

Final

First Quarter 2017 - Quarterly Groundwater Monitoring Report

**Red Hill Bulk Fuel Storage Facility
Joint Base Pearl Harbor-Hickam, O‘ahu, Hawai‘i**

DOH Facility ID No.: 9-102271

DOH Release ID Nos.: 990051, 010011, 020028, and 140010

April 2017



Contract Number N62742-12-D-1829, CTO 0053

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April 2017

Prepared for:

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Contract Number N62742-12-D-1829, CTO 0053

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EXECUTIVE SUMMARY

1
2 This quarterly groundwater monitoring report presents the results of the First Quarter 2017
3 groundwater sampling event conducted during January 9–12, 2017, and the results of previous
4 monthly sampling events conducted during November 14–17 and December 12–15, 2016, at the Red
5 Hill Bulk Fuel Storage Facility (“the Facility”), Joint Base Pearl Harbor-Hickam (JBPHH), Hawai‘i.
6 In addition, the results of resampling one groundwater monitoring well (RHMW08) on December
7 21, 2016 are also included. The Facility is located in Hālawā Heights on the island of O‘ahu. There
8 are 18 active and 2 inactive underground fuel storage tanks located at the Facility. The State of
9 Hawai‘i Department of Health (DOH) Facility Identification (ID) number is 9-102271. The DOH
10 Release ID numbers are 990051, 010011, 020028, and 140010.

11 The groundwater sampling was conducted as part of the Red Hill groundwater long-term monitoring
12 (LTM) program, and performed under the Comprehensive Long-Term Environmental Action Navy
13 (CLEAN) IV contract task order 0053. Data collected for this groundwater monitoring event also
14 support Sections 6 and 7 of the *Administrative Order on Consent in the Matter of Red Hill Bulk Fuel*
15 *Storage Facility, EPA Docket Number RCRA 7003-R9-2015-01 and DOH Docket*
16 *Number 15-UST-EA-01*, Attachment A, Statement of Work (EPA Region 9 and DOH 2015). The
17 purpose of the sampling is to assess the condition of groundwater beneath the Facility, and to ensure
18 the United States Department of the Navy (DON; Navy) remains in compliance with DOH
19 Underground Storage Tank (UST) release response requirements as described in Hawai‘i
20 Administrative Rules Chapter 11-281 Subchapter 7, Release Response Action. The sampling was
21 conducted in accordance with the Naval Facilities Engineering Command (NAVFAC) Pacific
22 *Project Procedures Manual* (DON 2015b), the DOH *Technical Guidance Manual for the*
23 *Implementation of the Hawaii State Contingency Plan* (DOH 2016b), and the *Investigation and*
24 *Remediation of Releases and Groundwater Protection and Evaluation Work Plan and Scope of*
25 *Work (WP/SOW) Revision 01* (DON 2016c) and *Revision 02* (DON 2017a). A *Sampling and*
26 *Analysis Plan* (SAP) (DON 2017b) was also prepared in January 2017 for Administrative Order on
27 Consent (AOC) Statement of Work Sections 6 and 7 that contains updated information for the
28 groundwater sampling.

29 This report presents the activities conducted and sampling results for wells located both inside and
30 outside the tunnels and combines the information into one report to facilitate review, and provide a
31 better understanding of the entire site in one document.

32 Monthly sampling of the Red Hill monitoring network was initiated in November 2016 in response
33 to information obtained that the Red Hill Shaft pumps have been relatively inoperable since
34 February 2016 due to equipment (i.e., transformer) malfunction. Pumping at a reduced capacity was
35 initiated in November 2016 using temporary equipment, and the permanent equipment is scheduled
36 to be replaced in early 2017, at which time pumping will return to normal capacity. To evaluate
37 potential impacts the changed pumping conditions may have on COPC concentrations in
38 groundwater at and around the Facility, monthly sampling was conducted in November and
39 December 2016 and January and February 2017. The next additional monitoring event is scheduled
40 for March 2017, followed by another quarterly event in April 2017. It is anticipated that equipment
41 repairs will have been completed by early 2017 and that only quarterly monitoring events will be
42 conducted after the April 2017 sampling event. Results of the monthly sampling events will be
43 included in the scheduled quarterly monitoring reports.

44 During November 14–17, 2016, AECOM Technical Services, Inc. (AECOM) personnel collected
45 groundwater samples from 11 monitoring wells in the Red Hill groundwater monitoring network
46 (wells RHMW01 to RHMW09, HDMW2253-03, and OWDFMW01) and one sampling point at

1 Red Hill Shaft (RHMW2254-01). One primary and one duplicate sample were collected from
2 sampling point RHMW2254-01 and from well OWDFMW01.

3 During December 12–15, 2016, AECOM personnel, with DOH and NAVFAC Hawaii oversight in a
4 trial run of upcoming split sampling events, collected groundwater samples from the 11 monitoring
5 wells and the sampling point at Red Hill Shaft. On December 21, 2016, AECOM re-collected
6 groundwater samples from one monitoring well (RHMW08). One primary and one duplicate sample
7 were collected from sampling point RHMW2254-01 and from well OWDFMW01, and one primary
8 sample and one duplicate sample were collected during the resampling of RHMW08 on December
9 21, 2106.

10 During January 9–12, 2017, AECOM personnel, with DOH and NAVFAC Hawaii oversight in this
11 first split sampling event, collected groundwater and split samples from the 11 monitoring wells and
12 the sampling point at Red Hill Shaft. One primary and one duplicate sample were collected from
13 sampling point RHMW2254-01 and from well RHMW08.

