	Water	08/01/19
3				
4				
5				
6				
7				
8				

Notes:

190805A BIK				



LDC #: 45972 B2C

### VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: [Signature]

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

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

Y N N/A  
Y N N/A

Was a LCS required?

Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

(L)

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	190805A	*	( )	( )	22.9 ( 20 )	All	J/W/P (ND)
	LCSD		( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
		* 2-(2-Methoxyethoxy)-Ethanol	( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

**Laboratory Data Consultants, Inc.**  
**Data Validation Report**

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

**LDC Report Date:** September 19, 2019

**Parameters:** Wet Chemistry

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89702

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH872	AZ96149	Water	07/31/19
ERH890	AZ96150	Water	07/31/19
ERH878	AZ96152	Water	08/01/19



## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Alkalinity by Standard Method 2320B

Bromide, Chloride, Fluoride, Nitrate as Nitrogen, and Sulfate by Environmental Protection Agency (EPA) Method 300.0

Dissolved Organic Carbon and Total Organic Carbon by EPA SW 846 Method 9060A

Ferrous Iron by Standard Method 3500-Fe B

Nitrate/Nitrite as Nitrogen by EPA Method 353.2

Silica and Dissolved Silica by Standard Method 4500-Si D

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is  $<0.995$ .
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

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

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
ERH872	Nitrate as N	128 hours	48 hours	J (all detects)	P
ERH878	Nitrate as N	105 hours	48 hours	R (all non-detects)	P

## II. Initial Calibration

All criteria for the initial calibration of each method were met.

## III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable with the following exceptions:

Date	Lab. Reference/ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
08/07/19	CCV (03:46)	Total organic carbon	115.9 (90-110)	ERH872	J (all detects)	P
08/07/19	CCV (15:06)	Total organic carbon	111.7 (90-110)	ERH872	J (all detects)	P
08/27/19	CCV (12:43)	Total organic carbon	116.5 (90-110)	ERH878	J (all detects)	P
08/27/19	CCV (14:11)	Total organic carbon	114.5 (90-110)	ERH878	J (all detects)	P

## IV. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Limit of Quantitation	Associated Samples
PB (prep blank)	Bicarbonate alkalinity Total alkalinity	1.8 mg/L 1.8 mg/L	2.0 mg/L 2.0 mg/L	ERH872 ERH878
ICB/CCB	Nitrate/Nitrite as N	0.030 mg/L	0.10 mg/L	ERH872 ERH878

Blank ID	Analyte	Maximum Concentration	Limit of Quantitation	Associated Samples
PB (prep blank)	Total organic carbon	0.17	0.93 mg/L	ERH872

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. 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	Limit of Quantitation	Modified Final Concentration
ERH878	Nitrate/Nitrite as N	0.049 mg/L	0.10 mg/L	0.049U mg/L
ERH872	Total organic carbon	0.59 mg/L	0.93 mg/L	0.59U mg/L

## 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. Sample Result Verification

Raw data were not reviewed for Level C validation.

## **XI. Overall Assessment of Data**

The analysis was conducted within all specifications of the methods.

Due to technical holding time, data were rejected in one sample.

Due to technical holding time and continuing calibration %R, data were qualified as estimated in two samples.

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Data Qualification Summary - SDG 89702**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH872	Nitrate as N	J (all detects)	P	Technical holding times (H)
ERH878	Nitrate as N	R (all non-detects)	P	Technical holding times (H)
ERH872 ERH878	Total organic carbon	J (all detects)	P	Continuing calibration (%R) (R)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 89702**

Sample	Analyte	Modified Final Concentration	A or P	Code
ERH878	Nitrate/Nitrite as N	0.049U mg/L	A	B
ERH872	Total organic carbon	0.59U mg/L	A	B

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Field Blank Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

LDC #: 45972B6  
 SDG #: 89702  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: A

**METHOD: (Analyte)** Alkalinity (SM2320B), Bromide, Chloride, Fluoride, Nitrate as N, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B), Nitrate/Nitrite-N (EPA Method 353.2), Silica (SM 4500-Si D), Dissolved Silica (SM 4500-SiD), DOC (EPA SW 846 Method 9060A), TOC (EPA SW 846 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	ASW	
II	Initial calibration	A	
III.	Calibration verification	SW	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS/D
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH872	AZ96149	Water	07/31/19
2	ERH890	AZ96150	Water	07/31/19
3	ERH878	AZ96152	Water	08/01/19
4				
5				
6				
7				
8				
9				
10				

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



LDC #: UGND36

### VALIDATION FINDINGS WORKSHEET Sample Specific Analysis Reference

Page: 1 of 1  
Reviewer: CR  
2nd reviewer: A

All circled methods are applicable to each sample.

Sample ID	Parameter
1	pH TDS <u>Cl</u> <u>F</u> <u>NO<sub>3</sub></u> NO <sub>2</sub> <u>SO<sub>4</sub></u> O-PO <sub>4</sub> <u>Alk</u> CN NH <sub>3</sub> TKN <u>TOC</u> Cr6+ ClO <sub>4</sub> <u>SiO<sub>2</sub></u> <u>NO<sub>3</sub></u> <u>NO<sub>2</sub>-N</u> <u>SiO<sub>2</sub></u>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub> <u>SiO<sub>2</sub></u> <u>Fe<sup>3+</sup></u> <u>DOC</u>
2	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub> <u>DOC</u>
3	pH TDS <u>Cl</u> <u>F</u> <u>NO<sub>3</sub></u> NO <sub>2</sub> <u>SO<sub>4</sub></u> O-PO <sub>4</sub> <u>Alk</u> CN NH <sub>3</sub> TKN <u>TOC</u> Cr6+ ClO <sub>4</sub> <u>NO<sub>3</sub></u> <u>NO<sub>2</sub>-N</u> <u>Fe<sup>3+</sup></u>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>

Comments: \_\_\_\_\_

### VALIDATION FINDINGS WORKSHEET Technical Holding Times

All circled dates have exceeded the technical holding time.  
 N N/A Were all samples preserved as applicable to each method?  
 N N/A Were all cooler temperatures within validation criteria?

H

Method:	300.0	
Parameters:	NO <sub>3</sub> -N	
Technical holding time:	48 hrs	

Sample ID	Sampling date	Analysis date	Total Time	Qualifier	Analysis date	Total Time	Qualifier
1 Det	7/31/19 10:10	8/5/19 18:52	128 hrs	J/R/P			
3 MD	8/1/19 09:20	8/5/19 19:00	105 hrs	↓			

LDC #: US77036

### VALIDATION FINDINGS WORKSHEET Calibration

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: Inorganics, EPA Method see cal

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  $\geq 0.995$ ?

**LEVEL IV/D ONLY:**

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

#	Date	Calibration ID	Analyte	%R	Associated Samples	Qualifications
	8/7/19	CCV (03:46)	TOC	115.9	1	Jdet 10 (Det)
	↓	↓ (15:06)	↓	111.7	1	
	8/27/19	CCV (12:43)	TOC	116.5	3 3	↓ ↓
	↓	CCV (14:11)	↓	114.5		

Comments: \_\_\_\_\_

**VALIDATION FINDINGS WORKSHEET**  
**Blanks**

**METHOD:** Inorganics, Method See Cover

**Conc. units:** mg/L

**Associated Samples:** 1, 3

Analyte	Blank ID	Blank ID	Blank Action Limit											
	PB	ICB/CCB (mg/L)		3										
Bicarbonate Alkalinity	1.8													
Total Alkalinity	1.8													
Nitrate/Nitrite as N		0.030		0.049										

**Conc. units:** mg/L

**Associated Samples:** 1

Analyte	Blank ID	Blank ID	Blank Action Limit											
	PB	ICB/CCB (mg/L)		1										
TOC	0.17			0.59										

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 19, 2019

**Parameters:** Gasoline Range Organics

**Validation Level:** Level C

**Laboratory:** APPL. Inc

**Sample Delivery Group (SDG):** 89702

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH871	AZ96148	Water	07/31/19
ERH872	AZ96149	Water	07/31/19
ERH877	AZ96151	Water	08/01/19
ERH878	AZ96152	Water	08/01/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.



## **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 ERH871 and ERH877 were identified as trip blanks. No contaminants were found.

Sample ERH870 (from SDG 89749) was identified as an equipment blank. 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**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were not within QC limits. No data were qualified since there were no associated samples in this SDG. Relative percent differences (RPD) were within QC limits.

### **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **XI. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

### **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Laboratory Blank Data Qualification Summary - SDG  
89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Field Blank Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

LDC #: 45972B7  
 SDG #: 89702  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: FJ  
 2nd Reviewer: A

**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	Δ	
III.	Initial calibration/ICV	Δ Δ	✓ $1CN \leq 20$
IV.	Continuing calibration	Δ	$CCV \leq 20$
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	EB = ERH870 (89749) TB = 1, 3
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	SW	ERH882 MSIP (%R, No Assoc sample)
IX.	Laboratory control samples	Δ	MSIP
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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

	Client ID	Lab ID	Matrix	Date
1	ERH871 TB	AZ96148	Water	07/31/19
2	ERH872	AZ96149	Water	07/31/19
3	ERH877 TB	AZ96151	Water	08/01/19
4	ERH878	AZ96152	Water	08/01/19
5				
6				
7				
8				

Notes:

1	190808BM				
2	190811AM				

## Laboratory Data Consultants, Inc. Data Validation Report

**Project/Site Name:** Red Hill Bulk Storage Facility, CTO 18F0126  
**LDC Report Date:** September 20, 2019  
**Parameters:** Total Petroleum Hydrocarbons as Extractables  
**Validation Level:** Level C  
**Laboratory:** APPL, Inc.  
**Sample Delivery Group (SDG):** 89702

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH872	AZ96149	Water	07/31/19
ERH878	AZ96152	Water	08/01/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.



## 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 compounds 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 compounds, 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 compounds.

## 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 compounds.

## IV. Laboratory Blanks

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

## V. Field Blanks

Sample ERH870 (from SDG 89749) was identified as an equipment blank. 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 with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
ERH872	Octacosane	159 (60-142)	TPH as extractables	NA	-
ERH878	Octacosane	148 (60-142)	TPH as extractables	NA	-

## VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were not within QC limits. No data were qualified since there were no associated samples in this SDG. Relative percent differences (RPD) were within QC limits.

## 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)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
190805A-LCS/D (All samples in SDG 89702)	Oil (C24-C40)	-	123 (41-113)	NA	-

Relative percent differences (RPD) were within QC limits.

## IX. Field Duplicates

No field duplicates were identified in this SDG.

## X. Compound Quantitation

Raw data were not reviewed for Level C validation.

## XI. Target Compound Identifications

Raw data were not reviewed for Level C validation.

## XII. Overall Assessment of Data

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -  
SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data  
Qualification Summary - SDG 89702**

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 89702**

No Sample Data Qualified in this SDG

LDC #: 45972B8  
 SDG #: 89702  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: FJ  
 2nd Reviewer: [Signature]

**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 Δ	
II.	Initial calibration/ICV	A / Δ	% PSD ≤ 20, r <sup>2</sup>   CV ≤ 20
III.	Continuing calibration	Δ	CV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	EB = ERH870 (89749)
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	SW	ERH882MS10 (%R NO ASSOC sample)
VIII.	Laboratory control samples	SW	100 ID
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	Overall assessment of data	Δ	

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

	Client ID	Lab ID	Matrix	Date
1	ERH872	AZ96149	Water	07/31/19
2	ERH878	AZ96152	Water	08/01/19
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

	190805A - BIK				

LDC #: 45972B8

### VALIDATION FINDINGS WORKSHEET Surrogate Recovery

Page: 1 of      
Reviewer:     FT  
2nd Reviewer:        

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".

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

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

(5)

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	1		G	159 ( 60-142 )	Jdu / P MD
				(            )	
				(            )	
	2		G	148 ( ↓ )	Jdu / P MD
				(            )	
				(            )	
				(            )	
				(            )	
				(            )	
				(            )	
				(            )	
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				(            )	
				(            )	
				(            )	

	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	2-Bromonaphthalene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Triphenyltin	AA	Chloro-octadecane
D	Bromochlorobenzene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin	BB	2,4-Dichlorophenylacetic acid
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate	CC	2,5-Dibromotoluene
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 4597208

**VALIDATION FINDINGS WORKSHEET**  
**Laboratory Control Samples (LCS)**

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: [Signature]

METHOD: ✓ GC    HPLC

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

Y N N/A  
Y N N/A

Were a laboratory control samples (LCS) and laboratory control sample duplicate (LCSD) analyzed for each matrix in this SDG?

Were the LCS percent recoveries (%R) and relative percent differences (RPD) within the QC limits?

**Level IV/D Only**

Y N N/A

Was an LCS analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

(L)

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
			( )	( )	( )		
	190805A	Oil (C24-C40)	( )	123 (41-113)	( )	All	Jdu / P NO
	LCSD		( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
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			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

## Laboratory Data Consultants, Inc. Data Validation Report

**Project/Site Name:** Red Hill Bulk Storage Facility, CTO 18F0126  
**LDC Report Date:** September 20, 2019  
**Parameters:** Ethylene Dibromide  
**Validation Level:** Level C  
**Laboratory:** APPL, Inc.  
**Sample Delivery Group (SDG):** 89702

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH871	AZ96148	Water	07/31/19
ERH872	AZ96149	Water	07/31/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Ethylene Dibromide by Environmental Protection Agency (EPA) SW 846 Method 8011

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

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 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**

Sample ERH871 was identified as a trip blank. No contaminants were found.

Sample ERH870 (from SDG 89749) was identified as an equipment blank. 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**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

### **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **XI. Target Compound Identification**

Raw data were not reviewed for Level C validation.

### **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126**  
**Ethylene Dibromide - Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126**  
**Ethylene Dibromide - Laboratory Blank Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126**  
**Ethylene Dibromide - Field Blank Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

LDC #: 45972B10  
 SDG #: 89702  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: \_\_\_\_\_  
 2nd Reviewer: \_\_\_\_\_

**METHOD:** GC Ethylene Dibromide (EPA SW846 Method 8011)

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	% PSD / 1W E 20
III.	Continuing calibration	Δ	CON E 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	EB = ERH870 (89749) TB = 1
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	A	ERH882 MS/D
VIII.	Laboratory control samples	Δ	LCS 10
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	Overall assessment of data	Δ	

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

	Client ID	Lab ID	Matrix	Date
1	PERH871 TB	AZ96148	Water	07/31/19
2	ERH872	AZ96149	Water	07/31/19
3				
4				
5				
6				
7				
8				
9				
10				
11				

Notes:

1	190805A - BLK				
2	190807A - BLK				

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 20, 2019

**Parameters:** Methane

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89702

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH871	AZ96148	Water	07/31/19
ERH872	AZ96149	Water	07/31/19
ERH877	AZ96151	Water	08/01/19
ERH878	AZ96152	Water	08/01/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Methane by Method RSK-175

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 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 ERH871 and ERH877 were identified as trip blanks. No contaminants were found.

## **VI. Matrix Spike/Matrix Spike Duplicates**

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were not within QC limits. No data were qualified since there were no associated samples in this SDG. Relative percent differences (RPD) were within QC limits.

## **VII. 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.

## **VIII. Field Duplicates**

No field duplicates were identified in this SDG.

## **IX. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **X. Target Compound Identification**

Raw data were not reviewed for Level C validation.

## **XI. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Laboratory Blank Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Field Blank Data Qualification Summary - SDG 89702**

No Sample Data Qualified in this SDG

LDC #: 45972B51

**VALIDATION COMPLETENESS WORKSHEET**

SDG #: 89702

Level C

Laboratory: APPL, Inc.

Date: 9/19/19

Page: 1 of 1

Reviewer: F/A

2nd Reviewer: F/A

**METHOD:** GC Methane (Method RSK-175)

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 Δ	
II.	Initial calibration/ICV	A Δ	12 ICV ≤ 20
III.	Continuing calibration	Δ	CCV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 1, 3
VI.	Matrix spike/Matrix spike duplicates	SW	ERH882MS10 (% R, no assoc. sample)
VII.	Laboratory control samples	A	KCS ID
VIII.	Field duplicates	N	
IX.	Compound quantitation RL/LOQ/LODs	N	
X.	Target compound identification	N	
XI.	Overall assessment of data	Δ	

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	ERH871 TB	AZ96148	Water	07/31/19
2	ERH872	AZ96149	Water	07/31/19
3	ERH877 TB	AZ96151	Water	08/01/19
4	ERH878	AZ96152	Water	08/01/19
5				
6				
7				
8				
9				
10				

Notes:

190806A - BIK				

**Red Hill Bulk Storage Facility, CTO 18F0126 - SDG 89702  
LDC 45972**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 2320B</b>													
ERH872	AZ96149	1	ALKALINITY, TOTAL (AS CaCO3)	7/31/2019 10:10:00 AM	8/14/2019 4:29:00 PM	C	64.3	MG_L		2.0	1.70		
ERH872	AZ96149	1	BICARBONATE	7/31/2019 10:10:00 AM	8/14/2019 4:29:00 PM	C	64.3	MG_L		2.0	1.70		
ERH872	AZ96149	1	CARBONATE (AS CO3)	7/31/2019 10:10:00 AM	8/14/2019 4:29:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH878	AZ96152	1	ALKALINITY, TOTAL (AS CaCO3)	8/1/2019 9:20:00 AM	8/14/2019 4:33:00 PM	C	116	MG_L		2.0	1.70		
ERH878	AZ96152	1	BICARBONATE	8/1/2019 9:20:00 AM	8/14/2019 4:33:00 PM	C	116	MG_L		2.0	1.70		
ERH878	AZ96152	1	CARBONATE (AS CO3)	8/1/2019 9:20:00 AM	8/14/2019 4:33:00 PM	C	1.70	MG_L	U	2.0	1.70		U
<b>METHOD: 300.0</b>													
ERH872	AZ96149	1	BROMIDE	7/31/2019 10:10:00 AM	8/5/2019 6:52:00 PM	C	0.45	MG_L	J	0.5	0.16		J
ERH872	AZ96149	2	CHLORIDE (AS CL)	7/31/2019 10:10:00 AM	8/7/2019 1:46:00 PM	C	53.4	MG_L	D	2.0	0.40		D
ERH872	AZ96149	1	FLUORIDE	7/31/2019 10:10:00 AM	8/5/2019 6:52:00 PM	C	0.09	MG_L	U	0.1	0.09		U
ERH872	AZ96149	1	NITROGEN, NITRATE (AS N)	7/31/2019 10:10:00 AM	8/5/2019 6:52:00 PM	C	1.5	MG_L		0.5	0.18		J h
ERH872	AZ96149	1	SULFATE (AS SO4)	7/31/2019 10:10:00 AM	8/5/2019 6:52:00 PM	C	9.4	MG_L		1.0	0.20		
ERH878	AZ96152	2	CHLORIDE (AS CL)	8/1/2019 9:20:00 AM	8/7/2019 1:55:00 PM	C	52.6	MG_L	D	2.0	0.40		D
ERH878	AZ96152	1	NITROGEN, NITRATE (AS N)	8/1/2019 9:20:00 AM	8/5/2019 7:00:00 PM	C	0.18	MG_L	U	0.5	0.18		R h
ERH878	AZ96152	1	SULFATE (AS SO4)	8/1/2019 9:20:00 AM	8/5/2019 7:00:00 PM	C	11.1	MG_L		1.0	0.20		
<b>METHOD: 3500-FE-B</b>													
ERH872	AZ96149	1	Iron, Ion (Fe2+)	7/31/2019 10:10:00 AM	8/5/2019 5:11:00 PM	C	0.32	MG_L	U	1.0	0.32		U
ERH878	AZ96152	1	Iron, Ion (Fe2+)	8/1/2019 9:20:00 AM	8/5/2019 5:12:00 PM	C	0.32	MG_L	U	1.0	0.32		U
<b>METHOD: 353.2</b>													
ERH872	AZ96149	1	NITROGEN, NITRATE-NITRITE	7/31/2019 10:10:00 AM	8/15/2019 4:34:00 PM	C	0.32	MG_L		0.10	0.090		
ERH878	AZ96152	1	NITROGEN, NITRATE-NITRITE	8/1/2019 9:20:00 AM	8/15/2019 4:35:00 PM	C		MG_L	J	0.10	0.049		U b
<b>METHOD: 4500-SIO2-C</b>													
ERH872	AZ96149	5	SILICA	7/31/2019 10:10:00 AM	8/16/2019 10:43:00 AM	C	52.7	MG_L		5.0	4.00		
ERH872	AZ96149	5	SILICA	7/31/2019 10:10:00 AM	8/16/2019 10:50:00 AM	C	51.1	MG_L		5.0	4.00		
<b>METHOD: 6010C</b>													
ERH872	AZ96149	1	CALCIUM	7/31/2019 10:10:00 AM	8/7/2019 3:39:00 PM	C	9430	UG_L		1000	75.0		
ERH872	AZ96149	1	MAGNESIUM	7/31/2019 10:10:00 AM	8/7/2019 3:39:00 PM	C	12700	UG_L		500	30.0		

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 6010C</b>													
ERH872	AZ96149	1	MANGANESE	7/31/2019 10:10:00 AM	8/7/2019 3:39:00 PM	C	64.5	UG_L		10.0	4.00		
ERH872	AZ96149	1	POTASSIUM	7/31/2019 10:10:00 AM	8/7/2019 3:39:00 PM	C	1600	UG_L	J	3000	500.0	J	
ERH872	AZ96149	1	SODIUM	7/31/2019 10:10:00 AM	8/7/2019 3:39:00 PM	C	36200	UG_L		5000	500.0		
<b>METHOD: 8011</b>													
ERH871	AZ96148	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	7/31/2019 9:40:00 AM	8/10/2019 4:07:00 AM	C	0.019	UG_L	U	0.02	0.019	U	
ERH872	AZ96149	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	7/31/2019 10:10:00 AM	8/7/2019 12:56:00 AM	C	0.019	UG_L	U	0.02	0.019	U	
<b>METHOD: 8015B_E</b>													
ERH872	AZ96149	1	C10-C24 DIESEL RANGE ORGANICS	7/31/2019 10:10:00 AM	8/23/2019 3:57:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH872	AZ96149	1	C24-C40 TOTAL PETROLEUM HYDROCARBONS, OIL RANGE	7/31/2019 10:10:00 AM	8/23/2019 3:57:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH878	AZ96152	1	C10-C24 DIESEL RANGE ORGANICS	8/1/2019 9:20:00 AM	8/23/2019 4:17:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH878	AZ96152	1	C24-C40 TOTAL PETROLEUM HYDROCARBONS, OIL RANGE	8/1/2019 9:20:00 AM	8/23/2019 4:17:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
<b>METHOD: 8260B</b>													
ERH871	AZ96148	1	1,2-DICHLOROETHANE	7/31/2019 9:40:00 AM	8/9/2019 4:05:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH871	AZ96148	1	BENZENE	7/31/2019 9:40:00 AM	8/9/2019 4:05:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH871	AZ96148	1	ETHYLBENZENE	7/31/2019 9:40:00 AM	8/9/2019 4:05:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH871	AZ96148	1	PETROLEUM HYDROCARBONS C6-C10	7/31/2019 9:40:00 AM	8/9/2019 4:06:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH871	AZ96148	1	TOLUENE	7/31/2019 9:40:00 AM	8/9/2019 4:05:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH871	AZ96148	1	Xylenes	7/31/2019 9:40:00 AM	8/9/2019 4:05:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH872	AZ96149	1	1,2-DICHLOROETHANE	7/31/2019 10:10:00 AM	8/9/2019 3:36:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH872	AZ96149	1	BENZENE	7/31/2019 10:10:00 AM	8/9/2019 3:36:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH872	AZ96149	1	ETHYLBENZENE	7/31/2019 10:10:00 AM	8/9/2019 3:36:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH872	AZ96149	1	PETROLEUM HYDROCARBONS C6-C10	7/31/2019 10:10:00 AM	8/9/2019 3:35:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH872	AZ96149	1	TOLUENE	7/31/2019 10:10:00 AM	8/9/2019 3:36:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH872	AZ96149	1	Xylenes	7/31/2019 10:10:00 AM	8/9/2019 3:36:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH877	AZ96151	1	BENZENE	8/1/2019 8:45:00 AM	8/12/2019 1:38:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH877	AZ96151	1	ETHYLBENZENE	8/1/2019 8:45:00 AM	8/12/2019 1:38:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH877	AZ96151	1	PETROLEUM HYDROCARBONS C6-C10	8/1/2019 8:45:00 AM	8/12/2019 1:39:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH877	AZ96151	1	TOLUENE	8/1/2019 8:45:00 AM	8/12/2019 1:38:00 AM	C	0.30	UG_L	U	1.0	0.30	UJ	c



EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 8260B</b>													
ERH877	AZ96151	1	Xylenes	8/1/2019 8:45:00 AM	8/12/2019 1:38:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH878	AZ96152	1	BENZENE	8/1/2019 9:20:00 AM	8/12/2019 2:07:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH878	AZ96152	1	ETHYLBENZENE	8/1/2019 9:20:00 AM	8/12/2019 2:07:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH878	AZ96152	1	PETROLEUM HYDROCARBONS C6-C10	8/1/2019 9:20:00 AM	8/12/2019 2:04:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH878	AZ96152	1	TOLUENE	8/1/2019 9:20:00 AM	8/12/2019 2:07:00 AM	C	0.30	UG_L	U	1.0	0.30	UJ	c
ERH878	AZ96152	1	Xylenes	8/1/2019 9:20:00 AM	8/12/2019 2:07:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
<b>METHOD: 8270D</b>													
ERH872	AZ96149	1	2-(2-METHOXY ETHOXY)-ETHANOL	7/31/2019 10:10:00 AM	8/6/2019 6:49:00 PM	C	80.0	UG_L	U	100	80.0	UJ	1
ERH872	AZ96149	1	PHENOL	7/31/2019 10:10:00 AM	8/9/2019 10:02:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH878	AZ96152	1	2-(2-METHOXY ETHOXY)-ETHANOL	8/1/2019 9:20:00 AM	8/6/2019 7:12:00 PM	C	80.0	UG_L	U	100	80.0	UJ	1
ERH878	AZ96152	1	PHENOL	8/1/2019 9:20:00 AM	8/9/2019 10:30:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
<b>METHOD: 8270DSIM</b>													
ERH872	AZ96149	1	1-METHYLNAPHTHALENE	7/31/2019 10:10:00 AM	8/13/2019 6:27:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH872	AZ96149	1	2-METHYLNAPHTHALENE	7/31/2019 10:10:00 AM	8/13/2019 6:27:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH872	AZ96149	1	NAPHTHALENE	7/31/2019 10:10:00 AM	8/13/2019 6:27:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH878	AZ96152	1	1-METHYLNAPHTHALENE	8/1/2019 9:20:00 AM	8/13/2019 6:50:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH878	AZ96152	1	2-METHYLNAPHTHALENE	8/1/2019 9:20:00 AM	8/13/2019 6:50:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH878	AZ96152	1	NAPHTHALENE	8/1/2019 9:20:00 AM	8/13/2019 6:50:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
<b>METHOD: 9060A</b>													
ERH872	AZ96149	1	DISSOLVED ORGANIC CARBON	7/31/2019 10:10:00 AM	8/19/2019 2:56:00 AM	C	1.1	MG_L		0.93	0.350		
ERH872	AZ96149	1	TOTAL ORGANIC CARBON	7/31/2019 10:10:00 AM	8/7/2019 1:23:00 PM	C		MG_L	J	0.93	0.59	UJ	b,r
ERH890	AZ96150	40	DISSOLVED ORGANIC CARBON	7/31/2019 8:45:00 AM	8/19/2019 5:50:00 PM	C	64.4	MG_L		37.20	14.000		
ERH878	AZ96152	20	TOTAL ORGANIC CARBON	8/1/2019 9:20:00 AM	8/27/2019 8:53:00 PM	C	50.6	MG_L		18.60	7.000	J	r
<b>METHOD: RSK175</b>													
ERH871	AZ96148	1	METHANE	7/31/2019 9:40:00 AM	8/6/2019 2:12:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH872	AZ96149	1	METHANE	7/31/2019 10:10:00 AM	8/6/2019 2:18:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH877	AZ96151	1	METHANE	8/1/2019 8:45:00 AM	8/6/2019 2:22:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH878	AZ96152	1	METHANE	8/1/2019 9:20:00 AM	8/6/2019 2:25:00 PM	C	1.00	UG_L	U	5.0	1.00	U	

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 23, 2019

**Parameters:** Volatiles

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89749

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH868	AZ96498	Water	08/05/19
ERH869	AZ96499	Water	08/05/19
ERH870	AZ96500	Water	08/05/19
ERH873	AZ96501	Water	08/05/19
ERH874**	AZ96502**	Water	08/05/19
ERH875	AZ96503	Water	08/06/19
ERH876**	AZ96504**	Water	08/06/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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 ERH868, ERH873, and ERH875 were identified as trip blanks. No contaminants were found.

Sample ERH870 was identified as an equipment blank. No contaminants were found.

Sample ERH869 was identified as a field blank. 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. Compound Quantitation**

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

The system performance was acceptable for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F.**

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**Volatiles - Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126**

**Volatiles - Laboratory Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126**

**Volatiles - Field Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG



LDC #: 45972C1a  
 SDG #: 89749  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/22/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC/MS BTEX & 1,2-DCA (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 Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	A/A	% PSD ≤ 15      ICV ≤ 20
IV.	Continuing calibration /ending	A	OCV ≤ 20/SD
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1, 4, 6      FB = 2      EB = 3
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LCs 10
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	Δ	Not reviewed for Level C validation
XIII.	Target compound identification	Δ	Not reviewed for Level C validation
XIV.	System performance	Δ	Not reviewed for Level C validation
XV.	Overall assessment of data	A	

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

\*\*Indicates sample underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH868 TB	AZ96498	Water	08/05/19
2	ERH869 FB	AZ96499	Water	08/05/19
3	ERH870 EB	AZ96500	Water	08/05/19
4	ERH873 TB	AZ96501	Water	08/05/19
5	ERH874**	AZ96502**	Water	08/05/19
6	ERH875 TB	AZ96503	Water	08/06/19
7	ERH876**	AZ96504**	Water	08/06/19
8				

Notes:

1	190814BM-BIK			
2	190816CT-BIK			

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
<b>II. GC/MS Instrument performance check</b>				
Were the BFB performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
<b>IIIa. Initial calibration</b>				
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) $\leq$ 30% (5%) and relative response factors (RRF) $\geq$ 0.05?	/			
<b>IIIb. Initial Calibration Verification</b>				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) $\leq$ 20%?	/			
<b>IV. Continuing calibration</b>				
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) $\leq$ 20% and relative response factors (RRF) $\geq$ 0.05?	/			
<b>V. Laboratory Blanks</b>				
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?			/	
<b>VI. Field blanks</b>				
Were field blanks were identified in this SDG?	/			
Were target compounds detected in the field blanks?		/		
<b>VII. Surrogate spikes</b>				
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?			/	

Validation Area	Yes	No	NA	Findings/Comments
<b>VIII. Matrix spike/Matrix spike duplicates</b>				
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?			/	
<b>IX. Laboratory control samples</b>				
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
<b>X. Field duplicates</b>				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
<b>XI. Internal standards</b>				
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?	/			
<b>XII. Compound quantitation</b>				
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 compound?	/			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
<b>XIII. Target compound identification</b>				
Were relative retention times (RRT's) within + 0.06 RRT units of the standard?	/			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	/			
Were chromatogram peaks verified and accounted for?	/			
<b>XIV. System performance</b>				
System performance was found to be acceptable.	/			
<b>XV. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.	/			

## TARGET COMPOUND WORKSHEET

### METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane
C. Vinyl choride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO. 1,1-Difluoroethane	O1. 3-Methylpentane
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3-Trimethylbutane
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methyl cyclohexane	T1. 2-Methylhexane
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.



**VALIDATION FINDINGS WORKSHEET**  
**Continuing Calibration Results 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 =  $100 * (\text{ave. RRF} - \text{RRF}) / \text{ave. RRF}$   
 $\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF  
 RRF = continuing calibration RRF  
 $A_x$  = Area of compound,  $A_{is}$  = Area of associated internal standard  
 $C_x$  = Concentration of compound;  $C_{is}$  = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference internal Standard)	Average RRF (initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	0816773 ceV 1808	8/17/19	V (1st internal standard)	0.8008	0.7631	0.7631	4.7	4.7
			EE (2nd internal standard)	0.9248	0.7816	0.7816	15	15
			(3rd internal standard)					
			(4th internal standard)					
2			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					
3			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					
4			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					

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

LDC #: 45972c/a

### VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page: 1 of 1  
Reviewer: FT  
2nd reviewer: A

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

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

% Recovery: SF/SS \* 100

Where: SF = Surrogate Found  
SS = Surrogate Spiked

Sample ID: 4

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane	25.0	27.95404	112	112	0
1,2-Dichloroethane-d4		27.10764	108	108	
Toluene-d8	↓	24.74575	99.0	99.0	↓
Bromofluorobenzene	↓	21.94561	87.8	87.8	↓

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 45972c/a

**VALIDATION FINDINGS WORKSHEET**  
**Laboratory Control Sample Results Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: RC

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

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 \* SSC/SA

Where: SSC = Spiked sample concentration  
 SA = Spike added

RPD = | LCSC - LCSDC | \* 2 / (LCSC + LCSDC)

LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: 190816 CT ics ID

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene										
Trichloroethene										
Benzene	10.0	10.0	9.53	9.16	95.3	95.3	91.6	91.6	4.0	4.0
Toluene	10.0	10.0	9.42	8.97	94.2	94.2	89.7	89.7	4.9	4.9
Chlorobenzene										

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





## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** October 11, 2019

**Parameters:** Phenol

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89749

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH869	AZ96499	Water	08/05/19
ERH870	AZ96500	Water	08/05/19
ERH874**	AZ96502**	Water	08/05/19
ERH876**	AZ96504**	Water	08/06/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Phenol by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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**

Sample ERH870 was identified as an equipment blank. No contaminants were found.

Sample ERH869 was identified as a field blank. 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. Compound Quantitation**

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

The system performance was acceptable for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Laboratory Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Field Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG



LDC #: 45972C2a  
 SDG #: 89749  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/02/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

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

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	% PSD ≤ 15      ICV ≤ 20 ECV ≤ 20
IV.	Continuing calibration <i>ending</i>	A	
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	FB = 1      EB = 2
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	res ID
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	Not reviewed for Level C validation
XIII.	Target compound identification	A	Not reviewed for Level C validation
XIV.	System performance	A	Not reviewed for Level C validation
XV.	Overall assessment of data	A	

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

\*\*Indicates sample underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH869	AZ96499	Water	08/05/19
2	ERH870	AZ96500	Water	08/05/19
3	ERH874**	AZ96502**	Water	08/05/19
4	ERH876**	AZ96504**	Water	08/06/19
5				
6				
7				
8				

Notes:

	190812B BIK				

Method: PAH (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
<b>II. GC/MS Instrument performance check (Not required)</b>				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
<b>IIIa. Initial calibration</b>				
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) ≤ 15% and relative response factors (RRF) > 0.05?	/			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of > 0.990?			/	
<b>IIIb. Initial Calibration Verification</b>				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) ≤ 20%?	/			
<b>IV. Continuing calibration</b>				
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) > 0.05?	/			
Were all percent differences (%D) < 50% for closing calibration verifications?	/			
<b>V. Laboratory Blanks</b>				
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?		/		
<b>VI. Field blanks</b>				
Were field blanks identified in this SDG?	/			
Were target compounds detected in the field blanks?		/		
<b>VII. Surrogate spikes</b>				
Were all surrogate percent differences (%R) within QC limits?	<del>NA</del>	/		
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?			/	
<b>VIII. Matrix spike/Matrix spike duplicates</b>				
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?				/
<b>IX. Laboratory control samples</b>				
Was an LCS analyzed per extraction batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
<b>X. Field duplicates</b>				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
<b>XI. Internal standards</b>				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	/			
Were retention times within + 10 seconds of the associated calibration standard?	/			
<b>XII. Compound quantitation</b>				
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 compound?	/			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
Did compound quantitation limits meet QAPP limits?	/			
<b>XIII. Target compound identification</b>				
Were relative retention times (RRT's) within + 0.06 RRT units of the standard?	/			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	/			
Were chromatogram peaks verified and accounted for?	/			
<b>XIV. System performance</b>				
System performance was found to be acceptable.	/			
<b>XV. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.	/			

## VALIDATION FINDINGS WORKSHEET

**METHOD: GC/MS SVOA**

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o'-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU. Benzo(b)thiophene	WWWW. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV. Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW. Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine



LDC #: 45972c2a

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: A

METHOD: GCMS 8270D

The calibration factors (RRFF), average RRFF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

$$RRF = (Ax)(Cis)/(Ais)(Cx)$$

average RRF = sum of the RRFs/number of standards

$$\%RSD = 100 * (S/X)$$

Where:

Ax = Area of compound

Cx = Concentration of compound

S = Standard deviation of the RRFs

X = Mean of the RRFs

Ais = Area of associated internal standard

Cis = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 50 ppb std)	Recalculated (RRF 50 ppbstd)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL -Yoda	8/6/2019	A	2.027	2.027	1.865	1.865	13	13

**VALIDATION FINDINGS WORKSHEET**  
**Continuing Calibration Results Verification**

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

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 =  $100 * (\text{ave. RRF} - \text{RRF}) / \text{ave. RRF}$   
 $\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF  
 RRF = continuing calibration RRF  
 $A_x$  = Area of compound,  
 $C_x$  = Concentration of compound,

$A_{is}$  = Area of associated internal standard  
 $C_{is}$  = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Internal Standard)	Average RRF (Initial)	Reported	Recalculated	Reported	Recalculated
					RRF (CC)	RRF (CC)	%D	%D
1	0822Y136 CW	8/30/19	A (1st IS)	1.865	1.851	1.851	0.76	0.76
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
2			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
3			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					

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

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Results Verification**

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

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

% Recovery: SF/SS \* 100

Where: SF = Surrogate Found  
SS = Surrogate Spiked

**Sample ID:** 3

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	125	124.45935	99.6	99.6	0
2-Fluorobiphenyl	125	99.91094	79.9	79.9	↓
Terphenyl-d14	125	92.56026	74.0	74.0	
Phenol-d5	250	218.51868	87.4	87.4	
2-Fluorophenol	250	218.90797	87.6	87.6	
2,4,6-Tribromophenol	250	197.11845	78.8	78.8	
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

**Sample ID:**

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

**Sample ID:**

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					



LDC #: 45972c2a

**VALIDATION FINDINGS WORKSHEET**

**Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification**

Reviewer: FT

2nd Reviewer: [Signature]

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

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

% Recovery = 100 \* (SC/SA)

Where: SSC = Spike concentration  
SA = Spike added

RPD = | LCSC - LCSDC | \* 2 / (LCSC + LCSDC)

LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: 190812B vs 1D

Compound	Spike Added (ug/L)		Spike Concentration (ug/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol	62.5	62.5	53.5	60.5	85.6	85.6	96.8	96.8	12.3	12.3
N-Nitroso-di-n-propylamine										
4-Chloro-3-methylphenol										
Acenaphthene										
Pentachlorophenol										
Pyrene										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.



## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** October 11, 2019

**Parameters:** Polynuclear Aromatic Hydrocarbons

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89749

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH869	AZ96499	Water	08/05/19
ERH870	AZ96500	Water	08/05/19
ERH874**	AZ96502**	Water	08/05/19
ERH876**	AZ96504**	Water	08/06/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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**

Sample ERH870 was identified as an equipment blank. No contaminants were found.

Sample ERH869 was identified as a field blank. 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. Compound Quantitation**

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

The system performance was acceptable for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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



**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification  
Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -  
SDG 89749**

No Sample Data Qualified in this SDG

LDC #: 45972C2b

**VALIDATION COMPLETENESS WORKSHEET**

Date: 9/22/19

SDG #: 89749

Level C/D

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: [Signature]  
2nd Reviewer: [Signature]

**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	Δ	
III.	Initial calibration/ICV	A/A	% PSD ≤ 15      ICV ≤ 20
IV.	Continuing calibration /ending	Δ	CV ≤ 20 / 30
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	FB = 1      EB = 2
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	CS 10
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	Δ	Not reviewed for Level C validation
XIII.	Target compound identification	Δ	Not reviewed for Level C validation
XIV.	System performance	Δ	Not reviewed for Level C validation
XV.	Overall assessment of data	A	

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

\*\*Indicates sample underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH869	AZ96499	Water	08/05/19
2	ERH870	AZ96500	Water	08/05/19
3	ERH874**	AZ96502**	Water	08/05/19
4	ERH876**	AZ96504**	Water	08/06/19
5				
6				
7				
8				

Notes:

190812B				

TTT, W, S

LDC #: 45972cab

## VALIDATION FINDINGS CHECKLIST

Page: 1 of 2  
Reviewer: FR  
2nd Reviewer: FR

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

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
<b>II. GC/MS Instrument performance check (Not required)</b>				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
<b>IIIa. Initial calibration</b>				
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) $\leq$ 15% and relative response factors (RRF) $>$ 0.05?	/			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of $>$ 0.990?			/	
<b>IIIb. Initial Calibration Verification</b>				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) $\leq$ 20%?	/			
<b>IV. Continuing calibration</b>				
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) $>$ 0.05?	/			
Were all percent differences (%D) $<$ 50% for closing calibration verifications?	/			
<b>V. Laboratory Blanks</b>				
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?		/		
<b>VI. Field blanks</b>				
Were field blanks identified in this SDG?	/			
Were target compounds detected in the field blanks?		/		
<b>VII. Surrogate spikes</b>				
Were all surrogate percent differences (%R) within QC limits?	/			
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?			/	
<b>VIII. Matrix spike/Matrix spike duplicates</b>				
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?				/
<b>IX. Laboratory control samples</b>				
Was an LCS analyzed per extraction batch?				/
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?				/
<b>X. Field duplicates</b>				
Were field duplicate pairs identified in this SDG?				/
Were target compounds detected in the field duplicates?				/
<b>XI. Internal standards</b>				
Were internal standard area counts within -50% or +100% of the associated calibration standard?				/
Were retention times within + 10 seconds of the associated calibration standard?				/
<b>XII. Compound quantitation</b>				
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 compound?				/
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?				/
Did compound quantitation limits meet QAPP limits?				/
<b>XIII. Target compound identification</b>				
Were relative retention times (RRT's) within + 0.06 RRT units of the standard?				/
Did compound spectra meet specified EPA "Functional Guidelines" criteria?				/
Were chromatogram peaks verified and accounted for?				/
<b>XIV. System performance</b>				
System performance was found to be acceptable.				/
<b>XV. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.				/

## VALIDATION FINDINGS WORKSHEET

**METHOD: GC/MS SVOA**

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o"-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU.. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU. Benzo(b)thiophene	WWWW.. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV. Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW. Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine

LDC #: 45972026

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: [Signature]

METHOD: GCMS 8270D

The calibration factors (RRFF), average RRFF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

$$\text{RRF} = (\text{Ax})(\text{Cis})/(\text{Ais})(\text{Cx})$$

average RRF = sum of the RRFs/number of standards

$$\% \text{RSD} = 100 * (\text{S}/\text{X})$$

Where:

Ax = Area of compound

Cx = Concentration of compound

S = Standard deviation of the RRFs

X = Mean of the RRFs

Ais = Area of associated internal standard

Cis = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 5 ppb std)	Recalculated (RRF5 ppb std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL Yoda	9/10/2019	S	1.2470	1.2472	1.2350	1.2350	9.3	9.3

LDC #: 45972 c26

**VALIDATION FINDINGS WORKSHEET**  
**Continuing Calibration Results Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: ↑

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

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 =  $(A_x)(C_{is}) / (A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF  
 RRF = continuing calibration RRF  
 $A_x$  = Area of compound,  
 $C_x$  = Concentration of compound,

$A_{is}$  = Area of associated internal standard  
 $C_{is}$  = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Internal Standard)	Average RRF (Initial)	Reported	Recalculated	Reported	Recalculated
					RRF (CC)	RRF (CC)	%D	%D
1	ccv 0830L003	8/30/19	S (1st IS)	1.235	1.183	1.183	4.2	4.2
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
2			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
3			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					

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

LDC #: 45972c2b

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Results Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd reviewer: X

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

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

% Recovery: SF/SS \* 100

Where: SF = Surrogate Found  
 SS = Surrogate Spiked

Sample ID: #3

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5 <u>W-d10</u>	<u>6.250</u>	<u>5.9235</u>	<u>94.8</u>	<u>94.8</u>	<u>0</u>
2-Fluorobiphenyl <u>Y-d10</u>	<u>↓</u>	<u>6.4487</u>	<u>103</u>	<u>103</u>	<u>0</u>
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					







## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** October 11, 2019

**Parameters:** 2-(2-Methoxyethoxy)-ethanol

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89749

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH869	AZ96499	Water	08/05/19
ERH870	AZ96500	Water	08/05/19
ERH874**	AZ96502**	Water	08/05/19
ERH876**	AZ96504**	Water	08/06/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

2-(2-Methoxyethoxy)-ethanol by Environmental Protection Agency (EPA) SW 846 Method 8270D Modified

All sample results were subjected to Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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.

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.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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**

Sample ERH870 was identified as an equipment blank. No contaminants were found.

Sample ERH869 was identified as a field blank. No contaminants were found.

## **VII. Surrogates**

Surrogates were not added to all samples as required by the method. Using professional judgment, no data were qualified, since the LCS/LCSD percent recoveries were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis with the exception of sample ERH876\*\*. Using professional judgment, no data were qualified when one surrogate %R was outside the QC limits and the %R was greater than or equal to 10%.

## **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. Compound Quantitation**

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

The system performance was acceptable for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.



**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -  
SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG  
89749**

No Sample Data Qualified in this SDG

LDC #: 45972C2c  
 SDG #: 89749  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/22/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-Modified)

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 Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	A Δ	1 <sup>2</sup> 1CV ≤ 20
IV.	Continuing calibration <i>pending</i>	Δ	CCV ≤ 20   50
V.	Laboratory Blanks	D	
VI.	Field blanks	ND	FB = 1 EB = 2
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	Δ	LOSID
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	Δ	Not reviewed for Level C validation
XIII.	Target compound identification	Δ	Not reviewed for Level C validation
XIV.	System performance	Δ	Not reviewed for Level C validation
XV.	Overall assessment of data	A	

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

\*\*Indicates sample underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH869	AZ96499	Water	08/05/19
2	ERH870	AZ96500	Water	08/05/19
3	ERH874**	AZ96502**	Water	08/05/19
4	ERH876**	AZ96504**	Water	08/06/19
5				
6				
7				
8				

Notes:

19082A - BIK				

LDC #: 45972 C2C

## VALIDATION FINDINGS CHECKLIST

Page: 1 of 1  
Reviewer: FJ  
2nd Reviewer: A

Method: PAH (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
Were all technical holding times met?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was cooler temperature criteria met?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>II. GC/MS Instrument performance check (Not required)</b>				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all samples analyzed within the 12 hour clock criteria?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>IIIa. Initial calibration</b>				
Did the laboratory perform a 5 point calibration prior to sample analysis?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent relative standard deviations (%RSD) $\leq$ 15% and relative response factors (RRF) $>$ 0.05?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of $>$ 0.990?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>IIIb. Initial Calibration Verification</b>				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) $\leq$ 20%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>IV. Continuing calibration</b>				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) $<$ 20% and relative response factors (RRF) $>$ 0.05?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) $<$ 50% for closing calibration verifications?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>V. Laboratory Blanks</b>				
Was a laboratory blank associated with every sample in this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was a laboratory blank analyzed for each matrix and concentration?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was there contamination in the laboratory blanks?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>VI. Field blanks</b>				
Were field blanks identified in this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were target compounds detected in the field blanks?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
<b>VII. Surrogate spikes</b>				
Were all surrogate percent differences (%R) within QC limits?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
If any percent recoveries (%R) was less than 10 percent, was a reanalysis performed to confirm %R?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
<b>VIII. Matrix spike/Matrix spike duplicates</b>				
Were matrix spike (MS) and matrix spike duplicate (MSD) analyzed in this SDG?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

LDC #: 45972c 2e

**VALIDATION FINDINGS CHECKLIST**

Page: 2 of 2  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?				/
<b>IX. Laboratory control samples</b>				
Was an LCS analyzed per extraction batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
<b>X. Field duplicates</b>				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
<b>XI. Internal standards</b>				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	/			
Were retention times within + 10 seconds of the associated calibration standard?	/			
<b>XII. Compound quantitation</b>				
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 compound?	/			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
Did compound quantitation limits meet QAPP limits?	/			
<b>XIII. Target compound identification</b>				
Were relative retention times (RRT's) within $\pm 0.06$ RRT units of the standard?	/			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	/			
Were chromatogram peaks verified and accounted for?	/			
<b>XIV. System performance</b>				
System performance was found to be acceptable.	/			
<b>XV. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.	/			

## VALIDATION FINDINGS WORKSHEET

**METHOD: GC/MS SVOA**

A. Phenol	CC. Dimethylphthalate	EEE. Bis(2-ethylhexyl)phthalate	GGGG. C30-Hopane	I1. Methyl methanesulfonate
B. Bis (2-chloroethyl) ether	DD. Acenaphthylene	FFF. Di-n-octylphthalate	HHHH. 1-Methylphenanthrene	J1. Ethyl methanesulfonate
C. 2-Chlorophenol	EE. 2,6-Dinitrotoluene	GGG. Benzo(b)fluoranthene	IIII. 1,4-Dioxane	K1. o,o',o"-Triethylphosphorothioate
D. 1,3-Dichlorobenzene	FF. 3-Nitroaniline	HHH. Benzo(k)fluoranthene	JJJJ. Acetophenone	L1. n-Phenylene diamine
E. 1,4-Dichlorobenzene	GG. Acenaphthene	III. Benzo(a)pyrene	KKKK. Atrazine	M1. 1,4-Naphthoquinone
F. 1,2-Dichlorobenzene	HH. 2,4-Dinitrophenol	JJJ. Indeno(1,2,3-cd)pyrene	LLLL. Benzaldehyde	N1. N-Nitro-o-toluidine
G. 2-Methylphenol	II. 4-Nitrophenol	KKK. Dibenz(a,h)anthracene	MMMM. Caprolactam	O1. 1,3,5-Trinitrobenzene
H. 2,2'-Oxybis(1-chloropropane)	JJ. Dibenzofuran	LLL. Benzo(g,h,i)perylene	NNNN. 2,6-Dichlorophenol	P1. Pentachlorobenzene
I. 4-Methylphenol	KK. 2,4-Dinitrotoluene	MMM. Bis(2-Chloroisopropyl)ether	OOOO. 1,2-Diphenylhydrazine	Q1. 4-Aminobiphenyl
J. N-Nitroso-di-n-propylamine	LL. Diethylphthalate	NNN. Aniline	PPPP. 3-Methylphenol	R1. 2-Naphthylamine
K. Hexachloroethane	MM. 4-Chlorophenyl-phenyl ether	OOO. N-Nitrosodimethylamine	QQQQ. 3&4-Methylphenol	S1. Triphenylene
L. Nitrobenzene	NN. Fluorene	PPP. Benzoic Acid	RRRR. 4-Dimethyldibenzothiophene (4MDT)	T1. Octachlorostyrene
M. Isophorone	OO. 4-Nitroaniline	QQQ. Benzyl alcohol	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	U1. Famphur
N. 2-Nitrophenol	PP. 4,6-Dinitro-2-methylphenol	RRR. Pyridine	TTTT. 1-Methyldibenzothiophene (1MDT)	V1. 1,4-phenylenediamine
O. 2,4-Dimethylphenol	QQ. N-Nitrosodiphenylamine	SSS. Benzidine	UUUU. 2,3,4,6-Tetrachlorophenol	W1. Methapyrilene
P. Bis(2-chloroethoxy)methane	RR. 4-Bromophenyl-phenylether	TTT. 1-Methylnaphthalene	VVVV. 1,2,4,5-Tetrachlorobenzene	X1. Pentachloroethane
Q. 2,4-Dichlorophenol	SS. Hexachlorobenzene	UUU. Benzo(b)thiophene	WWWWW. 2-Picoline	Y1. 3,3'-Dimethylbenzidine
R. 1,2,4-Trichlorobenzene	TT. Pentachlorophenol	VVV. Benzonaphthothiophene	XXXX. 3-Methylcholanthrene	Z1. o-Toluidine
S. Naphthalene	UU. Phenanthrene	WWW. Benzo(e)pyrene	YYYY. a,a-Dimethylphenethylamine	A2. 1-Naphthylamine
T. 4-Chloroaniline	VV. Anthracene	XXX. 2,6-Dimethylnaphthalene	ZZZZ. Hexachloropropene	B2. 4-Aminobiphenyl
U. Hexachlorobutadiene	WW. Carbazole	YYY. 2,3,5-Trimethylnaphthalene	A1. N-Nitrosodiethylamine	C2. 4-Nitroquinoline-1-oxide
V. 4-Chloro-3-methylphenol	XX. Di-n-butylphthalate	ZZZ. Perylene	B1. N-Nitrosodi-n-butylamine	D2. Hexachloropene
W. 2-Methylnaphthalene	YY. Fluoranthene	AAAA. Dibenzothiophene	C1. N-Nitrosomethylethylamine	E2. Bis (2-chloro-1-methylethyl) ether
X. Hexachlorocyclopentadiene	ZZ. Pyrene	BBBB. Benzo(a)fluoranthene	D1. N-Nitrosomorpholine	F2. Bifenthrin
Y. 2,4,6-Trichlorophenol	AAA. Butylbenzylphthalate	CCCC. Benzo(b)fluorene	E1. N-Nitrosopyrrolidine	G2. Cyfluthrin
Z. 2,4,5-Trichlorophenol	BBB. 3,3'-Dichlorobenzidine	DDDD. cis/trans-Decalin	F1. Phenacetin	H2. Cypermethrin
AA. 2-Chloronaphthalene	CCC. Benzo(a)anthracene	EEEE. Biphenyl	G1. 2-Acetylaminofluorene	I2. Permethrin (cis/trans)
BB. 2-Nitroaniline	DDD. Chrysene	FFFF. Retene	H1. Pronamide	J2. 5-Nitro-o-toluidine



LDC#: 45972 C2c  
 SDG#: mu cover

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: E7  
 2nd Reviewer: D

Method: 8270DM

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
4/30/2019	GCMS	2MEE	1	0.106871511	1.25
			2	2.145481715	12.5
			3	0.26773905	2.5
			4	0.600877104	5
			5	1.690411442	10
			6	2.265311117	15
			7	3.361865753	20
			8	3.931100065	25

**Regression Output**

**Reported**

Constant	-0.106670	-0.107000
Std Err of Y Est		
R Squared	0.991819	0.992000
Degrees of Freedom		
X Coefficient(s)	0.166828	0.167000
Std Err of Coef.		
Correlation Coefficient	0.995901	
Coefficient of Determination (r <sup>2</sup> )	0.991819	0.992000

LDC #: 45972 C2C

**VALIDATION FINDINGS WORKSHEET**  
**Continuing Calibration Results Verification**

Page: 1 of 1

Reviewer: FT

2nd Reviewer: [Signature]

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

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 =  $100 * (\text{ave. RRF} - \text{RRF}) / \text{ave. RRF}$   
 $\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF  
 RRF = continuing calibration RRF  
 $A_x$  = Area of compound,  
 $C_x$  = Concentration of compound,

$A_{is}$  = Area of associated internal standard  
 $C_{is}$  = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Internal Standard)	Average RRF (Initial)	Reported	Recalculated	Reported	Recalculated
					RRF (CC)	RRF (CC)	%D	%D
1	08194003 ccv	8/19/19	2-(-2 ME)-E (L) (1st IS)	500.0	401.95299	401.95299	20.0	19.61
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
2			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
3			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					

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



LDC #: 4597202c

**VALIDATION FINDINGS WORKSHEET**

**Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification**

Reviewer: FT  
 2nd Reviewer: ↑

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

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

% Recovery = 100 \* (SC/SA)

Where: SSC = Spike concentration  
 SA = Spike added

RPD = | LCSC - LCSDC | \* 2 / (LCSC + LCSDC)

LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: 190812A resid

Compound	Spike Added (ug/L)		Spike Concentration (ug/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol										
N-Nitroso-di-n-propylamine										
4-Chloro-3-methylphenol										
Acenaphthene										
Pentachlorophenol										
Pyrene										
<u>2-(2-ME)-E</u>	<u>80.0</u>	<u>80.0</u>	<u>73.1</u>	<u>65.8</u>	<u>91.4</u>	<u>91.4</u>	<u>82.3</u>	<u>82.3</u>	<u>10.5</u>	<u>10.5</u>

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

## VALIDATION FINDINGS WORKSHEET

### Sample Calculation Verification

**METHOD:** GC/MS BNA (EPA SW 846 Method 8270<sup>D</sup>)

Y N N/A      Were all reported results recalculated and verified for all level IV samples?  
Y N N/A      Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

$$\text{Concentration} = \frac{(A_x)(I_s)(V_i)(DF)(2.0)}{(A_s)(RRF)(V_o)(V_i)(\%S)}$$

- A<sub>x</sub> = Area of the characteristic ion (EICP) for the compound to be measured
- A<sub>s</sub> = Area of the characteristic ion (EICP) for the specific internal standard
- I<sub>s</sub> = Amount of internal standard added in nanograms (ng)
- V<sub>o</sub> = Volume or weight of sample extract in milliliters (ml) or grams (g).
- V<sub>i</sub> = Volume of extract injected in microliters (ul)
- V<sub>t</sub> = Volume of the concentrated extract in microliters (ul)
- Df = Dilution Factor.
- %S = Percent solids, applicable to soil and solid matrices only.
- 2.0 = Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 190812A LCS : 2-(2-ME)E

$$\text{Conc.} = \frac{\left( \frac{43847}{220995} + 0.106670 \right) (40)}{(0.166828)}$$

$$= 73.1$$

#	Sample ID	Compound	Reported Concentration ( <u>ug/L</u> )	Calculated Concentration ( <u>ug/L</u> )	Qualification
	<u>LCS</u>	<u>2-(2-ME)E</u>	<u>73.1</u>	<u>73.1</u>	

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 19, 2019

**Parameters:** Metals

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89749

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH874**	AZ96502**	Water	08/05/19
ERH876	AZ96504	Water	08/06/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Calcium, Magnesium, Manganese, Potassium, and Sodium by Environmental Protection Agency (EPA) SW 846 Method 6010C

All sample results were subjected to Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is  $<0.995$ .
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

## II. Instrument Calibration

Initial and continuing calibrations were performed as required by the method.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

## III. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

## 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	Analyte	Maximum Concentration	Associated Samples
ICB/CCB	Manganese	1.32 ug/L	All samples in SDG 89749

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated 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. Serial Dilution**

Serial dilution was 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. Sample Result Verification**

All sample result verifications were acceptable for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### **XII. Overall Assessment of Data**

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



**Red Hill Bulk Storage Facility, CTO 18F0126  
Metals - Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Metals - Laboratory Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Metals - Field Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

LDC #: 45972C4b  
 SDG #: 89749  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** Metals (EPA SW 846 Method 6010C)

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.	Instrument Calibration	A	
III.	ICP Interference Check Sample (ICS) Analysis	A	
IV.	Laboratory Blanks	SW	
V.	Field Blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Serial Dilution	N	
IX.	Laboratory control samples	A	LCS/D
X.	Field Duplicates	N	
XI.	Sample Result Verification	A	Not reviewed for Level C validation
XII.	Overall Assessment of Data	A	

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

\*\*Indicates sample underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH874**	AZ96502**	Water	08/05/19
2	ERH876	AZ96504	Water	08/06/19
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Method: Metals (EPA SW 846 Method 6010/6020/7000)

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
All technical holding times were met.	/			
Cooler temperature criteria was met.	/			
<b>II. ICP/MS Tune</b>				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?			/	
Were %RSD of isotopes in the tuning solution $\leq 5\%$ ?			/	
<b>III. Calibration</b>				
Were all instruments calibrated daily, each set-up time?	/			
Were the proper number of standards used?	/			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury) QC limits?	/			
Were the low standard checks within <del>80-130%</del> <sup>80-120</sup> 130%?	/			
Were all initial calibration correlation coefficients within limits as specified by the method?	/			
<b>IV. Blanks</b>				
Was a method blank associated with every sample in this SDG?	/			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	/			
<b>V. ICP Interference Check Sample</b>				
Were ICP interference check samples performed daily?	/			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	/			
<b>VI. Matrix spike/Matrix spike duplicates</b>				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.			/	
Were the MS/MSD or duplicate relative percent differences (RPD) $\leq 20\%$ for waters and $\leq 35\%$ for soil samples? A control limit of $\pm 2X$ RL ( $\pm 2X$ RL for soil) was used for samples that were $\leq 5X$ the RL, including when only one of the duplicate sample values were $< 5X$ the RL.			/	
<b>VII. Laboratory control samples</b>				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per extraction batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% QC limits for water samples and laboratory established QC limits for soils?	/			DD

LDC #: 45972046

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2  
 Reviewer: OR  
 2nd Reviewer: JA

Validation Area	Yes	No	NA	Findings/Comments
<b>VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)</b>				
Were all the percent recoveries (%R) within the 30-120% (6020)/60-125% (200.8) of the intensity of the internal standard in the associated initial calibration?			/	
If the %Rs were outside the criteria, was a reanalysis performed?			/	
<b>IX. ICP Serial Dilution</b>				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the MDL (ICP)/>100X the MDL(ICP/MS)?			/	
Were all percent differences (%Ds) < 10%?			/	
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.			/	
<b>X. Sample Result Verification</b>				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
<b>XI. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.	/			
<b>XII. Field duplicates</b>				
Field duplicate pairs were identified in this SDG.		/		
Target analytes were detected in the field duplicates.			/	
<b>XIII. Field blanks</b>				
Field blanks were identified in this SDG.		/		
Target analytes were detected in the field blanks.			/	



LDC #: 45972C4b

**VALIDATION FINDINGS WORKSHEET**  
**PB/ICB/CCB QUALIFIED SAMPLES**

Page: 1 of 1  
Reviewer: [Signature]  
2nd Reviewer: [Signature]

**METHOD:** Trace metals (EPA SW 864 Method 6010B/6020/7000)

Soil preparation factor applied: \_\_\_\_\_

Sample Concentration units, unless otherwise noted: ug/L Associated Samples: All

				Sample Identification															
Analyte	Maximum PB <sup>a</sup> (ug/L)	Maximum ICB/CCB <sup>a</sup> (ug/L)	Action Level	No qualifiers															
Mn		1.32																	

Note : a - The listed analyte concentration is the highest ICB, CCB, or PB detected in the analysis of each element.

LDC #: 4597246

**VALIDATION FINDINGS WORKSHEET**  
**Initial and Continuing Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: AL  
 2nd Reviewer: AC

**METHOD:** Trace metals (EPA SW 846 Method 6010/6020/7000)

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

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

Where, Found = concentration (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution  
 True = concentration (in ug/L) of each analyte in the ICV or CCV source

Standard ID	Type of Analysis	Element	Found (ug/L)	True (ug/L)	Recalculated	Reported	Acceptable (Y/N)
					%R	%R	
ICV	ICP (Low Level calibration)	Mn	10.62	10	106	106	Y
	ICP/MS (Low Level calibration)						
ICV	ICP (Initial calibration) 10.44	Mg	13150	12500	105	105	Y
	ICP/MS (Initial calibration)						
	CVAA (Initial calibration)						
CCV	ICP (Continuing calibration) 12.52	Na	9189	9375	98.0	98.0	Y
	ICP/MS (Continuing calibration)						
	CVAA (Continuing calibration)						

ICP-MS TUNE	Calculation	Mass	Actual (Mean Counts / Axis)	Required (Counts / Axis)	Recalculated %RSD	Acceptable (Y/N)
	Mass Axis			± 0.1 AMU	NA	
	%RSD			≤ 5% RSD		

Comments:

LDC #: 45972C46

**VALIDATION FINDINGS WORKSHEET**  
**Level IV Recalculation Worksheet**

Page: 1 of 1  
Reviewer: [Signature]  
2nd Reviewer: [Signature]

**METHOD:** Trace Metals (EPA SW 846 Method 6010/6020/7000)

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

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

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

$$\%D = \frac{|I-SDR|}{I} \times 100$$
 Where, I = Initial Sample Result (mg/L)  
 SDR = Serial Dilution Result (mg/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I (units)	True / D / SDR (units)	Recalculated	Reported	Acceptable (Y/N)
					%R / RPD / %D	%R / RPD / %D	
IC5AB	ICP interference check	Mn	257.7	250	103	103	Y
LCS	Laboratory control sample	Mn	255.4	250	102	102	Y
	Matrix spike		(SSR-SR)				
	Duplicate						
	Post digestion spike						
	ICP serial dilution						

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_





**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 19, 2019

**Parameters:** Wet Chemistry

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89749

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH874**	AZ96502**	Water	08/05/19
ERH876	AZ96504	Water	08/06/19
ERH876DL	AZ96504DL	Water	08/06/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Alkalinity by Standard Method 2320B

Bromide, Chloride, Fluoride, Nitrate as Nitrogen, and Sulfate by Environmental Protection Agency (EPA) Method 300.0

Dissolved Organic Carbon and Total Organic Carbon by EPA SW 846 Method 9060A

Ferrous Iron by Standard Method 3500-Fe B

Nitrate/Nitrite as Nitrogen by EPA Method 353.2

Silica and Dissolved Silica by Standard Method 4500-Si D

All sample results were subjected to Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is <0.995.
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

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

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
ERH874**	Nitrate as N	176 hours	48 hours	J (all detects)	P
ERH874** ERH876	Ferrous iron	8 days	7 days	UJ (all non-detects)	P
ERH876	Nitrate as N	177 hours	48 hours	J (all detects)	P

## II. Initial Calibration

All criteria for the initial calibration of each method were met.

## III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable with the following exceptions:

Date	Lab. Reference/ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
08/13/19	CCV (15:33)	Ferrous iron	84.1 (90-110)	ERH874** ERH876	UJ (all non-detects)	P

## IV. Laboratory Blanks

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

Blank ID	Analyte	Maximum Concentration	Limit of Quantitation	Associated Samples
PB (prep blank)	Bicarbonate alkalinity Total alkalinity	2.0 mg/L 2.0 mg/L	2.0 mg/L 2.0 mg/L	ERH874** ERH876
ICB/CCB	Nitrate/Nitrite as N	0.030 mg/L	0.10 mg/L	ERH874** ERH876

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated 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. Sample Result Verification**

All sample result verifications were acceptable for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

**XI. Overall Assessment of Data**

The analysis was conducted within all specifications of the methods.

In the case where more than one result was reported for an individual sample, the least technically acceptable results were deemed unusable as follows:

Sample	Analyte	Reason	Flag	A or P
ERH876	Chloride	Results exceeded calibration range.	R	A

Due to technical holding time and continuing calibration %R, data were qualified as estimated in two samples.



**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Data Qualification Summary - SDG 89749**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH874** ERH876	Nitrate as N	J (all detects)	P	Technical holding times (H)
ERH874** ERH876	Ferrous iron	UJ (all non-detects)	P	Technical holding times (H)
ERH874** ERH876	Ferrous iron	UJ (all non-detects)	P	Continuing calibration (%R) (R)
ERH876	Chloride	R	A	Overall assessment of data (D)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Field Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

LDC #: 45972C6  
 SDG #: 89749  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C/D

Date: 9/19/19

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

**METHOD: (Analyte)** Alkalinity (SM2320B), Bromide, Chloride, Fluoride, Nitrate as N, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B), Nitrate/Nitrite-N (EPA Method 353.2), Silica (SM 4500-Si D), Dissolved Silica (SM 4500-SiD), DOC (EPA SW 846 Method 9060A), TOC (EPA SW 846 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 SW	
II.	Initial calibration	A	
III.	Calibration verification	SW	
IV.	Laboratory Blanks	SW	
V.	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A SW	LCS/D
IX.	Field duplicates	N	
X.	Sample result verification	SW	Not reviewed for Level C validation
XI.	Overall assessment of data	SW	

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

\*\*Indicates sample underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH874**	AZ96502**	Water	08/05/19
2	ERH876	AZ96504	Water	08/06/19
3	ERH876DL	AZ96504DL	Water	08/06/19
4				
5				
6				
7				
8				
9				
10				

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Method: Inorganics (EPA Method See over)

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
All technical holding times were met.		✓		
<b>II. Calibration</b>				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients $\geq 0.995$ ?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?		✓		
Were titrant checks performed as required? (Level IV only)			✓	
Were balance checks performed as required? (Level IV only)			✓	
<b>III. Blanks</b>				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
<b>IV. Matrix spike/Matrix spike duplicates and Duplicates</b>				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.			✓	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.			✓	
Were the MS/MSD or duplicate relative percent differences (RPD) $\leq 20\%$ for waters and $\leq 35\%$ for soil samples? A control limit of $\leq \text{CRDL}$ ( $\leq 2\text{X CRDL}$ for soil) was used for samples that were $\leq 5\text{X}$ the CRDL, including when only one of the duplicate sample values were $\leq 5\text{X}$ the CRDL.			✓	
<b>V. Laboratory control samples</b>				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?		✓		
<b>VI. Regional Quality Assurance and Quality Control</b>				
Were performance evaluation (PE) samples performed?			✓	
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

45917066

LDC #: \_\_\_\_\_

**VALIDATION FINDINGS CHECKLIST**

Page: 2 of 2  
Reviewer: a  
2nd Reviewer: h

Validation Area	Yes	No	NA	Findings/Comments
<b>VII. Sample Result Verification</b>				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓	/		
Were detection limits < RL?	✓			
<b>VIII. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.	✓			
<b>IX. Field duplicates</b>				
Field duplicate pairs were identified in this SDG.		/		
Target analytes were detected in the field duplicates.			/	
<b>X. Field blanks</b>				
Field blanks were identified in this SDG.		/	/	
Target analytes were detected in the field blanks.			/	

LDC #: 459706

**VALIDATION FINDINGS WORKSHEET**  
**Sample Specific Analysis Reference**

Page: 1 of 1  
Reviewer: CR  
2nd reviewer: π

All circled methods are applicable to each sample.