14 Analytical results from the groundwater monitoring events were compared to the current LTM
15 screening criteria – criteria agreed upon by the Parties to the AOC and presented in the February 4,
16 2016, AOC Statement of Work Sections 6 and 7 scoping completion letter (EPA Region 9 and DOH
17 2016), and updated (where applicable) with the most current DOH Tier 1 Groundwater
18 Environmental Action Levels (EALs) for sites where groundwater is a potential or current drinking
19 water resource and the nearest surface water body is greater than 150 meters from release site (DOH
20 2016a). Analytical results for wells RHMW01, RHMW02, and RHMW03 were also compared to the
21 Site-Specific Risk-Based Levels (SSRBLs) for total petroleum hydrocarbons (TPH)-diesel-range
22 organics (TPH-d) (4,500 micrograms per liter [$\mu\text{g/L}$]) and benzene (750 $\mu\text{g/L}$), as established in the
23 Red Hill *Groundwater Protection Plan* (GWPP) (DON 2014) and presented in the February 4, 2016,
24 AOC Statement of Work Sections 6 and 7 scoping completion letter (EPA Region 9 and DOH 2016).
25 A summary of the analytical results is provided in the following:

- 26 • *RHMW01*: The only analyte detected in groundwater during November 2016 through
27 January 2017 was TPH-d (ranging from 88 $\mu\text{g/L}$ to 94 $\mu\text{g/L}$) below the screening criterion.
- 28 • *RHMW02*: Concentrations of TPH-d (1,300–1,400 $\mu\text{g/L}$), 1-methylnaphthalene (17–29
29 $\mu\text{g/L}$), 2-methylnaphthalene (11–12 $\mu\text{g/L}$) and naphthalene (40–69 $\mu\text{g/L}$) were detected
30 exceeding their respective screening criteria during all three events. The concentrations of
31 TPH-d did not exceed the SSRBL of 4,500 $\mu\text{g/L}$. Concentrations of TPH-o (42–100 $\mu\text{g/L}$),
32 TPH-g (26–63 $\mu\text{g/L}$), and total xylenes (0.19–0.26 $\mu\text{g/L}$) were also detected, but below their
33 respective screening criteria in two out of the three events.
- 34 • *RHMW03*: The only analytes detected in groundwater were TPH-d (51–56 $\mu\text{g/L}$) and TPH-o
35 (42–49 $\mu\text{g/L}$). Both analytes were detected below the screening criteria in all three events.
- 36 • *RHMW08*: The only analytes detected in groundwater were TPH-d (27–63 $\mu\text{g/L}$) and TPH-o
37 (29–32 $\mu\text{g/L}$). The concentrations of both analytes did not exceed the screening criteria.
- 38 • *RHMW09*: The only analyte detected in groundwater was phenol (1.1 $\mu\text{g/L}$) during the
39 December 2016 sampling event at a concentration below the screening criterion.
- 40 • *RHMW2254-01*: The only analytes detected in groundwater were TPH-d (14 $\mu\text{g/L}$) and
41 TPH-o (16 $\mu\text{g/L}$) during the December 2016 event. The concentrations of both analytes did
42 not exceed the screening criteria.

1 • *OWDFMW01*: The only analyte detected in groundwater was TPH-o (45–46 µg/L) during
2 the December and January events. The concentration of TPH-o did not exceed the screening
3 criterion.

4 The historical groundwater contaminant concentrations indicate a decline in chemical of potential
5 concern (COPC) concentrations since the 1st Quarter 2016 event.

6 The natural attenuation parameters (NAPs) also present evidence of anaerobic biodegradation
7 occurring at RHMW02 at significant levels based on the depleted dissolved oxygen, very high
8 dissolved methane concentrations, and depleted sulfate concentrations. The concentrations of NAPs
9 at RHMW01 and RHMW03 also indicate that biodegradation is also occurring.

10 Based on the groundwater monitoring results and in accordance with AOC Statement of Work
11 Sections 6 and 7, continued groundwater monitoring at the wells in the Red Hill groundwater
12 monitoring network is recommended.

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ACRONYMS AND ABBREVIATIONS

1		
2	%	percent
3	—	no data
4	%R	percent recovery
5	µg/L	microgram per liter
6	AECOM	AECOM Technical Services, Inc.
7	AOC	Administrative Order on Consent
8	APPL	Agriculture and Priority Pollutants Laboratories, Inc.
9	bgs	below ground surface
10	BTEX	benzene, toluene, ethylbenzene, and xylenes
11	btoc	below top of casing
12	CLEAN	Comprehensive Long-Term Environmental Action Navy
13	CoC	chain-of-custody
14	COPC	chemical of potential concern
15	DL	detection limit
16	DLNR	Department of Land and Natural Resources, State of Hawai‘i
17	DO	dissolved oxygen
18	DoD	Department of Defense
19	DOH	Department of Health, State of Hawai‘i
20	DON; Navy	Department of the Navy, United States
21	EAL	Environmental Action Level
22	EPA	Environmental Protection Agency, United States
23	F-24	NATO-grade F-24 jet fuel
24	F-76	Marine Diesel Fuel
25	Facility	Red Hill Bulk Fuel Storage Facility
26	GW	groundwater
27	ft	foot/feet
28	GPS	global positioning system
29	GW	groundwater
30	GWPP	Groundwater Protection Plan
31	H.A.R.	Hawai‘i Administrative Rules
32	ID	identification
33	IDW	investigation-derived waste
34	JBPHH	Joint Base Pearl Harbor-Hickam
35	JP	Jet Fuel Propellant
36	JP-5	Jet Fuel Propellant No. 5
37	JP-8	Jet Fuel Propellant No. 8
38	LCS	laboratory control sample
39	LCS D	laboratory control sample duplicate
40	LOD	limit of detection
41	LOQ	limit of quantitation
42	LTM	long-term monitoring
43	MDL	method detection limit
44	mg/L	milligram per liter
45	MS	matrix spike
46	MSD	matrix spike duplicate
47	msl	mean sea level

1	mV	millivolt
2	NAP	natural attenuation parameter
3	NAPL	non-aqueous-phase liquid
4	NATO	North Atlantic Treaty Organization
5	NAVFAC	Naval Facilities Engineering Command
6	NAVSUP FLC	Naval Supply Systems Command Fleet Logistics Center
7	ORP	oxidation reduction potential
8	PAH	polynuclear aromatic hydrocarbon
9	PARCCS	precision, accuracy, representativeness, completeness, comparability, and
10		sensitivity
11	pH	hydrogen activity
12	PID	photoionization detector
13	ppm	part per million
14	QA	quality assurance
15	QC	quality control
16	Qtr	quarter
17	QSM	quality systems manual
18	RPD	relative percent difference
19	Rpt	report
20	SAP	sampling and analysis plan
21	SOW	Scope of Work
22	SSRBL	Site-Specific Risk-Based Level
23	TGM	Technical Guidance Manual
24	THQ	target hazard quotient
25	TPH	total petroleum hydrocarbons
26	TPH-d	total petroleum hydrocarbons-diesel range organics
27	TPH-g	total petroleum hydrocarbons-gasoline range organics
28	TPH-o	total petroleum hydrocarbons-residual range organics (i.e., TPH-oil)
29	U.S.	United States
30	UST	underground storage tank
31	VOA	volatile organic analyte
32	VOC	volatile organic compound
33	WP	work plan

1 **1. Introduction**

2 This quarterly groundwater monitoring report presents the results of the First Quarter 2017
3 groundwater sampling event conducted during January 9–12, 2017, and the results of previous
4 monthly sampling events conducted during November 14–17 and December 12–15, 2016, at the Red
5 Hill Bulk Fuel Storage Facility (“the Facility”), Joint Base Pearl Harbor-Hickam (JBPHH), O’ahu,
6 Hawai’i (Figure 1). In addition, the results of resampling one well (RHMW08) on December 21,
7 2016 are included. The purpose of the sampling is to (1) assess the condition of groundwater beneath
8 the Facility with respect to chemical constituents associated with jet fuel propellant (JP) and marine
9 diesel fuel (F-76), and (2) ensure that the Navy remains in compliance with State of Hawai’i
10 Department of Health (DOH) Underground Storage Tank (UST) release response requirements as
11 described in Hawai’i Administrative Rules Chapter 11-281 Subchapter 7, Release Response Action
12 (DOH 2000) The DOH Facility Identification (ID) number for the Facility is 9-102271. The DOH
13 Release ID numbers are 990051, 010011, 020028, and 140010.

14 The groundwater sampling was conducted as part of the long-term groundwater and soil vapor
15 monitoring program at the Facility for Naval Supply Systems Command Fleet Logistics Center
16 (NAVSUP FLC) Pearl Harbor, under Naval Facilities Engineering Command (NAVFAC) Contract
17 Number N62742-12-D-1829. The sampling was conducted in accordance with the NAVFAC Pacific
18 *Project Procedures Manual* (DON 2015b), the DOH *Technical Guidance Manual for the*
19 *Implementation of the Hawaii State Contingency Plan* (TGM) (DOH 2016b), and the *Investigation*
20 *and Remediation of Releases and Groundwater Protection and Evaluation Work Plan and Statement*
21 *of Work* (WP/SOW) Revision 01 (DON 2016c) and Revision 02 (DON 2017a). A *Sampling and*
22 *Analysis Plan* (SAP) was prepared in January 2017 for Administrative Order on Consent (AOC)
23 Statement of Work Sections 6 and 7 that contains updated information for the groundwater sampling.

24 This report presents the activities conducted and sampling results for sampling locations both inside
25 and outside the Facility tunnels to combine the information into one report, facilitate review, and
26 provide a better understanding of the entire site in one document.

27 Monthly sampling of the Red Hill monitoring network was initiated in November 2016 in response
28 to information obtained that the Red Hill Shaft pumps have been relatively inoperable since
29 February 2016 due to equipment (i.e., transformer) malfunction. Pumping at a reduced capacity was
30 initiated in November 2016 using temporary equipment, and the permanent equipment is scheduled
31 to be replaced in early 2017, at which time pumping will return to normal capacity. To evaluate
32 potential impacts the changed pumping conditions may have on COPC concentrations in
33 groundwater at and around the Facility, monthly sampling was conducted in November and
34 December 2016 and January and February 2017. The next additional monitoring event is scheduled
35 for March 2017, followed by another quarterly event in April 2017. It is anticipated that equipment
36 repairs will have been completed by early 2017 and that only quarterly monitoring events will be
37 conducted after the April 2017 sampling event. Results of the monthly sampling events will be
38 included in the scheduled quarterly monitoring reports.

39 **1.1 SITE DESCRIPTION**

40 The Facility is located on Federal government land (zoned F1- Military and Federal) in
41 Hālawā Heights, approximately 2.5 miles northeast of Pearl Harbor (Figure 1). It is located on a low
42 ridge on the western edge of the Ko’olau Mountain Range that divides Hālawā Valley from
43 Moanalua Valley. The Facility is bordered on the north by Hālawā Correctional Facility and private
44 businesses, on the southwest by the United States (U.S.) Coast Guard reservation, on the south by
45 residential neighborhoods, and on the east by residential neighborhoods in Moanalua Valley. A

1 quarry is located less than one-quarter mile to the northwest. The Facility occupies 144 acres of land,
 2 and the majority of the ground surface of the site lies at an elevation of approximately 200–500 feet
 3 (ft) above mean sea level (msl).

4 The Facility contains 18 active and 2 inactive underground fuel storage tanks that are operated by
 5 NAVSUP FLC Pearl Harbor. Each tank has a capacity of approximately 12.5 million gallons. The
 6 bottoms of the Facility’s tanks are located approximately 100 ft above the basal aquifer. The fuel
 7 storage tanks currently contain JP-5, North Atlantic Treaty Organization (NATO)-grade F-24 jet
 8 fuel, and F-76. The current status of each tank is summarized in Table 1-1.

9 **Table 1-1: Current Status of the Facility’s Fuel Storage Tanks as of April 2017**

Tank Identification	Fuel Type	Status ^a	Capacity ^b
F-1	Empty	Inactive	12.5 million gallons
F-2	F-24	Active	12.5 million gallons
F-3	F-24	Active	12.5 million gallons
F-4	F-24	Active	12.5 million gallons
F-5	F-24	Active	12.5 million gallons
F-6	F-24	Active	12.5 million gallons
F-7	JP-5	Active	12.5 million gallons
F-8	JP-5	Active	12.5 million gallons
F-9	JP-5	Active	12.5 million gallons
F-10	JP-5	Active	12.5 million gallons
F-11	JP-5	Active	12.5 million gallons
F-12	JP-5	Active	12.5 million gallons
F-13	Empty ^c	Active	12.5 million gallons
F-14	Empty ^c	Active	12.5 million gallons
F-15	F-76	Active	12.5 million gallons
F-16	F-76	Active	12.5 million gallons
F-17	Empty	Active	12.5 million gallons
F-18	JP-5	Active	12.5 million gallons
F-19	Empty	Inactive	12.5 million gallons
F-20	JP-5	Active	12.5 million gallons

10 F-24 NATO-grade F-24 jet fuel

11 F-76 Marine Diesel Fuel

12 JP-5 Jet Fuel Propellant No. 5

13 ^a Active status indicates a tank is currently available for use, but does not necessarily indicate the tank is currently filled.