Sample ID	Parameter
1,2	pH TDS <u>Cl</u> <u>F</u> <u>NO<sub>3</sub></u> <u>NO<sub>2</sub></u> <u>SO<sub>4</sub></u> O-PO <sub>4</sub> <u>Alk</u> <u>CN</u> <u>NH<sub>3</sub></u> <u>TKN</u> <u>TOC</u> Cr6+ ClO <sub>4</sub> <u>BO</u> <u>NO<sub>3</sub></u> <u>NO<sub>2</sub>-N</u> <u>SiO<sub>2</sub></u>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub> <u>D.SiO<sub>2</sub></u> <u>Fe<sup>3+</sup></u> <u>NO<sub>3</sub></u>
3	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>
	pH TDS Cl F NO <sub>3</sub> NO <sub>2</sub> SO <sub>4</sub> O-PO <sub>4</sub> Alk CN NH <sub>3</sub> TKN TOC Cr6+ ClO <sub>4</sub>

Comments: \_\_\_\_\_





LDC #: 45972C6

# VALIDATION FINDINGS WORKSHEET

## Blanks

Page: 1 of 1  
Reviewer: [Signature]  
2nd Reviewer: [Signature]

**METHOD:** Inorganics, Method See Cover

**Conc. units:** mg/L

**Associated Samples:** 1, 2

Analyte	Blank ID	Blank ID	Blank Action Limit													
	PB	ICB/CCB (mg/L)		No qualifiers												
Bicarbonate Alkalinity	2.0		10													
Total Alkalinity	2.0		10													
Nitrate/Nitrite as N		0.030														







LDC #: 4597266

**Validation Findings Worksheet  
Initial and Continuing Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

Method: Inorganics, Method See Cover

The correlation coefficient (r) for the calibration of TOC was recalculated. Calibration date: 8/11/19

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	Standard	Conc. (mg/L)	Area	Recalculated	Reported	Acceptable (Y/N)
					r or r <sup>2</sup>	r or r <sup>2</sup>	
Initial calibration	TOC	s1	0.0	1316906	0.9994	0.9987	Y
		s2	0.5	4509403			
		s3	1.25	10661265			
		s4	2.5	19817176			
		s5	3.75	28801267			
		s6	5	37233293			
Calibration verification	SO <sub>4</sub>	ICV	25	23.36	93.4	93.4	
Calibration verification	DOC	CCV	2.5	2.55	102.2	102.2	
Calibration verification	SiO <sub>2</sub>	CCV	4	371	92.7	92.7	

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 #: 4597266

**VALIDATION FINDINGS WORKSHEET**  
**Level IV Recalculation Worksheet**

Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** Inorganics, Method see over

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

$\%R = \frac{\text{Found}}{\text{True}} \times 100$     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 (units)	True / D (units)	Recalculated	Reported	Acceptable (Y/N)
					%R / RPD	%R / RPD	
<u>LCS</u>	Laboratory control sample	<u>Fe<sup>3+</sup></u>	<u>3.06</u>	<u>3.00</u>	<u>102</u>	<u>102</u>	<u>Y</u>
	Matrix spike sample		(SSR-SR)				
	Duplicate sample						

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

LDC #: 450706

**VALIDATION FINDINGS WORKSHEET**  
Sample Calculation Verification

Page: 1 of 1  
 Reviewer: DL  
 2nd reviewer: A

**METHOD:** Inorganics, Method see cal

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 Cl reported with a positive detect were recalculated and verified using the following equation:

Concentration =  
 $y = 0.111x - 0.128$

Recalculation:  
 $\frac{4.449 + 0.128}{0.111} = 40.08 \text{ mg/L}$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
	1	Br	0.44	0.44	Y
		Cl	40.0	40.0	
		NO <sub>3</sub> -N	2.4	2.4	
		SO <sub>4</sub>	10.0	10.0	
		NO <sub>3</sub> /NO <sub>2</sub> -N	0.44	0.44	
		TK	43.2	43.2	
		SiO <sub>2</sub>	43.1	43.1	
		D-SiO <sub>2</sub>	41.1	41.1	
		DOC	0.85	0.85	
		TOC	1.3	1.3	

Note: \_\_\_\_\_

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 23, 2019

**Parameters:** Gasoline Range Organics

**Validation Level:** Level C & D

**Laboratory:** APPL. Inc

**Sample Delivery Group (SDG):** 89749

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH868	AZ96498	Water	08/05/19
ERH869	AZ96499	Water	08/05/19
ERH870	AZ96500	Water	08/05/19
ERH873	AZ96501	Water	08/05/19
ERH874**	AZ96502**	Water	08/05/19
ERH875	AZ96503	Water	08/06/19
ERH876**	AZ96504**	Water	08/06/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 ERH868, ERH873, and ERH875 were identified as trip blanks. No contaminants were found.

Sample ERH870 was identified as an equipment blank. No contaminants were found.

Sample ERH869 was identified as a field blank. 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. Compound Quantitation**

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### **XI. Target Compound Identifications**

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Laboratory Blank Data Qualification Summary - SDG  
89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Field Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

LDC #: 45972C7  
 SDG #: 89749  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C/D

Date: 9/22/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**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 Δ	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	Δ/A	ICV ≤ 20
IV.	Continuing calibration	A	CW ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1 FB = 2 EB = 3
VII.	Surrogate spikes	A	= 4, 6
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LOQ ID
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	Δ	Not reviewed for Level C validation
XIII.	Target compound identification	Δ	Not reviewed for Level C validation
XIV.	System performance	Δ	Not reviewed for Level C validation
XV.	Overall assessment of data	A	

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

\*\*Indicates sample underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH868 TB	AZ96498	Water	08/05/19
2	ERH869 FB	AZ96499	Water	08/05/19
3	ERH870 EB	AZ96500	Water	08/05/19
4	ERH873 TB	AZ96501	Water	08/05/19
5	ERH874**	AZ96502**	Water	08/05/19
6	ERH875 TB	AZ96503	Water	08/06/19
7	ERH876**	AZ96504**	Water	08/06/19
8				

Notes:

1	190814 BM - BIK			
2	190816 CT - BIK			

**Method: Volatiles (EPA SW 846 Method 8260B)**

Validation Area	Yes	No	NA	Findings/Comments
<b>I. Technical holding times</b>				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
<b>II. GC/MS Instrument performance check</b>				
Were the BFB performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
<b>IIIa. Initial calibration</b>				
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 $\geq 0.990$ ?	/			
Were all percent relative standard deviations (%RSD) $\leq 30\%/15\%$ and relative response factors (RRF) $\geq 0.05$ ?			/	
<b>IIIb. Initial Calibration Verification</b>				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) $\leq 20\%$ ?	/			
<b>IV. Continuing calibration</b>				
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) $\leq 20\%$ and relative response factors (RRF) $\geq 0.05$ ?	/			
<b>V. Laboratory Blanks</b>				
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?		/		
<b>VI. Field blanks</b>				
Were field blanks were identified in this SDG?	/			
Were target compounds detected in the field blanks?		/		
<b>VII. Surrogate spikes</b>				
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?			/	

Validation Area	Yes	No	NA	Findings/Comments
<b>VIII. Matrix spike/Matrix spike duplicates</b>				
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?			/	
<b>IX. Laboratory control samples</b>				
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
<b>X. Field duplicates</b>				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
<b>XI. Internal standards</b>				
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?	/			
<b>XII. Compound quantitation</b>				
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 compound?	/			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
<b>XIII. Target compound identification</b>				
Were relative retention times (RRT's) within + 0.06 RRT units of the standard?	/			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	/			
Were chromatogram peaks verified and accounted for?	/			
<b>XIV. System performance</b>				
System performance was found to be acceptable.	/			
<b>XV. Overall assessment of data</b>				
Overall assessment of data was found to be acceptable.	/			

## TARGET COMPOUND WORKSHEET

### METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane
C. Vinyl choride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO. 1,1-Difluoroethane	O1. 3-Methylpentane
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3-Trimethylbutane
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methyl cyclohexane	T1. 2-Methylhexane
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.



LDC#: 4597207  
 SDG#: pu cover

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: FJ  
 2nd Reviewer: [Signature]

Method: GRO (8260B)

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
7/29/2019	GCMS Thor  TGAS729	Gasoline Range Organics	1	12.24301924	0.8
			2	11.20970848	2
			3	11.74544656	4
			4	15.45640785	12
			5	19.74361044	24
			6	22.43514501	32
			7	25.1823161	40

**Regression Output**

**Reported**

Constant	11.013053	11.000000
Std Err of Y Est		
R Squared	0.991020	0.991000
Degrees of Freedom		
X Coefficient(s)	0.356483	0.356000
Std Err of Coef.		
Correlation Coefficient	0.995500	
Coefficient of Determination (r <sup>2</sup> )	0.991020	

**VALIDATION FINDINGS WORKSHEET**  
**Continuing Calibration Results 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 =  $100 * (\text{ave. RRF} - \text{RRF}) / \text{ave. RRF}$   
 $\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF

RRF = continuing calibration RRF

A<sub>x</sub> = Area of compound,

A<sub>is</sub> = Area of associated internal standard

C<sub>x</sub> = Concentration of compound;

C<sub>is</sub> = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference internal Standard)	Average RRF (initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	0816T17 ceV 2002	8/17/19	GRD (1st internal standard)	300	251.70	251.70	16	16
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					
2			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					
3			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					
4			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
			(4th internal standard)					

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

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Results Verification**

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

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

% Recovery: SF/SS \* 100

Where: SF = Surrogate Found  
SS = Surrogate Spiked

Sample ID: #5

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene	<u>25.0</u>	<u>21.94561</u>	<u>87.4</u>	<u>87.4</u>	<u>0</u>

Sample ID: \_\_\_\_\_

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID: \_\_\_\_\_

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID: \_\_\_\_\_

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID: \_\_\_\_\_

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 45972c7

**VALIDATION FINDINGS WORKSHEET**  
**Laboratory Control Sample Results Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: [Signature]

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

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 \* SSC/SA

Where: SSC = Spiked sample concentration  
 SA = Spike added

RPD = | LCSC - LCSDC | \* 2 / (LCSC + LCSDC)

LCSC = Laboratory control sample concentration    LCSDC = Laboratory control sample duplicate concentration

LCS ID: 190816 ef ves 10

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
<del>GR0 1,1-Dichloroethene</del>	300	300	252	273	84.0	84.0	91.0	91.0	8.0	8.0
Trichloroethene										
Benzene										
Toluene										
Chlorobenzene										

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



## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** October 11, 2019

**Parameters:** Total Petroleum Hydrocarbons as Extractables

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89749

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH869	AZ96499	Water	08/05/19
ERH870	AZ96500	Water	08/05/19
ERH874**	AZ96502**	Water	08/05/19
ERH876**	AZ96504**	Water	08/06/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds 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 compounds, 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 compounds.

## **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 compounds.

## **IV. Laboratory Blanks**

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

## **V. Field Blanks**

Sample ERH870 was identified as an equipment blank. No contaminants were found.

Sample ERH869 was identified as a field blank. 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 with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
190812ALCS/D (All samples in SDG 89749)	Oil ( C24-C40)	-	114 (41-113)	NA	-

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

### IX. Field Duplicates

No field duplicates were identified in this SDG.

### X. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### XI. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### XII. Overall Assessment of Data

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -  
SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data  
Qualification Summary - SDG 89749**

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 89749**

No Sample Data Qualified in this SDG

LDC #: 45972C8

### VALIDATION COMPLETENESS WORKSHEET

Date: 9/22/19

SDG #: 89749

Level C/D

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: [Signature]

2nd Reviewer: [Signature]

**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 1A	
II.	Initial calibration/ICV	A 1A	% PSD ≤ 20, r <sup>2</sup> 1CV ≤ 20
III.	Continuing calibration	A	CV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	FB = 1 EB = 2
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	N	
VIII.	Laboratory control samples	SW	LES 10
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	A	Not reviewed for Level C validation
XI.	Target compound identification	A	Not reviewed for Level C 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 Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH869 FB	AZ96499	Water	08/05/19
2	ERH870 FB	AZ96500	Water	08/05/19
3	ERH874**	AZ96502**	Water	08/05/19
4	ERH876**	AZ96504**	Water	08/06/19
5				
6				
7				
8				
9				
10				

Notes:

190812 A BIK				

Method:  GC  HPLC

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

LDC #: 4597208

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2  
Reviewer: FT  
2nd Reviewer: AL

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





LDC #: 4597208

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: [Signature]

METHOD: GC X HPLC \_\_\_\_\_

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C  
average CF = sum of the CF/number of standards  
%RSD = 100 \* (S/X)

Where: A = Area of compound  
C = Concentration of compound  
S = Standard deviation of calibration factors  
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported ( std=250ppb)	Recalculated ( std=250ppb)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	9/11/2019	Diesel (C10-C24)	1790144	1790144	1845767	1845767	9.0	9.0

LDC #: 45972 *ej*

**VALIDATION FINDINGS WORKSHEET**  
**Continuing Calibration Results Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: *[Signature]*

METHOD: GC */* HPLC         

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

% Difference = 100 \* (ave. CF - CF)/ave.CF      Where: ave. CF = initial calibration average CF  
 CF = continuing calibration CF  
 A = Area of compound  
 C = Concentration of compound

#	Standard ID	Calibration Date	Compound	Average CF(ICAL)/ CCV Conc.	Reported	Recalculated	Reported	Recalculated
					CF/ Conc. CCV	CF/ Conc. CCV	%D	%D
1	ccv 1121 911046	9/12/19	Diesel Gp - C24	1845770	1906890	1906890	3.3	3.3
2								
3								
4								

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

LDC #: 4597208

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Results Verification**

Page: 1 of 1  
Reviewer: FT  
2nd reviewer: X

METHOD:  GC  HPLC

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

% Recovery: SF/SS \* 100

Where: SF = Surrogate Found  
SS = Surrogate Spiked

Sample ID: 3

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
Octacosane	-	75.0	93.172	124	124	0
o-Terphenyl	-	↓	75.869	101	101	0

Sample ID: \_\_\_\_\_

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

	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	2-Bromonaphthalene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Triphenyltin	AA	Chloro-octadecane
D	Bromochlorobenzene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin	BB	2,4-Dichlorophenylacetic acid
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate	CC	2,5-Dibromotoluene
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 4597208

**VALIDATION FINDINGS WORKSHEET**

Page: 1 of 1

**Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification**

Reviewer: FT

2nd Reviewer: [Signature]

METHOD: GC HPLC

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

%Recovery = 100 \* (SSC/SA)

RPD = ((SSCLCS - SSCLCSD) \* 2) / (SSCLCS + SSCLCSD) \* 100

Where SSC = Spiked sample concentration  
LCS = Laboratory Control Sample

SA = Spike added  
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: 19082A LCSD

Compound	Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS		LCSD		LCS/LCSD		
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD		
					Reported	Recalc.	Reported	Recalc.	Reported	Recalc.	
Gasoline (8015)			FT								
Diesel <u>10-64</u> (8015)	1250	1250	<del>1300</del> 1290	1300	103	103	104	104	0.77	0.77	
Benzene (8021B)											
Methane (RSK-175)											
2,4-D (8151)											
Dinoseb (8151)											
Naphthalene (8310)											
Anthracene (8310)											
HMX (8330)											
2,4,6-Trinitrotoluene (8330)											
Phorate (8141A)											
Malathion (8141A)											
Formaldehyde (8315A)											

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.



## Laboratory Data Consultants, Inc. Data Validation Report

**Project/Site Name:** Red Hill Bulk Storage Facility, CTO 18F0126  
**LDC Report Date:** September 23, 2019  
**Parameters:** Total Petroleum Hydrocarbons as Extractables  
**Validation Level:** Level C & D  
**Laboratory:** APPL, Inc.  
**Sample Delivery Group (SDG):** 89749

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH869	AZ96499	Water	08/05/19
ERH870	AZ96500	Water	08/05/19
ERH874**	AZ96502**	Water	08/05/19
ERH876**	AZ96504**	Water	08/06/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds 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 compounds, 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 compounds.

## **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 compounds.

## **IV. Laboratory Blanks**

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

## **V. Field Blanks**

Sample ERH870 was identified as an equipment blank. No contaminants were found.

Sample ERH869 was identified as a field blank. 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 with the following exceptions:

LCS ID (Associated Samples)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
190812ALCS/D (All samples in SDG 89749)	Oil ( C24-C40)	-	114 (41-113)	NA	-

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

### IX. Field Duplicates

No field duplicates were identified in this SDG.

### X. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### XI. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### XII. Overall Assessment of Data

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -  
SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data  
Qualification Summary - SDG 89749**

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 89749**

No Sample Data Qualified in this SDG

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 23, 2019

**Parameters:** Ethylene Dibromide

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89749

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH868	AZ96498	Water	08/05/19
ERH869	AZ96499	Water	08/05/19
ERH870	AZ96500	Water	08/05/19
ERH873	AZ96501	Water	08/05/19
ERH874**	AZ96502**	Water	08/05/19
ERH875	AZ96503	Water	08/06/19
ERH876	AZ96504	Water	08/06/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Ethylene Dibromide by Environmental Protection Agency (EPA) SW 846 Method 8011

All sample results were subjected to Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.



## **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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0%.

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 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 ERH868, ERH873, and ERH875 were identified as trip blanks. No contaminants were found.

Sample ERH870 was identified as an equipment blank. No contaminants were found.

Sample ERH869 was identified as a field blank. 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. Compound Quantitation**

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### **XI. Target Compound Identification**

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

### **XII. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Ethylene Dibromide - Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Ethylene Dibromide - Laboratory Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Ethylene Dibromide - Field Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

LDC #: 45972C10  
 SDG #: 89749  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/22/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC Ethylene Dibromide (EPA SW846 Method 8011)

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	0% PSD / ICV ≤ 20
III.	Continuing calibration	A	CW ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	TB = 4, 4    FB = 2    EB = 3
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LC > 10
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	A	Not reviewed for Level C validation
XI.	Target compound identification	A	Not reviewed for Level C validation
XII.	Overall assessment of data	A	

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

\*\*Indicates sample underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH868 TB	AZ96498	Water	08/05/19
2	ERH869 FB	AZ96499	Water	08/05/19
3	ERH870 EB	AZ96500	Water	08/05/19
4	ERH873 TB	AZ96501	Water	08/05/19
5	ERH874**	AZ96502**	Water	08/05/19
6	ERH875 TB	AZ96503	Water	08/06/19
7	ERH876	AZ96504	Water	08/06/19
8				
9				
10				
11				

Notes:

190812A-BIK				

Method:  GC  HPLC

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

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

LDC #: 45972 C/D

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
Reviewer: FT  
2nd Reviewer: [Signature]

METHOD: GC X HPLC \_\_\_\_\_

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C  
average CF = sum of the CF/number of standards  
%RSD = 100 \* (S/X)

Where: A = Area of compound  
C = Concentration of compound  
S = Standard deviation of calibration factors  
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound	Reported (CF4 std=0.5)	Recalculated (CF4 std=0.5)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	8/9/2019	EDB (DB-35MS)	691484	691484	671458	671458	8.5	8.5
	Herbie		EDB (DB-XLB)	2795296	2795296	3117057	3117057	10.0	10.0

LDC #: 45972 C10

**VALIDATION FINDINGS WORKSHEET**  
**Continuing Calibration Results Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: [Signature]

METHOD: GC      HPLC     

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

% Difference = 100 \* (ave. CF - CF)/ave.CF      Where: ave. CF = initial calibration average CF  
 CF = continuing calibration CF  
 A = Area of compound  
 C = Concentration of compound

#	Standard ID	Calibration Date	Compound	Average CF(ICAL)/ CCV Conc.	Reported	Recalculated	Reported	Recalculated
					CF/ Conc. CCV	CF/ Conc. CCV	%D	%D
1	0715282 CCV 1650	8/13/19	EDB DB 3SMS	671458	694222	694222	3.4	3.4
			↓ DB XLB	3117060	3156920	3156920	1.3	1.3
2	0715297 CCV 2154	8/13/19	↓	↓	682932	682932	1.7	1.7
					3071530	3071530	1.3	1.3
3								
4								

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



LDC #: 4597240

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Results Verification**

Page: 1 of 1  
Reviewer: FT  
2nd reviewer: OC

METHOD:  GC  HPLC

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

% Recovery: SF/SS \* 100

Where: SF = Surrogate Found  
SS = Surrogate Spiked

Sample ID: #5

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
<u>1,3-Dibromopropane</u>	<u>DB 35MS</u>	<u>0.346</u>	<u>0.324</u>	<u>93.7</u>	<u>93.64</u>	<u>0</u>

Sample ID: \_\_\_\_\_

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

	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	2-Bromonaphthalene
C	a,a,a-Trifluorotoluene	I	Fluorobenzene (FBZ)	O	Decachlorobiphenyl (DCB)	U	Triphenyltin	AA	Chloro-octadecane
D	Bromochlorobenzene	J	n-Triacontane	P	1-methylnaphthalene	V	Tri-n-propyltin	BB	2,4-Dichlorophenylacetic acid
E	1,4-Dichlorobutane	K	Hexacosane	Q	Dichlorophenyl Acetic Acid (DCAA)	W	Tributyl Phosphate	CC	2,5-Dibromotoluene
F	1,4-Difluorobenzene (DFB)	L	Bromobenzene	R	4-Nitrophenol	X	Triphenyl Phosphate		

LDC #: 4597240

**VALIDATION FINDINGS WORKSHEET**

Page: 1 of 1

**Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification**

Reviewer: FT

2nd Reviewer: [Signature]

METHOD:  GC  HPLC

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

%Recovery = 100 \* (SSC/SA)

RPD = (((SSCLCS - SSCLCSD) \* 2) / (SSCLCS + SSCLCSD)) \* 100

Where SSC = Spiked sample concentration  
LCS = Laboratory Control Sample

SA = Spike added  
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: 190812A 10510

Compound	Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)										
Benzene (8021B)										
Methane (RSK-175)										
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)										
2,4,6-Trinitrotoluene (8330)										
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										
<b>EDB</b>	<b>0.290</b>	<b>0.250</b>	<b>0.266</b>	<b>0.234</b>	<b>106</b>	<b>106</b>	<b>93.6</b>	<b>93.6</b>	<b>12.8</b>	<b>12.8</b>

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.



**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 23, 2019

**Parameters:** Methane

**Validation Level:** Level C & D

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89749

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH873	AZ96501	Water	08/05/19
ERH874**	AZ96502**	Water	08/05/19
ERH875	AZ96503	Water	08/06/19
ERH876	AZ96504	Water	08/06/19

\*\*Indicates sample underwent Level D 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Methane by Method RSK-175

All sample results were subjected to Level C 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 Level D 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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.

Retention time windows were established as required by the method for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

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 required frequencies.

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

Retention times in the calibration standards were within the established retention time windows for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **IV. Laboratory Blanks**

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

## **V. Field Blanks**

Samples ERH873 and ERH875 were identified as trip blanks. No contaminants were found.

## **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. 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.

## **VIII. Field Duplicates**

No field duplicates were identified in this SDG.

## **IX. Compound Quantitation**

All compound quantitations met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **X. Target Compound Identification**

All target compound identifications met validation criteria for samples which underwent Level D validation. Raw data were not reviewed for Level C validation.

## **XI. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Laboratory Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Field Blank Data Qualification Summary - SDG 89749**

No Sample Data Qualified in this SDG

LDC #: 45972C51  
 SDG #: 89749  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C/D

Date: 9/22/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC Methane (Method RSK-175)

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	
III.	Continuing calibration	Δ	
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 1, 3
VI.	Matrix spike/Matrix spike duplicates	N	CS
VII.	Laboratory control samples	A	KS 10
VIII.	Field duplicates	N	
IX.	Compound quantitation RL/LOQ/LODs	A	Not reviewed for Level C validation
X.	Target compound identification	A	Not reviewed for Level C validation
XI.	Overall assessment of data	A	

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

\*\*Indicates sample underwent Level D validation

	Client ID	Lab ID	Matrix	Date
1	ERH873 TB	AZ96501	Water	08/05/19
2	ERH874**	AZ96502**	Water	08/05/19
3	ERH875 TB	AZ96503	Water	08/06/19
4	ERH876	AZ96504	Water	08/06/19
5				
6				
7				
8				
9				
10				

Notes:

190913A				

Method:  GC  HPLC

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

LDC #: 4597205

**VALIDATION FINDINGS CHECKLIST**

Page: 2 of 2  
 Reviewer: FT  
 2nd Reviewer: [Signature]

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

LDC#: 45972051  
 SDG#: su cover

**VALIDATION FINDINGS WORKSHEET**  
**Initial Calibration Calculation Verification**

Page: 1 of 1  
 Reviewer: FZ  
 2nd Reviewer: SR

Method: RSK 175

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
6/18/2019	Ints 7890	Methane	1	15338	2.080
			2	21752	4.160
			3	29757	8.340
			4	101573	20.850
			5	435711	83.400
			6	1167694	208.500
			7	4416985	834.000

**Regression Output**

**Reported**

Constant	3638.647460	3640.00
Std Err of Y Est		
R Squared	0.999738	1.000000
Degrees of Freedom		
X Coefficient(s)	5307.138770	5310.00
Std Err of Coef.		
Correlation Coefficient	0.999869	
Coefficient of Determination (r <sup>2</sup> )	0.999738	1.000000

LDC #: 45972 (5)

**VALIDATION FINDINGS WORKSHEET**  
**Continuing Calibration Results Verification**

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: [Signature]

METHOD: GC  HPLC

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

% Difference =  $100 * (\text{ave. CF} - \text{CF}) / \text{ave. CF}$       Where: ave. CF = initial calibration average CF  
 CF = continuing calibration CF  
 A = Area of compound  
 C = Concentration of compound

#	Standard ID	Calibration Date	Compound	Average CF(ICAL)/ CCV Conc.	Reported	Recalculated	Reported	Recalculated
					CF/ Conc. CCV	CF/ Conc. CCV	%D	%D
1	19081301 ccv	8/13/19	Methane	83.40	94.673	94.673	14	14
2								
3								
4								

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

LDC #: 45972 05/

**VALIDATION FINDINGS WORKSHEET**

Page: 1 of 1

**Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification**

Reviewer: FT  
2nd Reviewer: [Signature]

METHOD: GC HPLC

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

%Recovery = 100 \* (SSC/SA)

RPD = (((SSCLCS - SSCLCSD) \* 2) / (SSCLCS + SSCLCSD)) \* 100

Where SSC = Spiked sample concentration  
LCS = Laboratory Control Sample

SA = Spike added  
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: 190813A les 10

Compound	Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)										
Benzene (8021B)										
Methane (RSK-175)	83.4	83.4	94.7	104	114	114	125	125	9.4	9.4
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)										
2,4,6-Trinitrotoluene (8330)										
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.