14 Inactive status indicates a tank is currently not available for use.

15 ^b Tank capacity in this table is estimated, and is not considered a tank-rated capacity or maximum allowable fill volume.

16 ^c Currently being converted from F-76 to JP-5.

17 Four groundwater monitoring wells (wells RHMW01 through RHMW03 and RHMW05) and one
 18 sampling point at Red Hill Shaft (RHMW2254-01) are located within the Facility’s lower access
 19 tunnel (Figure 1). Seven groundwater monitoring wells (wells HDMW2253-03, OWDFMW01,
 20 RHMW04, and RHMW06 through RHMW09) are located outside the Facility tunnel system.

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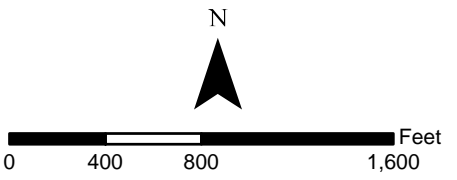
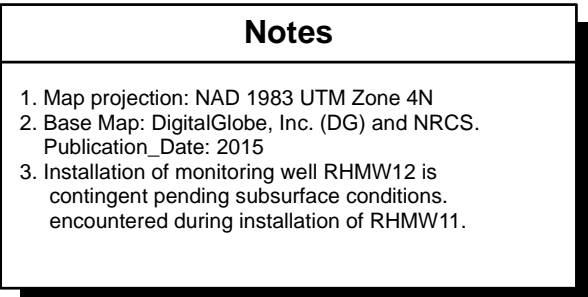
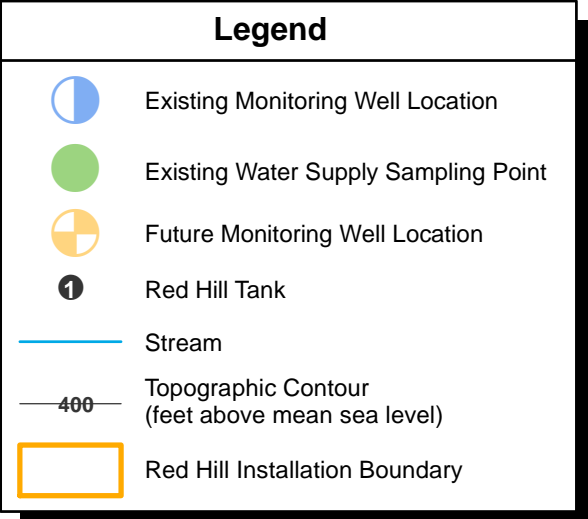
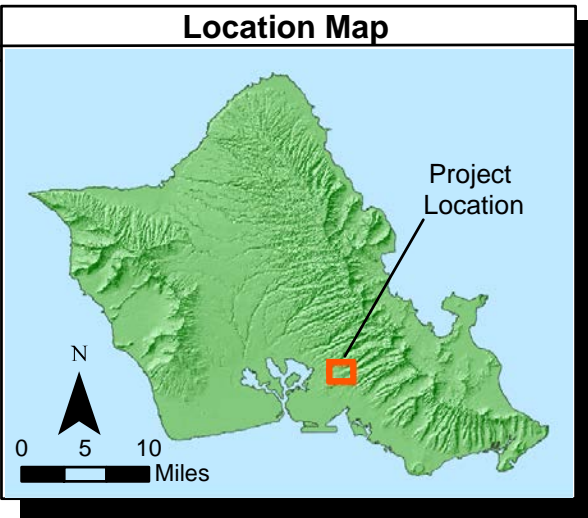
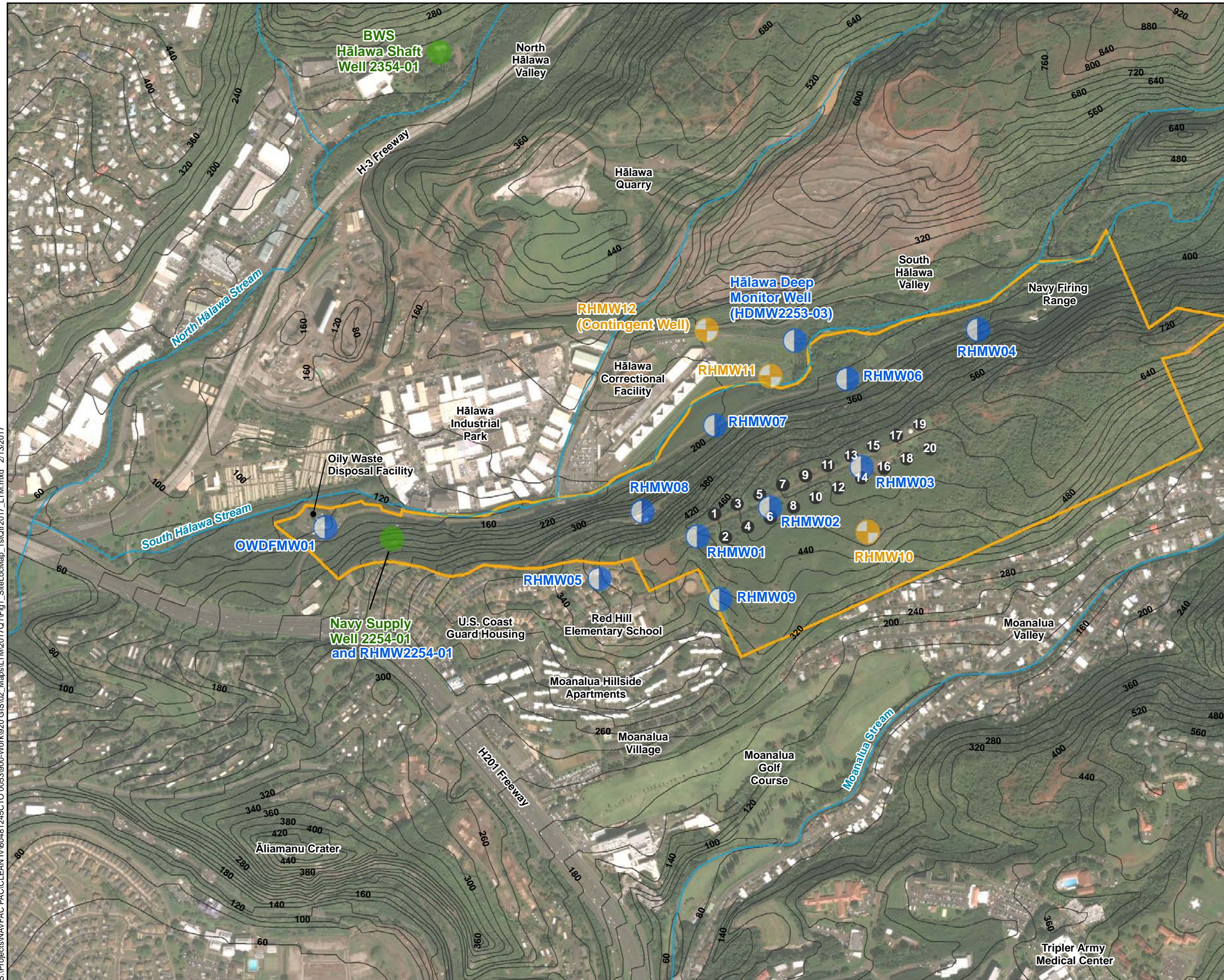