**Red Hill Bulk Storage Facility, CTO 18F0126 - SDG 89749  
LDC 45972**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 2320B</b>													
ERH874	AZ96502	1	ALKALINITY, TOTAL (AS CaCO3)	8/5/2019 8:55:00 AM	8/18/2019 2:08:00 PM	D	43.2	MG_L		2.0	1.70		
ERH874	AZ96502	1	BICARBONATE	8/5/2019 8:55:00 AM	8/18/2019 2:08:00 PM	D	43.2	MG_L		2.0	1.70		
ERH874	AZ96502	1	CARBONATE (AS CO3)	8/5/2019 8:55:00 AM	8/18/2019 2:08:00 PM	D	1.70	MG_L	U	2.0	1.70		U
ERH876	AZ96504	1	ALKALINITY, TOTAL (AS CaCO3)	8/6/2019 8:00:00 AM	8/18/2019 2:12:00 PM	C	64.1	MG_L		2.0	1.70		
ERH876	AZ96504	1	BICARBONATE	8/6/2019 8:00:00 AM	8/18/2019 2:12:00 PM	C	64.1	MG_L		2.0	1.70		
ERH876	AZ96504	1	CARBONATE (AS CO3)	8/6/2019 8:00:00 AM	8/18/2019 2:12:00 PM	C	1.70	MG_L	U	2.0	1.70		U
<b>METHOD: 300.0</b>													
ERH874	AZ96502	1	BROMIDE	8/5/2019 8:55:00 AM	8/12/2019 5:02:00 PM	D	0.44	MG_L	J	0.5	0.16		J
ERH874	AZ96502	1	CHLORIDE (AS CL)	8/5/2019 8:55:00 AM	8/12/2019 5:02:00 PM	D	40.0	MG_L		1.0	0.20		
ERH874	AZ96502	1	FLUORIDE	8/5/2019 8:55:00 AM	8/12/2019 5:02:00 PM	D	0.09	MG_L	U	0.1	0.09		U
ERH874	AZ96502	1	NITROGEN, NITRATE (AS N)	8/5/2019 8:55:00 AM	8/12/2019 5:02:00 PM	D	2.4	MG_L		0.5	0.18		J h
ERH874	AZ96502	1	SULFATE (AS SO4)	8/5/2019 8:55:00 AM	8/12/2019 5:02:00 PM	D	10.0	MG_L		1.0	0.20		
ERH876	AZ96504	1	BROMIDE	8/6/2019 8:00:00 AM	8/12/2019 5:09:00 PM	C	0.44	MG_L	J	0.5	0.16		J
ERH876	AZ96504	1	CHLORIDE (AS CL)	8/6/2019 8:00:00 AM	8/12/2019 5:09:00 PM	C	59.5	MG_L	E	1.0	0.20		R d
ERH876	AZ96504	10	CHLORIDE (AS CL)	8/6/2019 8:00:00 AM	8/12/2019 5:23:00 PM	C	54.7	MG_L	D	10.0	2.00		
ERH876	AZ96504	1	FLUORIDE	8/6/2019 8:00:00 AM	8/12/2019 5:09:00 PM	C	0.09	MG_L	U	0.1	0.09		U
ERH876	AZ96504	1	NITROGEN, NITRATE (AS N)	8/6/2019 8:00:00 AM	8/12/2019 5:09:00 PM	C	2.1	MG_L		0.5	0.18		J h
ERH876	AZ96504	1	SULFATE (AS SO4)	8/6/2019 8:00:00 AM	8/12/2019 5:09:00 PM	C	9.6	MG_L		1.0	0.20		
<b>METHOD: 3500-FE-B</b>													
ERH874	AZ96502	1	Iron, Ion (Fe2+)	8/5/2019 8:55:00 AM	8/13/2019 3:30:00 PM	D	0.32	MG_L	U	1.0	0.32		UJ h,r
ERH876	AZ96504	1	Iron, Ion (Fe2+)	8/6/2019 8:00:00 AM	8/13/2019 3:31:00 PM	C	0.32	MG_L	U	1.0	0.32		UJ h,r
<b>METHOD: 353.2</b>													
ERH874	AZ96502	1	NITROGEN, NITRATE-NITRITE	8/5/2019 8:55:00 AM	8/15/2019 4:36:00 PM	D	0.44	MG_L		0.10	0.090		
ERH876	AZ96504	1	NITROGEN, NITRATE-NITRITE	8/6/2019 8:00:00 AM	8/15/2019 4:39:00 PM	C	0.38	MG_L		0.10	0.090		
<b>METHOD: 4500-SIO2-C</b>													
ERH874	AZ96502	5	SILICA	8/5/2019 8:55:00 AM	8/16/2019 10:44:00 AM	D	43.1	MG_L		5.0	4.00		

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 4500-SIO2-C</b>													
ERH874	AZ96502	5	SILICA	8/5/2019 8:55:00 AM	8/16/2019 10:51:00 AM	D	41.1	MG_L		5.0	4.00		
ERH876	AZ96504	5	SILICA	8/6/2019 8:00:00 AM	8/16/2019 10:52:00 AM	C	58.9	MG_L		5.0	4.00		
ERH876	AZ96504	5	SILICA	8/6/2019 8:00:00 AM	8/16/2019 10:45:00 AM	C	62.4	MG_L		5.0	4.00		
<b>METHOD: 6010C</b>													
ERH874	AZ96502	1	CALCIUM	8/5/2019 8:55:00 AM	8/14/2019 12:17:00 PM	D	6200	UG_L		1000	75.0		
ERH874	AZ96502	1	MAGNESIUM	8/5/2019 8:55:00 AM	8/14/2019 12:17:00 PM	D	6130	UG_L		500	30.0		
ERH874	AZ96502	1	MANGANESE	8/5/2019 8:55:00 AM	8/14/2019 12:17:00 PM	D	4.00	UG_L	U	10.0	4.00		U
ERH874	AZ96502	1	POTASSIUM	8/5/2019 8:55:00 AM	8/14/2019 12:17:00 PM	D	737	UG_L	J	3000	500.0		J
ERH874	AZ96502	1	SODIUM	8/5/2019 8:55:00 AM	8/14/2019 12:17:00 PM	D	34700	UG_L		5000	500.0		
ERH876	AZ96504	1	CALCIUM	8/6/2019 8:00:00 AM	8/14/2019 12:23:00 PM	C	12400	UG_L		1000	75.0		
ERH876	AZ96504	1	MAGNESIUM	8/6/2019 8:00:00 AM	8/14/2019 12:23:00 PM	C	12200	UG_L		500	30.0		
ERH876	AZ96504	1	MANGANESE	8/6/2019 8:00:00 AM	8/14/2019 12:23:00 PM	C	4.00	UG_L	U	10.0	4.00		U
ERH876	AZ96504	1	POTASSIUM	8/6/2019 8:00:00 AM	8/14/2019 12:23:00 PM	C	1540	UG_L	J	3000	500.0		J
ERH876	AZ96504	1	SODIUM	8/6/2019 8:00:00 AM	8/14/2019 12:23:00 PM	C	40100	UG_L		5000	500.0		
<b>METHOD: 8011</b>													
ERH868	AZ96498	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	8/5/2019 9:30:00 AM	8/13/2019 6:52:00 PM	C	0.019	UG_L	U	0.02	0.019		U
ERH869	AZ96499	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	8/5/2019 9:50:00 AM	8/13/2019 7:12:00 PM	C	0.019	UG_L	U	0.02	0.019		U
ERH870	AZ96500	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	8/5/2019 1:20:00 PM	8/13/2019 7:32:00 PM	C	0.019	UG_L	U	0.02	0.019		U
ERH873	AZ96501	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	8/5/2019 8:30:00 AM	8/13/2019 7:53:00 PM	C	0.019	UG_L	U	0.02	0.019		U
ERH874	AZ96502	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	8/5/2019 8:55:00 AM	8/13/2019 8:13:00 PM	D	0.019	UG_L	U	0.02	0.019		U
ERH875	AZ96503	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	8/6/2019 7:40:00 AM	8/13/2019 8:33:00 PM	C	0.019	UG_L	U	0.02	0.019		U
ERH876	AZ96504	1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	8/6/2019 8:00:00 AM	8/13/2019 8:53:00 PM	C	0.019	UG_L	U	0.02	0.019		U
<b>METHOD: 8015B_E</b>													
ERH869	AZ96499	1	C10-C24 DIESEL RANGE ORGANICS	8/5/2019 9:50:00 AM	9/12/2019 1:02:00 PM	C	25.00	UG_L	U	40.0	25.00		U
ERH869	AZ96499	1	C24-C40 TOTAL PETROLEUM HYDROCARBONS, OIL RANGE	8/5/2019 9:50:00 AM	9/12/2019 1:02:00 PM	C	40.00	UG_L	U	40.0	40.00		U
ERH870	AZ96500	1	C10-C24 DIESEL RANGE ORGANICS	8/5/2019 1:20:00 PM	9/12/2019 1:22:00 PM	C	25.00	UG_L	U	40.0	25.00		U
ERH870	AZ96500	1	C24-C40 TOTAL PETROLEUM HYDROCARBONS, OIL RANGE	8/5/2019 1:20:00 PM	9/12/2019 1:22:00 PM	C	40.00	UG_L	U	40.0	40.00		U
ERH874	AZ96502	1	C10-C24 DIESEL RANGE ORGANICS	8/5/2019 8:55:00 AM	9/12/2019 1:42:00 PM	D	25.00	UG_L	U	40.0	25.00		U

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 8015B_E</b>													
ERH874	AZ96502	1	C24-C40 TOTAL PETROLEUM HYDROCARBONS, OIL RANGE	8/5/2019 8:55:00 AM	9/12/2019 1:42:00 PM	D	40.00	UG_L	U	40.0	40.00	U	
ERH876	AZ96504	1	C10-C24 DIESEL RANGE ORGANICS	8/6/2019 8:00:00 AM	9/12/2019 2:03:00 PM	D	25.00	UG_L	U	40.0	25.00	U	
ERH876	AZ96504	1	C24-C40 TOTAL PETROLEUM HYDROCARBONS, OIL RANGE	8/6/2019 8:00:00 AM	9/12/2019 2:03:00 PM	D	40.00	UG_L	U	40.0	40.00	U	
<b>METHOD: 8260B</b>													
ERH868	AZ96498	1	1,2-DICHLOROETHANE	8/5/2019 9:30:00 AM	8/15/2019 10:13:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH868	AZ96498	1	BENZENE	8/5/2019 9:30:00 AM	8/15/2019 10:13:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH868	AZ96498	1	ETHYLBENZENE	8/5/2019 9:30:00 AM	8/15/2019 10:13:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH868	AZ96498	1	PETROLEUM HYDROCARBONS C6-C10	8/5/2019 9:30:00 AM	8/15/2019 10:14:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH868	AZ96498	1	TOLUENE	8/5/2019 9:30:00 AM	8/15/2019 10:13:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH868	AZ96498	1	Xylenes	8/5/2019 9:30:00 AM	8/15/2019 10:13:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH869	AZ96499	1	1,2-DICHLOROETHANE	8/5/2019 9:50:00 AM	8/17/2019 11:49:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH869	AZ96499	1	BENZENE	8/5/2019 9:50:00 AM	8/17/2019 11:49:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH869	AZ96499	1	ETHYLBENZENE	8/5/2019 9:50:00 AM	8/17/2019 11:49:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH869	AZ96499	1	PETROLEUM HYDROCARBONS C6-C10	8/5/2019 9:50:00 AM	8/17/2019 11:50:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH869	AZ96499	1	TOLUENE	8/5/2019 9:50:00 AM	8/17/2019 11:49:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH869	AZ96499	1	Xylenes	8/5/2019 9:50:00 AM	8/17/2019 11:49:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH870	AZ96500	1	1,2-DICHLOROETHANE	8/5/2019 1:20:00 PM	8/18/2019 12:17:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH870	AZ96500	1	BENZENE	8/5/2019 1:20:00 PM	8/18/2019 12:17:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH870	AZ96500	1	ETHYLBENZENE	8/5/2019 1:20:00 PM	8/18/2019 12:17:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH870	AZ96500	1	PETROLEUM HYDROCARBONS C6-C10	8/5/2019 1:20:00 PM	8/18/2019 12:18:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH870	AZ96500	1	TOLUENE	8/5/2019 1:20:00 PM	8/18/2019 12:17:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH870	AZ96500	1	Xylenes	8/5/2019 1:20:00 PM	8/18/2019 12:17:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH873	AZ96501	1	1,2-DICHLOROETHANE	8/5/2019 8:30:00 AM	8/18/2019 12:46:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH873	AZ96501	1	BENZENE	8/5/2019 8:30:00 AM	8/18/2019 12:46:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH873	AZ96501	1	ETHYLBENZENE	8/5/2019 8:30:00 AM	8/18/2019 12:46:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH873	AZ96501	1	PETROLEUM HYDROCARBONS C6-C10	8/5/2019 8:30:00 AM	8/18/2019 12:47:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH873	AZ96501	1	TOLUENE	8/5/2019 8:30:00 AM	8/18/2019 12:46:00 AM	C	0.30	UG_L	U	1.0	0.30	U	

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 8260B</b>													
ERH873	AZ96501	1	Xylenes	8/5/2019 8:30:00 AM	8/18/2019 12:46:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH874	AZ96502	1	1,2-DICHLOROETHANE	8/5/2019 8:55:00 AM	8/18/2019 1:14:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH874	AZ96502	1	BENZENE	8/5/2019 8:55:00 AM	8/18/2019 1:14:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH874	AZ96502	1	ETHYLBENZENE	8/5/2019 8:55:00 AM	8/18/2019 1:14:00 AM	D	0.50	UG_L	U	1.0	0.50	U	
ERH874	AZ96502	1	PETROLEUM HYDROCARBONS C6-C10	8/5/2019 8:55:00 AM	8/18/2019 1:15:00 AM	D	18.0	UG_L	U	20	18.0	U	
ERH874	AZ96502	1	TOLUENE	8/5/2019 8:55:00 AM	8/18/2019 1:14:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH874	AZ96502	1	Xylenes	8/5/2019 8:55:00 AM	8/18/2019 1:14:00 AM	D	0.30	UG_L	U	2.0	0.30	U	
ERH875	AZ96503	1	1,2-DICHLOROETHANE	8/6/2019 7:40:00 AM	8/18/2019 1:42:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH875	AZ96503	1	BENZENE	8/6/2019 7:40:00 AM	8/18/2019 1:42:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH875	AZ96503	1	ETHYLBENZENE	8/6/2019 7:40:00 AM	8/18/2019 1:42:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH875	AZ96503	1	PETROLEUM HYDROCARBONS C6-C10	8/6/2019 7:40:00 AM	8/18/2019 1:43:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH875	AZ96503	1	TOLUENE	8/6/2019 7:40:00 AM	8/18/2019 1:42:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH875	AZ96503	1	Xylenes	8/6/2019 7:40:00 AM	8/18/2019 1:42:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH876	AZ96504	1	1,2-DICHLOROETHANE	8/6/2019 8:00:00 AM	8/18/2019 2:11:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH876	AZ96504	1	BENZENE	8/6/2019 8:00:00 AM	8/18/2019 2:11:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH876	AZ96504	1	ETHYLBENZENE	8/6/2019 8:00:00 AM	8/18/2019 2:11:00 AM	D	0.50	UG_L	U	1.0	0.50	U	
ERH876	AZ96504	1	PETROLEUM HYDROCARBONS C6-C10	8/6/2019 8:00:00 AM	8/18/2019 2:12:00 AM	D	18.0	UG_L	U	20	18.0	U	
ERH876	AZ96504	1	TOLUENE	8/6/2019 8:00:00 AM	8/18/2019 2:11:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH876	AZ96504	1	Xylenes	8/6/2019 8:00:00 AM	8/18/2019 2:11:00 AM	D	0.30	UG_L	U	2.0	0.30	U	
<b>METHOD: 8270D</b>													
ERH869	AZ96499	1	2-(2-METHOXY ETHOXY)-ETHANOL	8/5/2019 9:50:00 AM	8/19/2019 1:22:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH869	AZ96499	1	PHENOL	8/5/2019 9:50:00 AM	8/30/2019 5:15:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH870	AZ96500	1	2-(2-METHOXY ETHOXY)-ETHANOL	8/5/2019 1:20:00 PM	8/19/2019 1:45:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH870	AZ96500	1	PHENOL	8/5/2019 1:20:00 PM	8/30/2019 5:43:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH874	AZ96502	1	2-(2-METHOXY ETHOXY)-ETHANOL	8/5/2019 8:55:00 AM	8/19/2019 2:09:00 PM	D	80.0	UG_L	U	100	80.0	U	
ERH874	AZ96502	1	PHENOL	8/5/2019 8:55:00 AM	8/30/2019 6:11:00 PM	D	4.00	UG_L	U	5.0	4.00	U	
ERH876	AZ96504	1	2-(2-METHOXY ETHOXY)-ETHANOL	8/6/2019 8:00:00 AM	8/19/2019 2:33:00 PM	D	80.0	UG_L	U	100	80.0	U	

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 8270D</b>													
ERH876	AZ96504	1	PHENOL	8/6/2019 8:00:00 AM	8/30/2019 6:40:00 PM	D	4.00	UG_L	U	5.0	4.00		U
<b>METHOD: 8270DSIM</b>													
ERH869	AZ96499	1	1-METHYLNAPHTHALENE	8/5/2019 9:50:00 AM	8/30/2019 11:27:00 AM	C	0.10	UG_L	U	0.2	0.10		U
ERH869	AZ96499	1	2-METHYLNAPHTHALENE	8/5/2019 9:50:00 AM	8/30/2019 11:27:00 AM	C	0.10	UG_L	U	0.2	0.10		U
ERH869	AZ96499	1	NAPHTHALENE	8/5/2019 9:50:00 AM	8/30/2019 11:27:00 AM	C	0.10	UG_L	U	0.2	0.10		U
ERH870	AZ96500	1	1-METHYLNAPHTHALENE	8/5/2019 1:20:00 PM	8/30/2019 11:50:00 AM	C	0.10	UG_L	U	0.2	0.10		U
ERH870	AZ96500	1	2-METHYLNAPHTHALENE	8/5/2019 1:20:00 PM	8/30/2019 11:50:00 AM	C	0.10	UG_L	U	0.2	0.10		U
ERH870	AZ96500	1	NAPHTHALENE	8/5/2019 1:20:00 PM	8/30/2019 11:50:00 AM	C	0.10	UG_L	U	0.2	0.10		U
ERH874	AZ96502	1	1-METHYLNAPHTHALENE	8/5/2019 8:55:00 AM	8/30/2019 12:12:00 PM	D	0.10	UG_L	U	0.2	0.10		U
ERH874	AZ96502	1	2-METHYLNAPHTHALENE	8/5/2019 8:55:00 AM	8/30/2019 12:12:00 PM	D	0.10	UG_L	U	0.2	0.10		U
ERH874	AZ96502	1	NAPHTHALENE	8/5/2019 8:55:00 AM	8/30/2019 12:12:00 PM	D	0.10	UG_L	U	0.2	0.10		U
ERH876	AZ96504	1	1-METHYLNAPHTHALENE	8/6/2019 8:00:00 AM	8/30/2019 12:34:00 PM	D	0.10	UG_L	U	0.2	0.10		U
ERH876	AZ96504	1	2-METHYLNAPHTHALENE	8/6/2019 8:00:00 AM	8/30/2019 12:34:00 PM	D	0.10	UG_L	U	0.2	0.10		U
ERH876	AZ96504	1	NAPHTHALENE	8/6/2019 8:00:00 AM	8/30/2019 12:34:00 PM	D	0.10	UG_L	U	0.2	0.10		U
<b>METHOD: 9060A</b>													
ERH874	AZ96502	1	DISSOLVED ORGANIC CARBON	8/5/2019 8:55:00 AM	8/19/2019 3:38:00 AM	D	0.85	MG_L	J	0.93	0.350		J
ERH874	AZ96502	1	TOTAL ORGANIC CARBON	8/5/2019 8:55:00 AM	8/16/2019 4:14:00 AM	D	1.3	MG_L		0.93	0.350		
ERH876	AZ96504	1	DISSOLVED ORGANIC CARBON	8/6/2019 8:00:00 AM	8/19/2019 3:55:00 AM	C	1.4	MG_L		0.93	0.350		
ERH876	AZ96504	1	TOTAL ORGANIC CARBON	8/6/2019 8:00:00 AM	8/16/2019 4:47:00 AM	C	0.67	MG_L	J	0.93	0.350		J
<b>METHOD: RSK175</b>													
ERH873	AZ96501	1	METHANE	8/5/2019 8:30:00 AM	8/13/2019 8:03:00 PM	C	1.00	UG_L	U	5.0	1.00		U
ERH874	AZ96502	1	METHANE	8/5/2019 8:55:00 AM	8/13/2019 8:06:00 PM	D	1.00	UG_L	U	5.0	1.00		U
ERH875	AZ96503	1	METHANE	8/6/2019 7:40:00 AM	8/13/2019 8:10:00 PM	C	1.00	UG_L	U	5.0	1.00		U
ERH876	AZ96504	1	METHANE	8/6/2019 8:00:00 AM	8/13/2019 8:13:00 PM	C	1.00	UG_L	U	5.0	1.00		U

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 19, 2019

**Parameters:** Volatiles

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89785

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH858	AZ96694	Water	08/07/19
ERH859	AZ96695	Water	08/07/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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**

Sample ERH858 was identified as a trip blank. 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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Laboratory Blank Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Volatiles - Field Blank Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

LDC #: 45972D1a

**VALIDATION COMPLETENESS WORKSHEET**

Date: 9/19/19

SDG #: 89785

Level C

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: FR  
2nd Reviewer: FR

**METHOD:** GC/MS 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 / Δ	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A Δ	% PSD ≤ 15    ICV ≤ 20
IV.	Continuing calibration <i>ending</i>	Δ	COV ≤ 20 / 50
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	CS / P
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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	ERH858 <i>TB</i>	AZ96694	Water	08/07/19
2	ERH859	AZ96695	Water	08/07/19
3				
4				
5				
6				
7				
8				

Notes:

<i>190816C T1 - BIK</i>				

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 19, 2019

**Parameters:** Phenol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89785

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH859	AZ96695	Water	08/07/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Phenol by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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%.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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.