Figure 1
Site Location Map
 1st Qtr 2017 Groundwater LTM Report
 Red Hill Bulk Fuel Storage Facility
 JBPHH, O'ahu, Hawai'i

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1 As noted, sampling point RHMW2254-01 is located inside the infiltration gallery of the
2 U.S. Department of the Navy (DON; Navy) drinking water supply Well 2254-01. Navy Supply
3 Well 2254-01 is located approximately 2,600 ft from the fuel storage tanks and provides potable
4 water to the JBPHH Water System, which serves approximately 65,200 military customers.
5 NAVFAC Hawaii Public Works Department operates the infiltration gallery and Navy Supply
6 Well 2254-01.

7 **1.2 PHYSICAL SETTING**

8 The Facility is located on the southwest flank of the Ko'olau shield volcano and is underlain by
9 primarily Ko'olau volcanic series basalts. Climatological conditions in the area of the Facility consist
10 of warm to moderate temperatures and low to moderate rainfall. The average annual precipitation is
11 approximately 40 inches, which occurs mainly between November and April (Giambelluca, Nullet,
12 and Schroeder 1986). Average temperatures range from the low 60s to high 80s (degrees Fahrenheit)
13 (Juvik and Juvik 1998).

14 The Facility is located at the boundary between the Waimalu Aquifer System of the Pearl Harbor
15 Aquifer Sector and the Moanalua Aquifer System of the Honolulu Aquifer Sector. The aquifer is
16 classified as a basal, unconfined, flank-type; and is currently used as a drinking water source. The
17 aquifer is considered fresh, with less than 250 milligrams per liter (mg/L) of chloride, and is
18 considered an irreplaceable resource with a high vulnerability to contamination (Mink and Lau
19 1990).

20 The nearest drinking water supply well is Navy Supply Well 2254-01, located in the infiltration
21 gallery within the Facility lower tunnel. The Navy Supply Well 2254-01 is located approximately
22 2,600 ft topographically downgradient of the fuel storage tanks (Figure 1).

23 The nearest body of surface water is Hālawā Stream, which is an ephemeral stream present along the
24 north side of the facility. Wells RHMW01 through RHMW03, RHMW05, and RHMW09 are all
25 located greater than 150 meters from any portion of Hālawā Stream. Wells HDMW2253-03,
26 OWDFMW01, RHMW04, RHMW06 through RHMW08, and sampling point RHMW2254-01 are
27 located within 150 meters of a portion of Hālawā Stream. The distance of each well and sampling
28 point to Hālawā Stream is presented in Table 1-2. Both Hālawā Stream and Moanalua Stream
29 (located in Moanalua Valley east of the Facility) are losing streams located approximately 100 ft or
30 more above the groundwater table. However, the bottoms of the fuel tanks are located at least 50 ft
31 below the bottom of the streams (a cross section diagram depicting these elevations is presented in
32 the Red Hill Monitoring Well Installation WP; DON 2016b). Thus, analytical results for the
33 long-term monitoring (LTM) program are compared to the screening criteria based on Table D-1b
34 Environmental Action Levels (EALs) (groundwater EALs for sites where groundwater is a current or
35 potential drinking water resource, and the nearest surface water body is greater than 150 meters from
36 release site) because there are no indications of any complete pathways to ecological receptors in the
37 nearby water bodies, despite some of the wells being within 150 meters of Hālawā Stream.

1 **Table 1-2: Distance of Wells/Sampling Point to Hālawā Stream**

Well/Sampling Point	Distance to Hālawā Stream (meters)
RHMW01	232
RHMW02	299
RHMW03	271
RHMW04	81
RHMW05	225
RHMW06	104
RHMW07	81
RHMW08	64
RHMW09	376
RHMW2254-01	85
HDMW2253-03	64
OWDFMW01	143

2 **1.3 BACKGROUND**

3 The Facility was constructed by the U.S. Government in the early 1940s. Twenty underground fuel
4 storage tanks and a series of tunnels were constructed. The tanks were constructed of steel, and in the
5 past have stored Navy special fuel oil, Navy distillate, aviation gasoline, and motor gasoline (DON
6 2010). The tanks currently contain JP-5, F-24, and F-76. The fueling system is a self-contained
7 underground unit that was installed into native rock composed primarily of basalt with some
8 interbedded tuffs and breccias (DON 2010). Each tank measures approximately 250 ft in height and
9 100 ft in diameter. The upper domes of the tanks lie at a depth varying between 100 ft and 200 ft
10 below ground surface (bgs).

11 **1.3.1 Previous Groundwater Monitoring Results**

12 Results of the Red Hill groundwater LTM program ranging from 2005 to October 2016 are
13 summarized in Table 1-3. Historical results indicate that most chemicals of potential concern
14 (COPCs), and in general the highest detected COPC concentrations, occur in well RHMW02.
15 Cumulative results of historical groundwater monitoring are presented in Appendix C, and graphs of
16 COPC concentrations over time are presented in Appendix G. Groundwater sampling locations are
17 depicted on Figure 1.