### **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

### **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

### **XIV. System Performance**

Raw data were not reviewed for Level C validation.

### **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Laboratory Blank Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Phenol - Field Blank Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

LDC #: 45972D2a

**VALIDATION COMPLETENESS WORKSHEET**

SDG #: 89785

Level C

Laboratory: APPL, Inc.

Date: 9/19/19

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

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

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	Δ	
III.	Initial calibration/ICV	A/A	% PSD ≤ 15    ICV ≤ 20
IV.	Continuing calibration <i>ending</i>	Δ	CV ≤ 20/50
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	Δ	LCID
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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	ERH859	AZ96695	Water	08/07/19
2				
3				
4				
5				
6				
7				
8				

Notes:

190814A BK				

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 19, 2019

**Parameters:** Polynuclear Aromatic Hydrocarbons

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89785

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH859	AZ96695	Water	08/07/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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 compounds.

Average relative response factors (RRF) for all compounds 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 compounds.

## **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 compounds.

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

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.

## **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification  
Summary - SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -  
SDG 89785**

No Sample Data Qualified in this SDG

LDC #: 45972D2b  
 SDG #: 89785  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: FJ  
 2nd Reviewer: FR

**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	% PSD ≤ 15      ICV ≤ 20
IV.	Continuing calibration <i>tending</i>	A	dev ≤ 20/SD
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	res ID
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH859	AZ96695	Water	08/07/19
2				
3				
4				
5				
6				
7				
8				

Notes:

1	190814A - BIK				

TTT, W, S

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 19, 2019

**Parameters:** 2-(2-Methoxyethoxy)-ethanol

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89785

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH859	AZ96695	Water	08/07/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

2-(2-Methoxyethoxy)-ethanol by Environmental Protection Agency (EPA) SW 846 Method 8270D Modified

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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.

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.

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

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

## **IV. Continuing Calibration**

Continuing calibration was performed at the required frequencies.

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

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

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 not added to all samples as required by the method. Using professional judgment, no data were qualified, since the LCS/LCSD percent recoveries were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis.

## **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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XIII. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XIV. System Performance**

Raw data were not reviewed for Level C validation.

## **XV. Overall Assessment of Data**

The analysis was conducted within all specifications of the method with the exception noted in Section VII. No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -  
SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG  
89785**

No Sample Data Qualified in this SDG

LDC #: 45972D2c  
 SDG #: 89785  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/17/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**METHOD:** GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-Modified)

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	Δ / Δ	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	Δ / Δ	12 10% ≤ 20
IV.	Continuing calibration <i>pending</i>	Δ	CCV ≤ 20 / SD
V.	Laboratory Blanks	Δ	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	100% ID
X.	Field duplicates	N	
XI.	Internal standards	Δ	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	Δ	

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

	Client ID	Lab ID	Matrix	Date
1	ERH859	AZ96695	Water	08/07/19
2				
3				
4				
5				
6				
7				
8				

Notes:

190814A-B12				

LDC #: 4597202e

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Recovery**

Page: 1 of 1  
 Reviewer: FT  
 2nd Reviewer: [Signature]

**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?

#	Sample ID	Surrogate	%R (Limits)	Qualifications
	all	Surrogates were not added to all samples as required by the method. Using professional judgment, no data were qualified. The LCS/LCSD percent recovery <sup>up</sup> and RPD were within QC limits. Additionally, all base surrogate percent recoveries were within QC limits in the phenol analysis.		Text
			( )	
			( )	
			( )	
			( )	
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			( )	

(NBZ) = Nitrobenzene - d5  
 (FBP) = 2-Fluorobiphenyl  
 (TPH) = Terphenyl - d14  
 (2FP) = 2-Fluorophenol  
 (TBP) = 2,4,6 -Tribromophenol  
 (2CP) = 2-Chlorophenol - d4

## Laboratory Data Consultants, Inc. Data Validation Report

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

**LDC Report Date:** September 19, 2019

**Parameters:** Wet Chemistry

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89785

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH859	AZ96695	Water	08/07/19



## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Alkalinity by Standard Method 2320B

Chloride, Nitrate as Nitrogen, and Sulfate by Environmental Protection Agency (EPA) Method 300.0

Ferrous Iron by Standard Method 3500-Fe B

Nitrate/Nitrite as Nitrogen by EPA Method 353.2

Total Organic Carbon by EPA SW 846 Method 9060A

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S The sequence or number of standards used for the calibration was incorrect.
- C Correlation coefficient is  $<0.995$ .
- R %R for calibration is not within control limits.
- B Presumed contamination from preparation (method) blank or calibration blank.
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD or difference was high.
- I ICP ICS results were unsatisfactory.
- A ICP Serial Dilution %D were not within control limits.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Post Digestion Spike recovery was not within control limits.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

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

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
ERH859	Nitrate as N	122 hours	48 hours	J (all detects)	P

## II. Initial Calibration

All criteria for the initial calibration of each method were met.

## III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met for each method when applicable with the following exceptions:

Date	Lab. Reference/ID	Analyte	%R (Limits)	Associated Samples	Flag	A or P
08/13/19	CCV (15:33)	Ferrous iron	84.1 (90-110)	All samples in SDG 89785	UJ (all non-detects)	P

## IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. 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. Sample Result Verification**

Raw data were not reviewed for Level C validation.

### **XI. Overall Assessment of Data**

The analysis was conducted within all specifications of the methods.

Due to technical holding time and continuing calibration %R, data were qualified as estimated in one sample.

No results were rejected in this SDG.

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Data Qualification Summary - SDG 89785**

<b>Sample</b>	<b>Analyte</b>	<b>Flag</b>	<b>A or P</b>	<b>Reason (Code)</b>
ERH859	Nitrate as N	J (all detects)	P	Technical holding times (H)
ERH859	Ferrous iron	UJ (all non-detects)	P	Continuing calibration (%R) (R)

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Wet Chemistry - Field Blank Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

LDC #: 45972D6  
 SDG #: 89785  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/9/15  
 Page:    of     
 Reviewer:     
 2nd Reviewer:   

**METHOD: (Analyte)** Alkalinity (SM2320B), Chloride, Nitrate as N, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B), Nitrate/Nitrite-N (EPA Method 353.2), TOC (EPA SW 846 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 SW	
II	Initial calibration	A	
III.	Calibration verification	SW	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS/D
IX.	Field duplicates	N	
X.	Sample result verification	N	
XI.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH859	AZ96695	Water	08/07/19
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_





# VALIDATION FINDINGS WORKSHEET

## Technical Holding Times

All circled dates have exceeded the technical holding time.  
Y N N/A Were all samples preserved as applicable to each method?  
Y N N/A Were all cooler temperatures within validation criteria?

(H)

Method:		300.0					
Parameters:		NO <sub>3</sub> -N					
Technical holding time:		48 hrs					
Sample ID	Sampling date	Analysis date	Total Time	Qualifier	Analysis date	Total Time	Qualifier
1 (Det)	8/7/19 13:35	8/12/19 16:08	122 hrs	J/R/P			

LDC #: 4597006

### VALIDATION FINDINGS WORKSHEET Calibration

Page: 1 of 1  
Reviewer: [Signature]  
2nd Reviewer: [Signature]

METHOD: Inorganics, EPA Method See call

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

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

**LEVEL IV/D ONLY:**

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

R

#	Date	Calibration ID	Analyte	%R	Associated Samples	Qualifications
	8/13/19	CCV (15:33)	Fe <sup>3+</sup>	84.1	All	JLUJ/P (MD)

Comments: \_\_\_\_\_

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 19, 2019

**Parameters:** Gasoline Range Organics

**Validation Level:** Level C

**Laboratory:** APPL. Inc

**Sample Delivery Group (SDG):** 89785

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH858	AZ96694	Water	08/07/19
ERH859	AZ96695	Water	08/07/19

## **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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## **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**

Sample ERH858 was identified as a trip blank. 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. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **XI. Target Compound Identifications**

Raw data were not reviewed for Level C validation.

## **XII. Overall Assessment of Data**

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



**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Laboratory Blank Data Qualification Summary - SDG  
89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Gasoline Range Organics - Field Blank Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

LDC #: 45972D7  
 SDG #: 89785  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**  
 Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: FR  
 2nd Reviewer: FR

**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/D	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	r <sup>2</sup> ICV ≤ 20
IV.	Continuing calibration <u>FR</u>	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LOS ID
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	
XIII.	Target compound identification	N	
XIV.	System performance	N	
XV.	Overall assessment of data	A	

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

	Client ID	Lab ID	Matrix	Date
1	ERH858	AZ96694	Water	08/07/19
2	ERH859	AZ96695	Water	08/07/19
3				
4				
5				
6				
7				
8				

Notes:

190816CT BIK				

**Laboratory Data Consultants, Inc.  
Data Validation Report**

**Project/Site Name:** Red Hill Bulk Storage Facility, CTO 18F0126  
**LDC Report Date:** September 20, 2019  
**Parameters:** Total Petroleum Hydrocarbons as Extractables  
**Validation Level:** Level C  
**Laboratory:** APPL, Inc.  
**Sample Delivery Group (SDG):** 89785

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH859	AZ96695	Water	08/07/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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 Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was  $<0.05$ .
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.

## 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 compounds 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 compounds, 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 compounds.

## 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 compounds.

## 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 Compound	Flag	A or P
ERH859	Octacosane	146 (60-142)	TPH as extractables	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)	Compound	LCS %R (Limits)	LCSD %R (Limits)	Flag	A or P
190814A-LCS/D (All samples in SDG 89785)	Oil (C24-C40)	-	116 (41-113)	NA	-

Relative percent differences (RPD) were within QC limits.

## IX. Field Duplicates

No field duplicates were identified in this SDG.

## X. Compound Quantitation

Raw data were not reviewed for Level C validation.

## XI. Target Compound Identifications

Raw data were not reviewed for Level C validation.

## XII. Overall Assessment of Data

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



**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -  
SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data  
Qualification Summary - SDG 89785**

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 89785**

No Sample Data Qualified in this SDG

LDC #: 45972D8  
 SDG #: 89785  
 Laboratory: APPL, Inc.

**VALIDATION COMPLETENESS WORKSHEET**

Level C

Date: 9/19/19  
 Page: 1 of 1  
 Reviewer: [Signature]  
 2nd Reviewer: [Signature]

**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 Δ	
II.	Initial calibration/ICV	Δ / Δ	% PSD ≤ 20, r <sup>2</sup> 100 ≤ 20
III.	Continuing calibration	Δ	100 ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	N	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	SW	LOD ID
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	N	
XI.	Target compound identification	N	
XII.	Overall assessment of data	Δ	

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

	Client ID	Lab ID	Matrix	Date
1	ERH859	AZ96695	Water	08/07/19
2				
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

190814A - BIK				

LDC #: 45972 D8

**VALIDATION FINDINGS WORKSHEET**  
**Surrogate Recovery**

Page: 1 of 1

Reviewer: FT

2nd Reviewer: [Signature]

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?

(5)

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	1		G	146 (60-142)	Just/P NO
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

Surrogate Compound	Surrogate Compound	Surrogate Compound	Surrogate Compound
A Chlorobenzene (CBZ)	G Octacosane	M Benzo(e)Pyrene	S 1-Chloro-3-Nitrobenzene
B 4-Bromofluorobenzene (BFB)	H Ortho-Terphenyl	N Terphenyl-D14	T 3,4-Dinitrotoluene
C a,a,a-Trifluorotoluene	I Fluorobenzene (FBZ)	O Decachlorobiphenyl (DCB)	U Triphenyltin
D Bromochlorobenzene	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 #: 4597208

# VALIDATION FINDINGS WORKSHEET Laboratory Control Samples (LCS)

Page: 1 of 1

Reviewer: FT

2nd Reviewer:

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 a laboratory control samples (LCS) and laboratory control sample duplicate (LCSD) analyzed for each matrix in this SDG?

Y N N/A Were the LCS percent recoveries (%R) and relative percent differences (RPD) within the QC limits?

Level IV/D Only

Y N N/A Was an LCS analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

(L)

#	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	190814A LCSD	Dil (C24-C40)	( )	116 (41-113)	( )	All	Just/P ND
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

**Laboratory Data Consultants, Inc.  
Data Validation Report**

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

**LDC Report Date:** September 20, 2019

**Parameters:** Methane

**Validation Level:** Level C

**Laboratory:** APPL, Inc.

**Sample Delivery Group (SDG):** 89785

<b>Sample Identification</b>	<b>Laboratory Sample Identification</b>	<b>Matrix</b>	<b>Collection Date</b>
ERH858	AZ96694	Water	08/07/19
ERH859	AZ96695	Water	08/07/19

## 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 Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015), and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (2017). 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:

Methane by Method RSK-175

All sample results were subjected to Level C 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): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.
- U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.
- NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or 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

- H Holding times were exceeded.
- S Surrogate recovery was outside QC limits.
- C Calibration %RSD,  $r$ ,  $r^2$  or %D were noncompliant.
- R Calibration RRF was <0.05.
- B Presumed contamination from preparation (method blank).
- L Laboratory Control Sample/Laboratory Control Sample Duplicate %R or RPD was not within control limits.
- Q MS/MSD recovery was poor.
- E MS/MSD or Duplicate RPD was high.
- I Internal standard performance was unsatisfactory.
- M Instrument Performance Check (BFB or DFTPP) was noncompliant.
- T Presumed contamination from trip blank.
- F Presumed contamination from FB or ER.
- D The analysis with this flag should not be used because another more technically sound analysis is available.
- P Instrument performance for pesticides was poor.
- V Unusual problems found with the data not defined elsewhere. Description of the problem can be found in the validation report.



## **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 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**

Sample ERH858 was identified as a trip blank. No contaminants were found.

## **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. 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.

## **VIII. Field Duplicates**

No field duplicates were identified in this SDG.

## **IX. Compound Quantitation**

Raw data were not reviewed for Level C validation.

## **X. Target Compound Identification**

Raw data were not reviewed for Level C validation.

## **XI. Overall Assessment of Data**

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

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Laboratory Blank Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 18F0126  
Methane - Field Blank Data Qualification Summary - SDG 89785**

No Sample Data Qualified in this SDG

LDC #: 45972D51

**VALIDATION COMPLETENESS WORKSHEET**

SDG #: 89785

Level C

Laboratory: APPL, Inc.

Date: 9/19/19

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

**METHOD:** GC Methane (Method RSK-175)

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 Δ	
II.	Initial calibration/ICV	A Δ	r <sup>2</sup> ICV ≤ 20
III.	Continuing calibration	A	CV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 1
VI.	Matrix spike/Matrix spike duplicates	N	CS
VII.	Laboratory control samples	A	LCS IP
VIII.	Field duplicates	N	
IX.	Compound quantitation RL/LOQ/LODs	N	
X.	Target compound identification	N	
XI.	Overall assessment of data	Δ	

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	ERH858	AZ96694	Water	08/07/19
2	ERH859	AZ96695	Water	08/07/19
3				
4				
5				
6				
7				
8				
9				
10				

Notes:

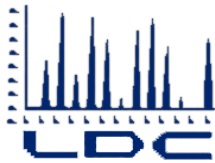
190814A BIK				

**Red Hill Bulk Storage Facility, CTO 18F0126 - SDG 89785  
LDC 45972**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 2320B</b>													
ERH859	AZ96695	1	ALKALINITY, TOTAL (AS CaCO3)	8/7/2019 1:35:00 PM	8/18/2019 2:57:00 PM	C	93.1	MG_L		2.0	1.70		
ERH859	AZ96695	1	BICARBONATE	8/7/2019 1:35:00 PM	8/18/2019 2:57:00 PM	C	93.1	MG_L		2.0	1.70		
ERH859	AZ96695	1	CARBONATE (AS CO3)	8/7/2019 1:35:00 PM	8/18/2019 2:57:00 PM	C	1.70	MG_L	U	2.0	1.70	U	
<b>METHOD: 300.0</b>													
ERH859	AZ96695	50	CHLORIDE (AS CL)	8/7/2019 1:35:00 PM	8/16/2019 4:11:00 PM	C	176	MG_L	D	50.0	10.00		
ERH859	AZ96695	1	NITROGEN, NITRATE (AS N)	8/7/2019 1:35:00 PM	8/12/2019 4:08:00 PM	C	6.5	MG_L		0.5	0.18	J	h
ERH859	AZ96695	1	SULFATE (AS SO4)	8/7/2019 1:35:00 PM	8/12/2019 4:08:00 PM	C	44.0	MG_L		1.0	0.20		
<b>METHOD: 3500-FE-B</b>													
ERH859	AZ96695	1	Iron, Ion (Fe2+)	8/7/2019 1:35:00 PM	8/13/2019 3:31:00 PM	C	0.32	MG_L	U	1.0	0.32	UJ	r
<b>METHOD: 353.2</b>													
ERH859	AZ96695	1	NITROGEN, NITRATE-NITRITE	8/7/2019 1:35:00 PM	8/15/2019 4:39:00 PM	C	1.2	MG_L		0.10	0.090		
<b>METHOD: 8015B_E</b>													
ERH859	AZ96695	1	C10-C24 DIESEL RANGE ORGANICS	8/7/2019 1:35:00 PM	9/12/2019 3:44:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH859	AZ96695	1	C24-C40 TOTAL PETROLEUM HYDROCARBONS, OIL RANGE	8/7/2019 1:35:00 PM	9/12/2019 3:44:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
<b>METHOD: 8260B</b>													
ERH858	AZ96694	1	BENZENE	8/7/2019 1:00:00 PM	8/18/2019 2:39:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH858	AZ96694	1	ETHYLBENZENE	8/7/2019 1:00:00 PM	8/18/2019 2:39:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH858	AZ96694	1	PETROLEUM HYDROCARBONS C6-C10	8/7/2019 1:00:00 PM	8/18/2019 2:40:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH858	AZ96694	1	TOLUENE	8/7/2019 1:00:00 PM	8/18/2019 2:39:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH858	AZ96694	1	Xylenes	8/7/2019 1:00:00 PM	8/18/2019 2:39:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH859	AZ96695	1	BENZENE	8/7/2019 1:35:00 PM	8/18/2019 3:07:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH859	AZ96695	1	ETHYLBENZENE	8/7/2019 1:35:00 PM	8/18/2019 3:07:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH859	AZ96695	1	PETROLEUM HYDROCARBONS C6-C10	8/7/2019 1:35:00 PM	8/18/2019 3:08:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH859	AZ96695	1	TOLUENE	8/7/2019 1:35:00 PM	8/18/2019 3:07:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH859	AZ96695	1	Xylenes	8/7/2019 1:35:00 PM	8/18/2019 3:07:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
<b>METHOD: 8270D</b>													
ERH859	AZ96695	1	2-(2-METHOXY ETHOXY)-ETHANOL	8/7/2019 1:35:00 PM	9/12/2019 12:11:00 PM	C	80.0	UG_L	U	100	80.0	U	

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
<b>METHOD: 8270D</b>													
ERH859	AZ96695	1	PHENOL	8/7/2019 1:35:00 PM	9/12/2019 9:58:00 AM	C	4.00	UG_L	U	5.0	4.00	U	
<b>METHOD: 8270DSIM</b>													
ERH859	AZ96695	1	1-METHYLNAPHTHALENE	8/7/2019 1:35:00 PM	9/6/2019 1:00:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH859	AZ96695	1	2-METHYLNAPHTHALENE	8/7/2019 1:35:00 PM	9/6/2019 1:00:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH859	AZ96695	1	NAPHTHALENE	8/7/2019 1:35:00 PM	9/6/2019 1:00:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
<b>METHOD: 9060A</b>													
ERH859	AZ96695	1	TOTAL ORGANIC CARBON	8/7/2019 1:35:00 PM	8/16/2019 2:22:00 PM	C	2.2	MG_L		0.93	0.350		
<b>METHOD: RSK175</b>													
ERH858	AZ96694	1	METHANE	8/7/2019 1:00:00 PM	8/14/2019 4:42:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH859	AZ96695	1	METHANE	8/7/2019 1:35:00 PM	8/26/2019 5:40:00 PM	C	1.00	UG_L	U	5.0	1.00	U	



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October 15, 2019

**SUBJECT: Data Quality Assessment Report  
July 2019 to August 2019  
Environmental Investigation and  
Groundwater Monitoring  
Red Hill Bulk Fuel Storage Facility  
Joint Base Pearl Harbor-Hickam  
Oahu, Hawaii  
CTO 18F0126**

Enclosed is the Data Quality Assessment Report, July 2019 to August 2019 October 15, 2019 October 15, 2019, Environmental Investigation and Groundwater Monitoring for Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, Oahu, Hawaii, CTO 18F0126.

We appreciate this opportunity to support AECOM in the performance of this project.

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

Sincerely,

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**DATA QUALITY ASSESSMENT REPORT**

**JULY 2019 TO AUGUST 2019  
ENVIRONMENTAL INVESTIGATION AND  
GROUNDWATER MONITORING**

**RED HILL BULK FUEL STORAGE FACILITY  
JOINT BASE PEARL HARBOR-HICKAM  
OAHU, HAWAII  
CTO 18F0126**

**October 15, 2019**



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## GLOSSARY

BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CTO	Contract Task Order
DCA	1,2-Dichloroethane
DQAR	Data Quality Assessment Report
DOD	Department of Defense
DL	Detection Limit
DUP	Laboratory Duplicate
EB	Equipment Blank
EDB	Ethylene Dibromide
FB	Field Blank
FD	Field Duplicate
GRO	Gasoline Range Organics
LCS/LCSD	Laboratory Control Sample/Laboratory Control Sample Duplicate
LDC	Laboratory Data Consultants, Inc
LOD	Limit of Detection
LOQ	Limit of Quantitation
MEE	2-(2-Methoxyethoxy)-ethanol
MS/MSD	Matrix Spike / Matrix Spike Duplicate
NAVFAC	Naval Facilities Engineering Command
PAH	Polynuclear Aromatic Hydrocarbons
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness, Sensitivity
PQO	Project Quality Objectives
PT	Proficiency Testing sample
QA/QC	Quality Assurance/Quality Control
QSM	Quality Systems Manual
RPD	Relative Percent Difference
RRF	Relative Response Factor
SDG	Sample Delivery Group
SGCU	Silica Gel Clean Up
SIM	Selected Ion Monitoring
TB	Trip Blank
TOC	Total Organic Carbon
TPHE	Total Petroleum Hydrocarbons as Extractables
VOC	Volatile Organic Compounds
%D	Percent Difference
%R	Percent Recovery
%RSD	Percent Relative Standard Deviation
mg/L	Milligrams per Liter
ug/L	Micrograms per Liter

## 1.0 INTRODUCTION

An environmental investigation and groundwater monitoring were conducted on July 2019 through August 2019 at the Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam in Oahu, Hawaii. This part of the investigation included the collection and analyses of 45 environmental and quality control (QC) samples. The analyses were performed by the following methods:

Benzene, Toluene, Ethylbenzene, Xylenes, total (BTEX) and 1,2-Dichloroethane (DCA) by Environmental Protection Agency (EPA) SW-846 Method 8260B  
Phenol by EPA SW-846 Method 8270D  
Polynuclear Aromatic Hydrocarbons (PAH) by EPA SW-846 Method 8270D-Selected Ion Monitoring (SIM) mode  
2-(2-Methoxyethoxy)-ethanol by (MEE) EPA SW-846 Method 8270D Modified  
Gasoline Range Organics (GRO) by EPA SW-846 Method 8260B  
Total Petroleum Hydrocarbons as Extractables (TPHE) by EPA SW-846 Method 8015B  
Methane by Method RSK-175  
Ethylene Dibromide (EDB) by EPA SW-846 Method 8011  
Metals by EPA SW-846 Method 6010C

### Wet Chemistry:

Alkalinity by Standard Method 2320B  
Bromide, Chloride, Fluoride, Nitrate as Nitrogen, and Sulfate (Anions) by EPA Method 300.0  
Ferrous Iron by Standard Method 3500-Fe B  
Silica and Dissolved Silica by Standard Method 4500-Si D  
Nitrate/Nitrite as Nitrogen by EPA Method 353.2  
Dissolved Organic Carbon (DOC) Total Organic Carbon (TOC) by EPA SW-846 Method 9060A

Analytical services for the water samples were provided by APPL, Inc. The samples were grouped into sample delivery groups (SDGs) as received by the laboratory. The environmental samples are associated with quality assurance (QA) and QC samples designed to document the data quality of the entire SDG or a sub-group of samples within a SDG. Table I is a cross-reference table listing each sample, analysis, SDG, collection date, laboratory sample number, matrix, and validation level.