18 Previous sampling results through October 2016 are summarized below:

- 19 • RHMW2254-01 is a sampling point located inside the infiltration gallery of Navy Supply
20 Well 2254-01. Samples collected during the first two quarterly sampling events in 2005 had
21 lead concentrations above the screening criterion (DOH Tier 1 action levels), but these
22 samples were not filtered prior to analysis and thus the results were not considered
23 appropriate for a risk assessment. In 2008, a total petroleum hydrocarbons (TPH)-diesel
24 range organics (TPH-d) concentration was initially reported as 102 micrograms per liter
25 ($\mu\text{g/L}$) but was later revalidated to 102 $\mu\text{g/L}$ non-detect. Detections of TPH-d, TPH-gasoline
26 range organics (TPH-g), TPH-residual range organics (TPH-o), and polynuclear aromatic
27 hydrocarbons (PAHs) occurred occasionally during quarterly sampling events between 2005
28 and 2016, but no COPCs have been detected above the screening criteria.

Table 1-3: Summary of Groundwater Detections

Analyte	Unit	DOH EAL (<150m from surface water)	RHMW2254-01						Inside Tunnel Wells						Outside Tunnel Wells							
			No. of Detects	No. of Non- detects	Percent Detected	Did Detects Exceed EALs?	Maximum Detected Concentration (µg/L)	Date Sampled of Max Concentration	No. of Detects	No. of Non- detects	Percent Detected	Did Detects Exceed EALs?	Location of Max Concentration	Maximum Detected Concentration (µg/L)	Date Sampled of Max Concentration	No. of Detects	No. of Non- detects	Percent Detected	Did Detects Exceed EALs?	Location of Max Concentration	Maximum Detected Concentration (µg/L)	Date Sampled of Max Concentration
TPH-d	µg/L	100	10	45	18%	No	67	28-Jun-05	149	47	76%	Yes	RHMW02	6500	20-Jan-16	44	72	38%	Yes	OWDFMW01	3100	22-Jul-15
TPH-g	µg/L	100	5	44	10%	No	19.1	13-May-09	54	120	31%	Yes	RHMW02	660	28-Jan-13	8	107	7%	No	OWDFMW01	31	23-Apr-14
TPH-o	µg/L	100	4	10	29%	No	59	8-Sep-05	31	21	60%	Yes	RHMW01	890	17-Feb-05	18	48	27%	Yes	OWDFMW01	390	22-Jul-15
Benzene	µg/L	5	0	56	0%	—	—	—	11	183	6%	No	RHMW02	0.26	4-Feb-09	18	98	16%	No	OWDFMW01	1.3	19-Jul-12
Ethylbenzene	µg/L	30	2	54	4%	No	0.1	20-Jul-16	30	164	15%	No	RHMW02	1.3	10-Jul-06	0	116	0%	—	—	—	—
Toluene	µg/L	40	4	52	7%	No	1.2	16-Feb-05	16	178	8%	No	RHMW01	2.5	15-Jan-14	13	103	11%	No	HDMW2253-03	3.8	22-Oct-14
Xylenes, Total (p/m-, o-xylene)	µg/L	20	0	56	0%	—	—	—	35	159	18%	No	RHMW02	1.1	15-Jan-08	1	115	1%	No	OWDFMW01	0.39	21-Apr-11
1-Methylnaphthalene	µg/L	6	2	47	4%	No	0.0435	15-Apr-08	78	114	41%	Yes	RHMW02	142	10-Jul-06	8	108	7%	No	OWDFMW01	0.03	19-Jan-16
2-Methylnaphthalene	µg/L	10	4	50	7%	No	0.0561	15-Apr-08	82	114	42%	Yes	RHMW02	88.5	20-Sep-05	16	100	14%	No	OWDFMW01	0.02	19-Jan-16
Naphthalene	µg/L	17	12	43	22%	No	0.099	23-Jul-13	107	89	55%	Yes	RHMW02	343	10-Jul-06	25	91	22%	No	HDMW2253-03	0.16	24-Apr-13

Notes:
 Analyte detected above DOH EAL.
 Inside Wells: RHMW01, RHMW02, RHMW03, RHMW05
 Outside Wells: RHMW04, RHMW06, RHMW07, RHMW08, RHMW09, OWDFMW01, HDMW2253-03
 — = no data
 % = percent
 µg/L = microgram per liter
 DOH = Department of Health, State of Hawai'i
 EAL = Environmental Action Level
 m = meter
 No. = number
 TPH-d = total petroleum hydrocarbons-diesel range organics
 TPH-g = total petroleum hydrocarbons-gasoline range organics
 TPH-o = total petroleum hydrocarbons-residual range organics (i.e., TPH-oil)

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- RHMW01, an in-tunnel monitoring well located southwest of the tank farm, was installed in 2001 (DON 2002). TPH-d frequently exceeded the screening criterion during quarterly sampling events, but never exceeded the Site-Specific Risk-Based Level (SSRBL). The SSRBLs for total petroleum hydrocarbons (TPH)-diesel-range organics (TPH-d) (4,500 µg/L) and benzene (750 µg/L) are established in the Red Hill *Groundwater Protection Plan* (GWPP) (DON 2014) and presented in the February 4, 2016, AOC Statement of Work Sections 6 and 7 scoping completion letter (EPA Region 9 and DOH 2016). TPH-o exceeded the screening criterion in 2005, and 1-methylnaphthalene exceeded the screening criterion once in 2009.
- RHMW02, an in-tunnel monitoring well located next to Tank 6, was installed in 2005 (DON 2007). TPH-d exceeded the screening criterion during all sampling events and exceeded the SSRBL in 2008, 2014, and 2015. TPH-g exceeded the screening criterion during quarterly sampling events in 2006, 2007, 2010, and 2012. TPH-o exceeded the screening criterion during sampling events in 2015 and 2016. 1-Methylnaphthalene, 2-methylnaphthalene, and naphthalene exceeded their screening criteria frequently during quarterly sampling events between 2005 and 2016.
- RHMW03, an in-tunnel monitoring well located next to Tank 14, was installed in 2005 (DON 2007). TPH-d frequently exceeded the screening criterion during quarterly sampling events, but never exceeded the SSRBL. TPH-o exceeded the screening criterion during quarterly sampling events in 2015 and 2016.
- RHMW04, an outside-tunnel monitoring well located northeast of the tank farm, was installed in 2005 as a background monitoring location (DON 2007). TPH-d exceeded the screening criterion once during a quarterly sampling event in 2005.
- RHMW05, an inside-tunnel monitoring well located southwest of the tank farm and southeast of sampling point RHMW2254-01, was installed in 2009. TPH-d exceeded the screening criterion during quarterly sampling events in 2009.
- RHMW06, an outside-tunnel monitoring well installed north of the tank farm, was installed in 2014 in response to the January 2014 release (DON 2015a). No COPCs have been detected above the screening criteria.
- RHMW07, an outside-tunnel monitoring well installed north of the tank farm, was installed in 2014 in response to the January 2014 release (DON 2015a). TPH-o was detected above the screening criterion during one sampling event in 2016.
- RHMW08 and RHMW09, outside-tunnel monitoring wells installed west and south of Tanks 1 and 2, respectively, were installed in 2016 as part of the AOC Statement of Work Sections 6 and 7 investigation (DON 2016c). The Fourth Quarter (October) 2016 sampling event was the first sampling event for the two wells; no COPCs were detected in either well in during that event (DON 2016d).
- HDMW2253-03 (Hālawā Deep Monitor Well 2253-03), an outside-tunnel well located north of the tank farm at the Hālawā Correctional Facility, was installed in 2000 by the State of Hawai'i Department of Land and Natural Resources (DLNR). TPH-d exceeded the screening criterion during quarterly sampling events in 2010, 2012, 2013, and 2014.
- OWDFMW01, located at the former Oily Waste Disposal Facility west of Navy Supply Well 2254-01, was installed in 1998 (DON 2000). TPH-d exceeded the screening criterion during quarterly sampling events in 2010 and between 2012 and 2016. TPH-o exceeded the screening criterion during sampling events in 2015 and 2016.