Approximately ten percent of the analytical data were validated according to Naval Facilities Engineering Command (NAVFAC) Pacific Level D data validation procedures and ninety percent of the analytical data were validated according to NAVFAC Pacific Level C data validation procedures. The analytical data were evaluated for QA/QC based on the *NAVFAC Pacific Environmental Restoration (ER) Program Data Validation Procedures (DON 2015)* and the *Department of Defense Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.1 (DoD 2017)*.

This data quality assessment report (DQAR) summarizes the QA/QC evaluation of the data according to precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) relative to the project quality objectives (PQOs). This report provides a quantitative and qualitative assessment of the data and identifies potential sources of error, uncertainty, and bias that may affect the overall usability.

The DQAR evaluates and summarizes the results of QA/QC data validation for the entire sampling program. Each analytical fraction has a separate section for each of the PARCCS criteria. These sections interpret specific QC deviations and their effects on both individual data points and the analyses as a whole. Section 13 presents a summary of the PARCCS criteria by comparing quantitative parameters with acceptability criteria defined in the PQOs. Qualitative PARCCS criteria are also summarized in this

section.

### **Precision and Accuracy of Environmental Data**

Environmental data quality depends on sample collection procedures, analytical methods and instrumentation, documentation, and sample matrix properties. Both sampling procedures and laboratory analyses contain potential sources of uncertainty, error, and/or bias, which affect the overall quality of a measurement. Errors in sample data may result from incomplete equipment decontamination, inappropriate sampling techniques, sample heterogeneity, improper filtering, and improper preservation. The accuracy of analytical results is dependent on selecting appropriate analytical methods, maintaining equipment properly, and complying with QC requirements. The sample matrix also is an important factor in the ability to obtain precise and accurate results within a given media.

Environmental and laboratory QA/QC samples assess the effects of sampling procedures and evaluate laboratory contamination, laboratory performance, and matrix effects. QA/QC samples include: method blanks, calibration blanks, laboratory control samples/laboratory control sample duplicates (LCS/LCSD), matrix spike sample/matrix spike sample duplicate (MS/MSD), field duplicate samples (FD), trip blanks (TB), equipment blank (EB), field blank (FB) and proficiency testing (PT) samples.

Before conducting the PARCCS evaluation, the analytical data were validated according to the NAVFAC procedures and DoD QSM. Samples not meeting the NAVFAC procedures and DoD QSM acceptance criteria were qualified with a flag, an abbreviation indicating a deficiency with the data. The following are flags used in data validation.

- J     Estimated The associated numerical value is an estimated quantity. The analyte was detected but the reported value may not be accurate or precise. The "J" qualification indicates the data fell outside the QC limits, but the exceedance was not sufficient to cause rejection of the data.
  
- R     Rejected The data is unusable (the compound or analyte may or may not be present). Use of the "R" qualifier indicates a significant variance from functional guideline acceptance criteria. Either resampling or reanalysis is necessary to determine the presence or absence of the rejected analyte.
  
- U     Nondetected Analyses were performed for the compound or analyte, but it was not detected. The "U" designation is also applied to suspected blank contamination. The "U" flag is used to qualify any result detected in an environmental sample at a concentration less than 10 times the value of the concentration in any associated blank for common laboratory contaminants and less than 5 times the concentration in any associated blank for all other contaminants.
  
- UJ    Estimated/Nondetected Analyses were performed for the compound or analyte, but it was not detected and the limit of detection (LOD) is an estimated quantity due to poor accuracy or precision. This qualification is also used to flag possible false negative results in the case where low bias in the analytical system is indicated by low calibration response, surrogate, internal standard, or other spike recovery.

Once the data are reviewed and qualified according to the NAVFAC procedures and DoD QSM, the data set is then evaluated using PARCCS criteria. PARCCS criteria provide an evaluation of overall data usability. The following is a discussion of PARCCS criteria as related to the PQOs.

**Precision** is a measure of the agreement or reproducibility of analytical results under a given set of conditions. It is a quantity that cannot be measured directly but is calculated from the reported concentrations.

Precision is expressed as the relative percent difference (RPD):

$$\text{RPD} = (D1 - D2) / \{1/2(D1 + D2)\} \times 100$$

Where:

D1 = the reported concentration for primary sample analyses

D2 = the reported concentrations for duplicate analyses

Precision is primarily assessed by calculating a RPD from the reported concentrations of the spiked compounds for each sample in the MS/MSD pair. In the absence of a MS/MSD pair, a laboratory duplicate or LCS/LCSD pair can be analyzed as an alternative means of assessing precision. In some cases, samples from multiple SDGs were within one QC batch and therefore are associated with the same laboratory QC samples. An additional measure of sampling precision may be obtained by collecting and analyzing field duplicate samples, which are compared using the RPD result as the evaluation criteria.

MS and MSD samples are field samples spiked by the laboratory with target analytes prior to preparation and analysis. These samples measure the overall efficiency of the analytical method in recovering target analytes from an environmental matrix. A LCS is similar to a MS/MSD sample in that the LCS is spiked with the same target analytes prior to preparation and analysis. However, the LCS is prepared using a controlled interference-free matrix instead of a field sample aliquot. Laboratory reagent water is used to prepare aqueous LCS. The LCS measures laboratory efficiency in recovering target analytes from an aqueous matrix in the absence of matrix interferences.

For inorganic analysis, one primary sample is analyzed and accompanied by an unspiked laboratory duplicate. The data reviewer compares the reported results of the primary analysis and the laboratory duplicate and calculates RPDs to assess laboratory precision.

Laboratory and field precision are further evaluated by calculating RPDs for field duplicate pairs. The sampler collects two field samples at the same location and under identically controlled conditions. The laboratory then analyzes the samples under identical conditions.

An RPD outside the numerical QC limit in MS/MSD samples, LCS/LCSDs, or FDs indicates imprecision. Imprecision is the variance in the consistency with which the laboratory arrives at a particular reported result. Thus, the actual analyte concentration may be higher or lower than the reported result.

Possible causes of poor precision include sample matrix interference, improper sample collection or handling, inconsistent sample preparation, and poor instrument stability. In some duplicates, results maybe reported in either the primary or duplicate samples at levels below the limit of quantitation (LOQ) or non-detected. Since these values are considered to be estimates, RPD exceedances from these duplicate sets do not suggest a significant impact on the data quality.

**Accuracy** is a measure of the agreement of an experimental determination and the true value of the parameter being measured. It is used to identify bias in a given measurement system. Recoveries outside acceptable QC limits may be caused by factors such as instrumentation, analyst error, or matrix interference. Accuracy is assessed through the analysis of MS, MSD, LCS, and samples containing surrogate spikes. In some cases, samples from multiple SDGs were within one QC batch and therefore are associated with the same laboratory QC samples. Surrogate spikes are either isotopically labeled compounds or compounds that are not typically detected in the samples. Surrogate spikes are added to every blank, environmental sample, MS/MSD, LCS/LCSD and standard, for all applicable organic analyses. Accuracy of inorganic analyses is determined using the percent recoveries of MS and LCS

analyses.

Percent recovery (%R) is calculated using the following equation:

$$\%R = (A-B)/C \times 100$$

Where:

A = measured concentration in the spiked sample

B = measured concentration of the spike compound in the unspiked sample

C = concentration of the spike

The percent recovery of each analyte spiked in MS/MSD samples, LCS, and surrogate compounds added to environmental samples is evaluated against the acceptance criteria specified by the previously noted documents. Spike recoveries outside the acceptable QC accuracy limits provide an indication of bias, where the reported data may overestimate or underestimate the actual concentration of compounds detected or LODs reported for environmental samples.

Accuracy can also be evaluated by analyzing PT samples. PT testing determines the performance of individual laboratories for specific tests or measurements and is used to monitor laboratories' continuing performance.

**Representativeness** is a qualitative parameter that expresses the degree to which the sample data are characteristic of a population and is evaluated by reviewing the QC results of blank samples and holding times. Positive detects of compounds in the blank samples identify compounds that may have been introduced into the samples during sample collection, transport, preparation, or analysis. The QA/QC blanks collected and analyzed are method blanks, calibration blanks, field blanks, equipment blanks, and trip blanks.

A method blank is a laboratory grade water or solid matrix that contains the method reagents and has undergone the same preparation and analysis as the environmental samples. The method blank provides a measure of the combined contamination derived from the laboratory source water, glassware, instruments, reagents, and sample preparation steps. Method blanks are prepared for each sample of a similar matrix extracted by the same method at a similar concentration level.

For inorganic analyses, initial and continuing calibration blanks (ICB/CCB) consist of acidified laboratory grade water, which are injected at the beginning and at a regular frequency during each 12 - hour sample analysis run. These blanks estimate residual contaminants from the previous sample or standards analysis and measure baseline shifts that commonly occur in emission and absorption spectroscopy.

Trip blanks are used to identify possible volatile organic contamination introduced into the sample during transport. A trip blank is a sample volatile organics analysis vial filled in the laboratory with reagent-grade water and preserved to a pH less than 2 with hydrochloric acid. It is transported to the site, stored with the sample containers, and returned unopened to the laboratory for analysis. Trip blanks were collected and analyzed for BTEX, DCA, EDB, GRO, and methane.

Equipment blanks consist of analyte-free water poured over or through the sample collection equipment. The water is collected in a sample container for laboratory analysis. These blanks are collected after the sampling equipment is decontaminated and measure efficiency of the decontamination procedure. Equipment blanks were collected and analyzed for BTEX, DCA, EDB, GRO, MEE, PAH, phenol, and TPHE.

Field blanks consist of analyte-free source water stored at the sample collection site. The water is collected from each source water used during each sampling event. Field blanks were collected and analyzed for BTEX, DCA, EDB, GRO, MEE, PAH, phenol, and TPHE.

Contaminants found in both the environmental sample and a blank sample are assumed to be laboratory artifacts if the concentration in the environmental sample is less than 5 times the blank value.

Holding times are evaluated to assure that the sample integrity is intact for accurate sample preparation and analysis. Holding times will be specific for each method and matrix analyzed. Holding time exceedances can cause loss of sample constituents due to biodegradation, precipitation, volatilization, and chemical degradation.

**Comparability** is a qualitative expression of the confidence with which one data set may be compared to another. It provides an assessment of the equivalence of the analytical results to data obtained from other analyses. It is important that data sets be comparable if they are used in conjunction with other data sets. The factors affecting comparability include the following: sample collection and handling techniques, matrix type, and analytical method. If these aspects of sampling and analysis are carried out according to standard analytical procedures, the data are considered comparable. Comparability can only be compared with confidence when precision, accuracy, and representativeness are known.

**Completeness** is defined as the percentage of acceptable sample results compared to the total number of sample results. Completeness is evaluated to determine if an acceptable amount of usable data were obtained so that a valid scientific site assessment can be completed. Completeness equals the total number of sample results for each fraction minus the total number of rejected sample results divided by the total number of sample results multiplied by 100. As specified in the PQOs, the goal for completeness for target analytes in each analytical fraction is 90 percent.

Percent completeness is calculated using the following equation:

$$\%C = (T - R)/T \times 100$$

Where:

%C = percent completeness

T = total number of sample results

R = total number of rejected sample results

Completeness is also determined by comparing the planned number of samples per method and matrix as specified in the project planning document, with the number determined above.

**Sensitivity** is the ability of an analytical method or instrument to discriminate between measurement responses representing different concentrations. This capability is established during the planning phase to meet the PQOs. It is important that calibration requirements, detection limits (DLs), and project-specific LODs and LOQs presented in the work plan are achieved and that target analytes can be detected at concentrations necessary to support the PQOs. In addition, sample results are compared to method blank and field blank results to identify potential effects of laboratory background and field procedures on sensitivity.

The following sections present a review of QC data for each analytical method. The details regarding the qualification of results are provided in the data validation reports.



## **2.0 VOLATILE ORGANIC COMPOUNDS**

A total of 44 water samples were analyzed for BTEX and a total of 14 water samples were analyzed for 1,2-DCA by EPA SW 846 Method 8260B. All volatile organic compounds (VOC) data were assessed to be valid since none of the 190 total results were rejected due to holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the PQOs.

### **2.1 Precision and Accuracy**

#### **2.1.1 Instrument Calibration**

Initial and continuing calibration results provide a means of evaluating accuracy within a particular SDG. Relative response factor (RRF), percent relative standard deviation (%RSD), and percent difference (%D) are the three major parameters used to measure the effectiveness of instrument calibration. RRF is a measure of the relative spectral response of an analyte compared to its internal standard. %RSD is an expression of the linearity of instrument response. %D is a comparison of a continuing calibration instrumental response with its initial response. %RSD and %D exceedances suggest routine instrumental anomalies, which typically impact all sample results for the affected compounds.

The RRFs met the validation acceptance criteria of  $\geq 0.05$  in the initial and continuing calibrations. The %RSDs met the method acceptance criteria of 15 percent or the coefficient of determination ( $r^2$ ) was  $\geq 0.990$  in the initial calibration. The %Ds in the initial verifications met the method acceptance criteria of 20 percent. The %Ds in the ending continuing calibration verifications met the validation acceptance criteria of 50 percent.

The toluene results for samples ERH877 and ERH878 were qualified as non-detected estimated (UJ). The %D in the continuing calibration verification was outside the method acceptance criteria of 20 percent.

#### **2.1.2 Surrogates**

As a result of a low surrogate %R, the BTEX results for sample ERH846 were qualified as non-detected estimated (UJ). Low surrogate %R indicates that the results may be biased low in the associated sample.

No data were qualified as a result of high surrogate %Rs in several samples since the associated results were not detected.

#### **2.1.3 MS/MSD Samples**

As a result of a low MS %R, the xylenes, total result for sample ERH882 was qualified as non-detected estimated (UJ). Low MS/MSD %R indicates that the result may be biased low in the associated sample.

All MS/MSD RPDs were within the acceptance criteria.

#### **2.1.4 LCS/LCSD Samples**

No data were qualified as a result of high LCS/LCSD %Rs since the associated results were not detected.

All LCS/LCSD RPDs were within the acceptance criteria.

### **2.1.5 FD Samples**

No VOC were detected for field duplicate samples ERH838 and ERH839; samples ERH846 and ERH847; and samples ERH882 and ERH883.

### **2.1.6 Internal Standards**

All internal standard areas and retention areas were within acceptance criteria.

### **2.1.7 Proficiency Testing Samples**

Proficiency testing (PT) samples were not performed for the sampling event.

### **2.1.8 Compound Quantitation and Target Identification**

All compound quantitation and target identifications were found to be acceptable.

## **2.2 Representativeness**

### **2.2.1 Holding Times**

The evaluation of holding times to verify compliance with the method was conducted. All holding times were met.

### **2.2.2 Blanks**

Method blanks, TBs, EBs and FBs were collected and analyzed to evaluate representativeness. The concentration for an individual target compound in any of the types of QA/QC blanks was used for data qualification.

If contaminants were detected in a blank, corrective actions were made for the chemical analytical data during data validation. The corrective action consisted of amending the laboratory reported results based on the following criteria.

Results Below or Above the LOQ If a sample result for the blank contaminant was less than the LOQ or greater than the sample LOQ and less than 5 times the blank value for all contaminants, the sample result for the blank contaminant was amended as a non-detect at the concentration reported in the sample results.

No Action If a sample result for the blank contaminant was greater than 5 times the blank value for all contaminants, the result was not amended.

#### **2.2.2.1 Method Blanks**

No contaminants were detected in the method blanks for this analysis.

#### **2.2.2.2 EBs and FBs**

No contaminants were detected in the equipment blanks and field blanks for this analysis.

### **2.2.2.3 Trip Blanks**

No contaminants were detected in the trip blanks for this analysis.

## **2.3 Comparability**

The laboratory used standard analytical methods for all of the analyses. In all cases, the DLs and LODs attained were below the specified LOQs. The comparability of the data is regarded as acceptable.

## **2.4 Completeness**

The completeness level attained for VOC field samples was 100 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

## **2.5 Sensitivity**

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory DLs and LOQs met the specified requirements described in the QAPP.

## **3.0 PHENOL**

A total of 24 water samples were analyzed for phenol by EPA SW-846 Method 8270D. All phenol data were assessed to be valid since none of the 24 total results were rejected due to holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the PQOs.

### **3.1 Precision and Accuracy**

#### **3.1.1 Instrument Calibration**

The RRFs met the validation acceptance criteria of  $\geq 0.05$  in the initial and continuing calibrations. The %RSDs met the method acceptance criteria of 15 percent. The %Ds in the initial and continuing calibration verifications met the method acceptance criteria of 20 percent. The %Ds in the ending continuing calibration verifications met the validation acceptance criteria of 50 percent.

#### **3.1.2 Surrogates**

No data were qualified as a result of high surrogate %Rs in sample ERH847 since the associated phenol result was not detected.

#### **3.1.3 MS/MSD Samples**

All MS/MSD %Rs and RPDs were within the acceptance criteria.

#### **3.1.4 LCS/LCSD Samples**

All LCS/LCSD %Rs and RPDs were within the acceptance criteria.

### **3.1.5 Internal Standards**

All internal standard areas and retention times were within the acceptance criteria.

### **3.1.6 FD Samples**

No phenol was detected for field duplicate samples ERH838 and ERH839; samples ERH846 and ERH847; and samples ERH882 and ERH883.

### **3.1.7 Proficiency Testing Samples**

PT samples were not performed for the sampling event.

### **3.1.8 Compound Quantitation and Target Identification**

All compound quantitation and target compound identification were found to be acceptable.

## **3.2 Representativeness**

### **3.2.1 Holding Times**

The evaluation of holding times to verify compliance with the method was conducted. All holding times were met.

### **3.2.2 Blanks**

Method blanks, EBs, and FBs were collected and analyzed to evaluate representativeness.

#### **3.2.2.1 Method Blanks**

No phenol was detected in the method blanks for this analysis.

#### **3.2.2.2 EBs and FBs**

No phenol was detected in the equipment blanks and field blanks for this analysis.

## **3.3 Comparability**

The laboratory used standard analytical methods for all of the analyses. In all cases, the DLs and LODs attained were below the specified LOQs. The comparability of the data is regarded as acceptable.

## **3.4 Completeness**

The completeness level attained for phenol was 100 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

## **3.5 Sensitivity**

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory DLs and LOQs met the specified requirements described in the work plan.

## **4.0 POLYNUCLEAR AROMATIC HYDROCARBONS**

A total of 24 water samples were analyzed for 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene by EPA SW-846 Method 8270D-SIM. All PAH data were assessed to be valid since none of the 72 total results were rejected based on holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the PQOs.

### **4.1 Precision and Accuracy**

#### **4.1.1 Instrument Calibration**

The RRFs met the validation acceptance criteria of  $\geq 0.05$  in the initial and continuing calibrations. The %RSDs met the method acceptance criteria of 15 percent. The %Ds in the initial and continuing calibration verifications met the method acceptance criteria of 20 percent. The %Ds in the ending continuing calibration verifications met the validation acceptance criteria of 50 percent.

#### **4.1.2 Surrogates**

All surrogate %Rs were within the acceptance criteria.

#### **4.1.3 MS/MSD Samples**

All MS/MSD %Rs and RPDs were within the acceptance criteria.

#### **4.1.4 LCS/LCSD Samples**

All LCS/LCSD %Rs and RPD were within the acceptance criteria.

#### **4.1.5 Internal Standards**

All internal standard areas and retention times were within the acceptance criteria.

#### **4.1.6 Field Duplicate Samples**

The FD RPDs were within the acceptance criteria for field duplicate samples ERH846 and ERH847.

No PAH were detected for field duplicate samples ERH838 and ERH839; and samples ERH882 and ERH883.

#### **4.1.7 Proficiency Testing Samples**

PT samples were not performed for the sampling event.

#### **4.1.8 Compound Quantitation and Target Identification**

All compound quantitation and target compound identification were found to be acceptable.

## **4.2 Representativeness**

### **4.2.1 Holding Times**

The evaluation of holding times to verify compliance with the method was conducted. All holding times were met.

### **4.2.2 Blanks**

Method blanks, EBs, and FBs were collected and analyzed to evaluate representativeness.

#### **4.2.2.1 Method Blanks**

No contaminants were detected in the method blanks for this analysis.

#### **4.2.2.2 EBs and FBs**

No contaminants were detected in the equipment blanks and field blanks for this analysis.

## **4.3 Comparability**

The laboratory used standard analytical methods for all of the analyses. In all cases, the DLs and LODs attained were below the specified LOQs. The comparability of the data is regarded as acceptable.

## **4.4 Completeness**

The completeness level attained for PAH field samples was 100 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

## **4.5 Sensitivity**

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory DLs and LOQs met the specified requirements described in the work plan.

## **5.0 2-(2-METHOXYETHOXY)-ETHANOL**

A total of 24 water samples were analyzed for MEE by EPA SW 846 Method 8270D modified. All MEE data were assessed to be valid since none of the 24 total results were rejected based on holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the PQOs.

### **5.1 Precision and Accuracy**

#### **5.1.1 Instrument Calibration**

The RRFs met the validation acceptance criteria of  $\geq 0.05$  in the initial and continuing calibrations. The %RSDs met the method acceptance criteria of 15 percent. The %Ds in the initial and continuing calibration verifications met the method acceptance criteria of 20 percent. The %Ds in the ending continuing calibration verifications met the validation acceptance criteria of 50 percent.

### **5.1.2 Surrogates**

Surrogates were not added to all samples as required by the method. No data were qualified when one base surrogate %R was outside the QC limits and the %R was greater than or equal to 10% in the phenol analysis for sample ERH876.

### **5.1.3 MS/MSD Samples**

All MS/MSD %Rs and RPDs were within the acceptance criteria.

### **5.1.4 LCS/LCSD Samples**

No data were qualified as a result of a high LCSD %R since the associated results were not detected.

As a result of high LCS/LCSD RPDs, the MEE results for five samples were qualified as non-detected estimated (UJ). Bias cannot be determined.

### **5.1.5 Internal Standards**

All internal standard areas and retention times were within the acceptance criteria.

### **5.1.6 Field Duplicate Samples**

No MEE was detected for field duplicate samples ERH838 and ERH839; samples ERH846 and ERH847; and samples ERH882 and ERH883.

### **5.1.7 Proficiency Testing Samples**

PT samples were not performed for the sampling event.

### **5.1.8 Compound Quantitation and Target Identification**

All compound quantitation and target compound identification were found to be acceptable.

## **5.2 Representativeness**

### **5.2.1 Holding Times**

The evaluation of holding times to verify compliance with the method was conducted. All holding times were met.

### **5.2.2 Blanks**

Method blanks, EBs, and FBs were collected and analyzed to evaluate representativeness.

#### **5.2.2.1 Method Blanks**

No contaminants were detected in the method blanks for this analysis.

### **5.2.2.2 EBs and FBs**

No contaminants were detected in the equipment blanks and field blanks for this analysis.

### **5.3 Comparability**

The laboratory used standard analytical methods for all of the analyses. In all cases, the DLs and LODs attained were below the specified LOQs. The comparability of the data is regarded as acceptable.

### **5.4 Completeness**

The completeness level attained for MEE field samples was 100 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

### **5.5 Sensitivity**

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory DLs and LOQs met the specified requirements described in the work plan.

## **6.0 GASOLINE RANGE ORGANICS**

A total of 44 water samples were analyzed for GRO by EPA SW-846 Method 8260B. All GRO data were assessed to be valid since none of the 44 total results were rejected based on holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the PQOs.

### **6.1 Precision and Accuracy**

#### **6.1.1 Instrument Calibration**

The coefficient of determination ( $r^2$ ) was  $\geq 0.990$  in the initial calibration. The %Ds in the initial and continuing calibration verification met the method acceptance criteria of 20 percent.

#### **6.1.2 Surrogates**

No data were qualified as a result of high surrogate %Rs in samples ERH850 and ERH865 since the associated GRO results were not detected.

#### **6.1.3 MS/MSD Samples**

As a result of a low MS/MSD %Rs, the GRO result for sample ERH882 was qualified as non-detected estimated (UJ). Low MS/MSD %R indicates that the result may be biased low in the associated sample.

All MS/MSD RPDs were within the acceptance criteria.

#### **6.1.4 LCS/LCSD Samples**

All LCS/LCSD %Rs and RPDs were within the acceptance criteria.



### **6.1.5 Field Duplicate Samples**

The FD RPD was outside the acceptance criteria for field duplicate samples ERH846 and ERH847. Sample data were not qualified on the basis of field duplicate imprecision.

No GRO were detected for field duplicate samples ERH838 and ERH839; and samples ERH882 and ERH883.

### **6.1.6 Proficiency Testing Samples**

PT samples were not performed for the sampling event.

### **6.1.7 Compound Quantitation and Target Identification**

All compound quantitation and target compound identification were found to be acceptable

## **6.2 Representativeness**

### **6.2.1 Holding Times**

The evaluation of holding times to verify compliance with the method was conducted. All holding times were met.

### **6.2.2 Blanks**

Method blanks, EBs, FBs, and TBs were collected and analyzed to evaluate representativeness.

#### **6.2.2.1 Method Blanks**

No contaminants were detected in the method blanks for this analysis.

#### **6.2.2.2 EBs and FBs**

No contaminants were detected in the equipment blanks and field blanks for this analysis.

#### **6.2.2.3 Trip Blanks**

No contaminants were detected in the trip blanks for this analysis.

## **6.3 Comparability**

The laboratory used standard analytical methods for all of the analyses. In all cases, the DLs attained were below the specified LOQs. The comparability of the data is regarded as acceptable.

## **6.4 Completeness**

The completeness level attained for GRO field samples was 100 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

## **6.5 Sensitivity**

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory DLs and LOQs met the specified requirements described in the work plan.

## **7.0 TOTAL PETROLEUM HYDROCARBONS AS EXTRACTABLES**

A total of 24 water samples were analyzed for diesel range organics (DRO) and oil range organics (ORO) by EPA SW-846 Method 8015B and five water samples were also analyzed for DRO and ORO with silica gel cleanup (SGCU) by EPA SW-846 Method 8015B. All TPHE data were assessed to be valid since none of the 58 total results were rejected based on holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the PQOs.

### **7.1 Precision and Accuracy**

#### **7.1.1 Instrument Calibration**

The %RSDs in the initial calibration and the %Ds in the initial and continuing calibration verifications met the method acceptance criteria of 20 percent.

#### **7.1.2 Surrogates**

No data were qualified as a result of high surrogate %R in several samples since the associated results were not detected.

#### **7.1.3 MS/MSD Samples**

No data were qualified as a result of high ORO MS/MSD %Rs, since the associated result was not detected.

All MS/MSD RPDs were within the acceptance criteria.

#### **7.1.4 LCS/LCSD Samples**

No data were qualified as a result of high ORO LCSD %Rs, since the associated results were not detected.

All LCS/LCSD RPDs were within the acceptance criteria.

#### **7.1.5 Field Duplicate Samples**

The FD RPDs were within the acceptance criteria for field duplicate samples ERH846 and ERH847.

No DRO or ORO were detected for field duplicate samples ERH838 and ERH839; and samples ERH882 and ERH883.

#### **7.1.6 Proficiency Testing Samples**

PT samples were not performed for the sampling event.

### **7.1.7 Compound Quantitation and Target Identification**

All compound quantitation and target compound identification were found to be acceptable.

## **7.2 Representativeness**

### **7.2.1 Holding Times**

The evaluation of holding times to verify compliance with the method was conducted.

### **7.2.2 Blanks**

Method blanks, EBs, and FBs were collected and analyzed to evaluate representativeness.

#### **7.2.2.1 Method Blanks**

No contaminants were detected in the method blanks for this analysis.

#### **7.2.2.2 Equipment Blanks and Field Blanks**

No contaminants were detected in the equipment blanks and field blanks for this analysis.

## **7.3 Comparability**

The laboratory used standard analytical methods for all of the analyses. In all cases, the DLs attained were below the specified LOQs. The comparability of the data is regarded as acceptable.

## **7.4 Completeness**

The completeness level attained for TPHE field samples was 100 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

## **7.5 Sensitivity**

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory DLs and LOQs met the specified requirements described in the work plan.

## **8.0 ETHYLENE DIBROMIDE**

A total of 14 water samples were analyzed for EDB by EPA SW-846 Method 8011. All EDB data were assessed to be valid since none of the 14 total results were rejected based on holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the PQOs.

### **8.1 Precision and Accuracy**

#### **8.1.1 Instrument Calibration**

The %RSDs in the initial calibration and the %Ds in the initial and continuing calibration verifications met the method acceptance criteria of 20 percent.

### **8.1.2 Surrogates**

All surrogate %Rs were within the acceptance criteria.

### **8.1.3 LCS/LCSD Samples**

All LCS/LCSD %Rs and RPDs were within the acceptance criteria.

### **8.1.4 MS/MSD Samples**

All MS/MSD %Rs and RPDs were within the acceptance criteria.

### **8.1.5 Field Duplicate Samples**

No EDB was detected for field duplicate samples ERH882 and ERH883.

### **8.1.6 Proficiency Testing Samples**

PT samples were not performed for the sampling event.

### **8.1.7 Compound Quantitation and Target Identification**

All compound quantitation and target compound identification were found to be acceptable.

## **8.2 Representativeness**

### **8.2.1 Holding Times**

The evaluation of holding times to verify compliance with the method was conducted. All holding times were met.

### **8.2.2 Blanks**

Method blanks, equipment blanks, field blanks, and trip blanks were collected and analyzed to evaluate representativeness.

#### **8.2.2.1 Method Blanks**

No contaminants were detected in the method blanks for this analysis.

#### **8.2.2.2 Equipment Blanks and Field Blanks**

No contaminants were detected in the equipment blanks and field blanks for this analysis.

#### **8.2.2.3 Trip Blanks**

No contaminants were detected in the trip blanks for this analysis.

## **8.3 Comparability**

The laboratory used standard analytical methods for all of the analyses. In all cases, the DLs attained were

below the specified LOQs. The comparability of the data is regarded as acceptable.

#### **8.4 Completeness**

The completeness level attained for EDB field samples was 100 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

#### **8.5 Sensitivity**

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory DLs and LOQs met the specified requirements described in the work plan.

### **9.0 METHANE**

A total of 39 water samples were analyzed for methane by Method RSK-175. All methane data were assessed to be valid since none of the 39 total results were rejected based on holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the PQOs.

#### **9.1 Precision and Accuracy**

##### **9.1.1 Instrument Calibration**

The ~~the~~ coefficient of determination ( $r^2$ ) was  $\geq 0.990$  in the initial calibration. The %Ds in the initial and continuing calibration verifications met the method acceptance criteria of 20 percent.

##### **9.1.2 MS/MSD Samples**

No data were qualified as a result of high methane MS/MSD %Rs, since the associated results were not detected.

All MS/MSD RPDs were within the acceptance criteria.

##### **9.1.3 LCS/LCSD Samples**

All LCS/LCSD %Rs and RPDs were within the acceptance criteria.

##### **9.1.4 Field Duplicate Samples**

The FD RPDs were within the acceptance criteria for field duplicate samples ERH846 and ERH847.

##### **9.1.5 Proficiency Testing Samples**

PT samples were not performed for the sampling event.

##### **9.1.6 Compound Quantitation and Target Identification**

All compound quantitation and target compound identification were found to be acceptable.

In instances where data were diluted by the laboratory, data were qualified as not reportable by the validators in order to yield only one complete set of data for a given sample.

## **9.2 Representativeness**

### **9.2.1 Holding Times**

The evaluation of holding times to verify compliance with the method was conducted. All holding times were met.

### **9.2.2 Blanks**

Method blanks and trip blanks were collected and analyzed to evaluate representativeness.

#### **9.2.2.1 Method Blanks**

No contaminants were detected in the method blanks for this analysis.

#### **9.2.2.2 Trip Blanks**

No data were qualified due to methane detected in one trip blank.

## **9.3 Comparability**

The laboratory used standard analytical methods for all of the analyses. In all cases, the DLs attained were below the specified LOQs. The comparability of the data is regarded as acceptable.

## **9.4 Completeness**

The completeness level attained for methane field samples was 100 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

## **9.5 Sensitivity**

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory DLs and LOQs met the specified requirements described in the work plan.

## **10.0 METALS**

A total of five water samples were analyzed for metals by EPA SW-846 Method 6010C. All metals data were assessed to be valid since none of the 25 total results were rejected due to holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the DQOs.

### **10.1 Precision and Accuracy**

#### **10.1.1 Instrument Calibration**

Initial and continuing calibration verification results provide a means of evaluating accuracy within a particular SDG. Correlation coefficient ( $r$ ) and %R are the two major parameters used to measure the

effectiveness of instrument calibration. The *r* indicates the linearity of the calibration curve. %R is used to verify the ongoing calibration acceptability of the analytical system. The most critical of the two calibration parameters, *r*, has the potential to affect data accuracy across a SDG when it is outside the acceptable QC limits. %R exceedances suggest more routine instrumental anomalies, which typically impact all sample results for the affected analytes.

The correlation coefficients in the initial calibrations and percent recoveries in the initial and continuing calibration verifications were within the acceptance criteria of  $\geq 0.995$  and 90-110 percent, respectively.

#### **10.1.2 MS/MSD Samples**

All MS/MSD %Rs and RPDs were within the acceptance criteria.

#### **10.1.3 LCS/LCSD Samples**

All LCS/LCSD %Rs and RPDs were within the acceptance criteria.

#### **10.1.4 FD Samples**

Field duplicates were collected for this analysis.

#### **10.1.5 ICP Interference Check Sample**

All ICP interference check %Rs were within the acceptance criteria.

#### **10.1.6 Proficiency Testing Samples**

PT samples were not performed for the sampling event.

#### **10.1.7 Sample Result Verification**

All sample results were found to be acceptable.

### **10.2 Representativeness**

#### **10.2.1 Holding Times**

The evaluation of holding times to verify compliance with the method was conducted. All holding times were met.

#### **10.2.2 Blanks**

Method blanks and ICB/CCBs were analyzed to evaluate representativeness.

##### **10.2.2.1 Method and Calibration Blanks**

No data were qualified due to the contaminant detected in the calibration blank.

### **10.3 Comparability**

The laboratory used standard analytical methods for all of the analyses. In all cases, the DLs and LODs attained were below the specified LOQs. Target compounds detected below the LOQs flagged (J) by the laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

### **10.4 Completeness**

The completeness level attained for metal field samples was 100 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

### **10.5 Sensitivity**

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory LODs and LOQs met the specified requirements described in the work plan.

## **11.0 WET CHEMISTRY**

A total of 19 water samples were analyzed for alkalinity by Standard Method 2320B; anions by EPA Method 300.0; ferrous iron by Standard Method 3500-Fe B; nitrate/nitrite as nitrogen by EPA Method 353.2; and TOC by EPA SW-846 Method 9060A. A total of five water samples were analyzed for silica and dissolved silica by Standard Method 4500-Si D and DOC by EPA SW-846 Method 9060A. All wet chemistry data were assessed to be valid with the exception of two of the 196 total results were rejected due to holding time exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCCS criteria and evaluated based on the PQOs.

### **11.1 Precision and Accuracy**

#### **11.1.1 Instrument Calibration**

The correlation coefficients in the initial calibrations were within the method acceptance criteria of  $\geq 0.995$ .

Three ferrous iron results, one fluoride result and nine TOC results were qualified as detected estimated (J) or non-detected estimated (UJ). The continuing calibration verification (CCV) %Rs were outside the method acceptance criteria of 90-110 percent. Low CCV %R indicates that the ferrous iron results may be biased low in the associated samples. High CCV %R indicates that the fluoride and TOC results may be biased high in the associated samples.

#### **11.1.2 MS/MSD Samples**

All MS/MSD %Rs and RPDs were within the acceptance criteria.

#### **11.1.3 LCS/LCSD Samples**

As a result of low LCS %Rs, the TOC results for samples ERH880 and ERH882 were qualified as detected estimated (J). Low LCS %R indicates that the result may be biased low in the associated sample.

As a result of high LCS/LCSD %Rs, six TOC results were qualified as detected estimated (J). High LCS %R indicates that the result may be biased high in the associated sample.



As a result of a high LCS/LCSD RPD, the TOC results for samples ERH880 and ERH882 were qualified as detected estimated (J). Bias cannot be determined.

#### **11.1.4 Laboratory Duplicate Samples**

DUP sample analyses were performed for alkalinity. Results were within the acceptance criteria.

#### **11.1.5 Field Duplicate Samples**

Field duplicates were not collected for these analyses.

#### **11.1.6 Proficiency Testing Samples**

PT samples were not performed for the sampling event.

#### **11.1.7 Sample Result Verification**

All sample results were found to be acceptable.

In instances where data were diluted by the laboratory, data were qualified as not reportable by the validators in order to yield only one complete set of data for a given sample.

### **11.2 Representativeness**

#### **11.2.1 Holding Times**

The evaluation of holding times to verify compliance with the method was conducted.

As a result of analysis holding time exceedances, 11 nitrate as nitrogen results and three ferrous iron results were qualified as detected estimated (J) or non-detected estimated (UJ). For samples ERH844 and ERH878, since the holding time was grossly exceeded (i.e. > 2X), the associated [nitrate as nitrogen](#) results were qualified as rejected (R). The analysis holding time is 48 hours for nitrate and 7 days for ferrous iron. Results may be biased low in the associated samples.

#### **11.2.2 Blanks**

Method blanks and calibration blanks were analyzed to evaluate representativeness.

##### **11.2.2.1 Method and Calibration Blanks**

As a result of method blank contamination, seven TOC results and one nitrate/nitrite as nitrogen result were qualified as not detected (U).

### **11.3 Comparability**

The laboratory used standard analytical methods for all of the analyses. In all cases, the DLs attained were below the specified LOQs. Target compounds detected below the LOQs flagged (J) by the laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

## **11.4 Completeness**

The completeness level attained for wet chemistry field samples was 99.0 percent. This percentage was calculated as the total number of accepted sample results divided by the total number of sample results multiplied by 100.

## **11.5 Sensitivity**

The calibration was evaluated for instrument sensitivity and was determined to be technically acceptable. All laboratory DLs and LOQs met the specified requirements described in the work plan.

## **12.0 VARIANCES IN ANALYTICAL PERFORMANCE**

The laboratory used standard analytical methods for all of the analyses throughout the project. No systematic variances in analytical performance were noted in the case narratives.

## **13.0 SUMMARY OF PARCCS CRITERIA**

The validation reports present the PARCCS results for all SDGs. Each PARCCS criterion is discussed in detail in the following sections.

### **13.1 Precision and Accuracy**

Low surrogate %R, MS/MSD %R, LCS/LCSD %R and CCV %R indicate that the associated VOC, GRO, DRO, ferrous iron and TOC results may be biased low in the associated samples.

High LCS %R and CCV %R indicates that the associated fluoride and TOC results may be biased high in the associated samples.

Bias cannot be determined for MEE and TOC results due to continuing calibration verification %D, and LCS/LCSD RPD outside the acceptance criteria.

Precision and accuracy were evaluated using data quality indicators such as calibration, surrogates, MS/MSD, LCS/LCSD, FD, and internal standards. The precision and accuracy of the data set were considered acceptable after integration of qualification of estimated results as noted above.

### **13.2 Representativeness**

All samples for each method and matrix were evaluated for holding time compliance. All holding times were met with the exceptions noted in Section 11.2.1. All samples were associated with a method blank in each individual SDG. The representativeness of the project data is considered acceptable.

### **13.3 Comparability**

Sampling frequency requirements were met in obtaining field duplicates and necessary field blanks. The laboratory used standard analytical methods for their analyses. The analytical results were reported in correct standard units. The overall comparability is considered acceptable.

### 13.4 Completeness

Of the 686 total results reported, two results were rejected. The completeness for all SDGs is as follows:

<b>Parameter</b>	<b>Total Analytes</b>	<b>No. of Rejects</b>	<b>% Completeness</b>
VOC	190	0	100
Phenol	24	0	100
PAH	72	0	100
MEE	24	0	100
GRO	44	0	100
TPH as Extractables	58	0	100
EDB	14	0	100
Methane	39	0	100
Metals	25	0	100
Wet Chemistry	196	2	99.0
<b>Total</b>	<b>686</b>	<b>2</b>	<b>99.7</b>

The completeness percentage based on rejected data met the 90 percent PQO goal. A less quantifiable loss of data occurred in the application of blank qualifications as noted in Sections 11.2.2.1.

### 13.5 Sensitivity

Sensitivity was achieved by the laboratory to support the PQOs. Calibration concentrations, DLs, LODs and LOQs met the project requirements and low level contamination in the method blanks and one trip blank did not affect sensitivity.

Table I. Sample Cross-Reference

LDC	SDG	Client Sample ID	Lab Sample ID	Matrix	Sample Date	QC Type	Validation Level	BTEX + DCA (8260B)	BTEX (8260B)	Phenol (8270D)	2,2-MEE (8270D-Mod)	PAH (8270D SIM)	GRO (8260B)	TPHE (8015B)	TPHE.SGCU (8015B)	EDB (8011)	Methane (RSK 175)	Metals (6010C)	Alkalinity (2320B)	Anions (300.0)	NO3/NO2-N (353.2)	Fe II (3500-Fe B)	Silica (4500-Si D)	D.Silica(4500-Si D)	DOC (9060A)	TOC (9060A)
45841A	89570	ERH856	AZ95186	Water	07/22/19	TB	Level C		X				X				X									
45841A	89570	ERH857	AZ95187	Water	07/22/19		Level C		X	X	X	X	X	X			X		X	X	X	X				X
45841A	89570	ERH837	AZ95188	Water	07/22/19	TB	Level C		X				X				X									
45841A	89570	ERH838	AZ95189	Water	07/22/19	FD1	Level C		X	X	X	X	X	X			X		X	X	X	X				X
45841A	89570	ERH839	AZ95190	Water	07/22/19	FD1	Level C		X	X	X	X	X	X												
45841B	89593	ERH845	AZ95328	Water	07/23/19	TB	Level C		X				X				X									
45841B	89593	ERH846	AZ95329	Water	07/23/19	FD2	Level D		X	X	X	X	X	X	X		X		X	X	X	X				X
45841B	89593	ERH847	AZ95330	Water	07/23/19	FD2	Level C		X	X	X	X	X	X	X		X									
45841B	89593	ERH848	AZ95331	Water	07/23/19	TB	Level C		X				X				X									
45841B	89593	ERH849	AZ95332	Water	07/23/19		Level D		X				X													
45841B	89593	ERH849	AZ95332	Water	07/23/19		Level C			X	X	X		X	X		X		X	X	X	X				X
45841B	89593	ERH850	AZ95333	Water	07/23/19	TB	Level C		X				X				X									
45841B	89593	ERH851	AZ95334	Water	07/23/19		Level C		X	X	X	X	X	X			X		X	X	X	X				X
45841B	89593	ERH852	AZ95335	Water	07/22/19	TB	Level C		X				X				X									
45841B	89593	ERH853	AZ95336	Water	07/22/19		Level C		X	X	X	X	X	X			X		X	X	X	X				X
45841B	89593	ERH854	AZ95337	Water	07/22/19	TB	Level C		X				X				X									
45841B	89593	ERH855	AZ95338	Water	07/22/19		Level C		X	X	X	X	X	X			X		X	X	X	X				X
45841C	89607	ERH843	AZ95418	Water	07/23/19	TB	Level C		X				X				X									
45841C	89607	ERH844	AZ95419	Water	07/23/19		Level C		X	X	X	X	X	X	X		X		X	X	X	X				X
45841C	89607	ERH860	AZ95420	Water	07/23/19	TB	Level C		X				X				X									
45841C	89607	ERH861	AZ95421	Water	07/23/19		Level C		X	X	X	X	X	X			X		X	X	X	X				X
45841C	89607	ERH864	AZ95422	Water	07/24/19	TB	Level C		X				X				X									
45841C	89607	ERH865	AZ95423	Water	07/24/19		Level C		X	X	X	X	X	X	X		X		X	X	X	X				X
45873A	89624	ERH862	AZ95510	Water	07/24/19	TB	Level C		X				X				X									
45873A	89624	ERH863	AZ95511	Water	07/24/19		Level C		X	X	X	X	X	X			X		X	X	X	X				X
45873A	89624	ERH866	AZ95512	Water	07/25/19	TB	Level C		X				X				X									
45873A	89624	ERH867	AZ95513	Water	07/25/19		Level C		X	X	X	X	X	X			X		X	X	X	X				X
45918A	89674	ERH881	AZ95859	Water	07/29/19	TB	Level C	X					X			X	X									
45918A	89674	ERH880	AZ95860	Water	07/29/19		Level C	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X		X
45972A	89682	ERH879	AZ95986	Water	07/30/19	TB	Level C	X					X			X	X									
45972A	89682	ERH882	AZ95987	Water	07/30/19	FD3	Level C	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
45972A	89682	ERH883	AZ95988	Water	07/30/19	FD3	Level C	X		X	X	X	X	X		X										
45972B	89702	ERH871	AZ96148	Water	07/31/19	TB	Level C	X					X			X	X									
45972B	89702	ERH872	AZ96149	Water	07/31/19		Level C	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
45972B	89702	ERH877	AZ96151	Water	08/01/19	TB	Level C		X				X				X									
45972B	89702	ERH878	AZ96152	Water	08/01/19		Level C		X	X	X	X	X	X			X		X	X	X	X				X
45972B	89702	ERH890	AZ96150	Water	07/31/19		Level C																		X	
45972C	89749	ERH868	AZ96498	Water	8/5/2019	TB	Level C	X					X			X										

Table I. Sample Cross-Reference

LDC	SDG	Client Sample ID	Lab Sample ID	Matrix	Sample Date	QC Type	Validation Level	BTEX + DCA (8260B)	BTEX (8260B)	Phenol (8270D)	2,2-MEE (8270D-Mod)	PAH (8270D SIM)	GRO (8260B)	TPHE (8015B)	TPHE SGCU (8015B)	EDB (8011)	Methane (RSK 175)	Metals (6010C)	Alkalinity (2320B)	Anions (300.0)	NO3/NO2-N (353.2)	Fe II (3500-Fe B)	Silica (4500-Si D)	D.Silica(4500-Si D)	DOC (9060A)	TOC (9060A)
45972C	89749	ERH869	AZ96499	Water	8/5/2019	FB	Level C	X		X	X	X	X	X		X										
45972C	89749	ERH870	AZ96500	Water	08/05/19	EB	Level C	X		X	X	X	X	X		X										
45972C	89749	ERH873	AZ96501	Water	08/05/19	TB	Level C	X					X			X	X									
45972C	89749	ERH874	AZ96502	Water	08/05/19		Level D	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
45972C	89749	ERH875	AZ96503	Water	8/6/2019	TB	Level C	X					X			X	X									
45972C	89749	ERH876	AZ96504	Water	8/6/2019		Level D	X		X	X	X	X	X												
45972C	89749	ERH876	AZ96504	Water	8/6/2019		Level C									X	X	X	X	X	X	X	X	X	X	X
45972D	89785	ERH858	AZ96694	Water	08/07/19	TB	Level C		X				X				X									
45972D	89785	ERH859	AZ96695	Water	08/07/19		Level C		X	X	X	X	X	X			X		X	X	X	X				X

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