1.3.2 Previous Reports

The Red Hill groundwater LTM reports listed in Table 1-4 were previously submitted to DOH. Starting from the Fourth Quarter 2016 groundwater monitoring event, the information for both the inside-tunnel and outside-tunnel wells have been combined into one report.

Table 1-4: Previous Groundwater Monitoring Reports

Title	Inside-Tunnel Wells		Outside-Tunnel Wells	
	Sampling Period	Submittal Date	Sampling Period	Submittal Date
1st Qtr 2005 GW Sampling Rpt	1st Quarter 2005	April 2005	—	—
2nd Qtr 2005 GW Sampling Rpt	2nd Quarter 2005	August 2005	—	—
3rd Qtr 2005 GW Sampling Rpt	3rd Quarter 2005	November 2005	—	—
4th Qtr 2005 GW Sampling Rpt	4th Quarter 2005	February 2006	—	—
3rd Qtr 2006 GW Monitoring Results	July 2006	September 2006	—	—
4th Qtr 2006 GW Monitoring Results	December 2006	January 2007	—	—
1st Qtr 2007 GW Monitoring Results	March 2007	May 2007	—	—
2nd Qtr 2007 GW Monitoring Results	June 2007	August 2007	—	—
3rd Qtr 2007 GW Monitoring Results	September 2007	October 2007	—	—
1st Qtr 2008 GW Monitoring Rpt	January 2008	March 2008	—	—
2nd Qtr 2008 GW Monitoring Rpt	April 2008	May 2008	—	—
3rd Qtr 2008 GW Monitoring Rpt	July 2008	October 2008	—	—
4th Qtr 2008 GW Monitoring Rpt	October and December 2008	February 2009	—	—
1st Qtr 2009 GW Monitoring Rpt	February 2009	May 2009	—	—
2nd Qtr 2009 GW Monitoring Rpt	May 2009	July 2009	—	—
3rd Qtr 2009 GW Monitoring Rpt	July 2009	September 2009	August 2009	September 2009
4th Qtr 2009 GW Monitoring Rpt	October 2009	December 2009	October 2009	December 2009
1st Qtr 2010 GW Monitoring Rpt	January, February, and March 2010	April 2010	January 2010	April 2010
2nd Qtr 2010 GW Monitoring Rpt	April 2010	May 2010	April 2010	May 2010
3rd Qtr 2010 GW Monitoring Rpt	July 2010	August 2010	July 2010	August 2010
4th Qtr 2010 GW Monitoring Rpt	October 2010	December 2010	October 2010	December 2010
1st Qtr 2011 GW Monitoring Rpt	January 2011	March 2011	January 2011	March 2011
2nd Qtr 2011 GW Monitoring Rpt	April 2011	June 2011	April 2011	June 2011
3rd Qtr 2011 GW Monitoring Rpt	July 2011	September 2011	July 2011	September 2011
4th Qtr 2011 GW Monitoring Rpt	October 2011	December 2011	October 2011	December 2011
1st Qtr 2012 GW Monitoring Rpt	January–February 2012	March 2012	January 2012	March 2012
2nd Qtr 2012 GW Monitoring Rpt	April 2012	July 2012	April 2012	July 2012
3rd Qtr 2012 GW Monitoring Rpt	—	—	July 2012	August 2012
4th Qtr 2012 GW Monitoring Rpt	October 2012	January 2013	November 2012	January 2013
1st Qtr 2013 GW Monitoring Rpt	January 2013	April 2013	January 2013	April 2013
2nd Qtr 2013 GW Monitoring Rpt	April 2013	July 2013	April 2013	July 2013
3rd Qtr 2013 GW Monitoring Rpt	July 2013	September 2013	July 2013	September 2013
4th Qtr 2013 GW Monitoring Rpt	October 2013	January 2014	October 2013	January 2014
Groundwater Sampling Rpt for Additional Sampling (Inside-Tunnel)/ Groundwater Monitoring Rpt for Additional Sampling of HDMW2253-03 (Outside-Tunnel)	January 2014	January 2014	January 2014	February 2014

Title	Inside-Tunnel Wells		Outside-Tunnel Wells	
	Sampling Period	Submittal Date	Sampling Period	Submittal Date
1st Qtr 2014 GW Monitoring Rpt	January 2014	April 2014	January 2014	April 2014
Groundwater Sampling Rpt for Tank 5 Release Response on March 5 and 6	March 5, 6, 2014	March 2014	—	—
Groundwater Sampling Rpt for Tank 5 Release Response on March 10	March 10, 2014	March 2014	—	—
Groundwater Sampling Rpt for Tank 5 Release Response on March 25 and 26	March 25, 26, 2014	April 2014	—	—
Groundwater Sampling Rpt for Tank 5 Release Response on April 7	April 7, 2014	April 2014	—	—
2nd Qtr 2014 GW Monitoring Rpt	April 2014	June 2014	April 2014	June 2014
Groundwater Sampling Rpt for Tank 5 Release Response on May 27 and 28	May 27, 28, 2014	June 2014	—	—
Groundwater Sampling Rpt for Tank 5 Release Response on June 23 and 24	June 23, 24, 2014	July 2014	—	—
3rd Qtr 2014 GW Monitoring Rpt	July 2014	September 2014	July 2014	September 2014
4th Qtr 2014 GW Monitoring Rpt	October 2014	January 2015	October 2014	January 2015
1st Qtr 2015 GW Monitoring Rpt	January 2015	March 2015	January 2015	March 2015
Draft Monitoring Well Installation Rpt for RHMW06 and RHMW07	—	—	—	March 2015
2nd Qtr 2015 GW Monitoring Rpt	April 2015	August 2015	April 2015	August 2015
3rd Qtr 2015 GW Monitoring Rpt	July 2015	November 2015	July 2015	November 2015
4th Qtr 2015 GW Monitoring Rpt	October 2015	January 2016	October 2015	February 2016
1st Qtr 2016 GW Monitoring Rpt	January 2016	March 2016	January 2016	March 2016
2nd Qtr 2016 GW Monitoring Rpt	April 2016	July 2016	April 2016	July 2016
3rd Qtr 2016 GW Monitoring Rpt	July 2016	October 2016	July 2016	October 2016
4th Qtr 2016 GW Monitoring Rpt	October 2016	December 2016 (combined report with Outside-Tunnel Wells)	October 2016	December 2016 (combined report with Inside-Tunnel Wells)

— no data
 GW groundwater
 Qtr quarter
 Rpt report

2. Groundwater Monitoring Activities

During November 14–17, 2016, December 12–15, 2016, and January 9–12, 2017, groundwater samples were collected from 11 monitoring wells in the Red Hill groundwater monitoring network (RHMW01 through RHMW09, HDMW2253-03, and OWDFMW01) and one sampling point at Red Hill Shaft (RHMW2254-01). Monitoring well RHMW08 was resampled on December 21, 2017 due to sampling concerns noted by DOH oversight during the December 12–15, 2016 sampling event. All samples were collected in accordance with the AOC Statement of Work Sections 6 and 7 WP/SOW Revision 01 (DOH 2016b) and Revision 02 (DON 2017a). The WP/SOW is consistent with DOH UST release response requirements (Hawai’i Administrative Rules [H.A.R.] 11-281), Procedure I-C-3, *Monitoring Well Sampling* (DON 2015b), and the *Red Hill Groundwater Protection Plan* (GWPP) (DON 2014). Prior to purging and sampling, organic vapor readings from

each well were measured using a MiniRAE 2000 photoionization detector (PID) and a 4-gas meter. A methane analyzer was also used to determine the percent volume of methane in the well headspace in all sampling locations during the December 2016 and January 2017 monitoring events. The depth to groundwater was measured using a Solinst oil/water interface probe. No sheen or petroleum hydrocarbon odor was detected in any of the wells. Methane was measured at no more than 0.2% in any of the sampling locations.

2.1 GROUNDWATER SAMPLING

One sample was collected from each of the 11 wells and one sampling point during the November sampling event and the December sampling event. RHMW08 was resampled on December 21, 2016 as quality control for the December sampling at RHMW08. Starting in January 2017, split sampling was conducted at all of the sampling locations in support of the U.S. Environmental Protection Agency (EPA) split-sampling SAP (EPA 2017). One set of the split volumes collected for the groundwater and field QC samples was sent directly to the analytical laboratory by the sampling team, and the remaining set of split samples were relinquished to DOH custody to be sent to the EPA Region 9 laboratory.

Prior to collecting groundwater samples, the monitoring wells were purged of standing water in the well casings. RHMW02 through RHMW09 and RHMW2254-01 each contain a dedicated bladder pump, which was used to purge the well and to collect samples. A rental bladder pump was used to purge the well and collect samples from RHMW01, OWDFMW01, and HDMW2253-03. The groundwater wells were purged using low flow sampling methodology at flow rates of approximately 0.15–0.30 liter per minute to minimize drawdown.

To operate the pump, a portable air compressor with an in-line filter was connected to a QED MP10 MicroPurge Basics Controller box, which was then connected to the pump. The compressor was turned on to power the pump, and the controller was used to adjust the pumping rate to less than 1 liter of water per minute. Compressed nitrogen gas was used to purge all wells.

Water quality parameters were monitored on a periodic basis during well purging using a Horiba U-52 Water Quality Meter during the November and December 2016 events, and a YSI 6920 during the January 2017 event. Parameters measured included hydrogen activity (pH), temperature, specific conductivity, dissolved oxygen (DO), turbidity, oxidation reduction potential (ORP), and salinity. The water quality parameters were evaluated to assess whether the natural characteristics of the aquifer formation water were present within the monitoring wells before collecting the samples. A minimum of four readings were collected at each well during the purging process. Water level measurements were collected during purging to detect any indication of drawdown; if drawdown was detected approaching 0.2 ft, the rate of low-flow purging was reduced. Purging was considered complete when at least three consecutive water quality measurements stabilized within the specified range for each parameter noted in groundwater sampling logs (see Appendix A) and in accordance with NAVFAC Pacific Installation Restoration Program Procedure I-C-3, *Monitoring Well Sampling* (DON 2015b). The readings were recorded on the groundwater sampling logs (Appendix A). In addition, field notes were taken to document the sampling event (Appendix B).

When the water quality parameters stabilized, groundwater samples were immediately collected from the wells using the bladder pumps. During the November and December 2016 events, the groundwater samples were completely collected no more than 2.5 hours after purging was completed to decrease groundwater interaction with the monitoring well casing and atmosphere. During the January 2017 split sampling event, groundwater samples were completely collected no more than 6 hours after purging. Groundwater samples were collected into sampling containers that are

pre-preserved (if needed) and provided by the analytical laboratory. The analytical suite for the First Quarter 2017 groundwater monitoring event is shown in Table 2-1. Samples collected for ferrous iron and dissolved silica analysis were filtered in the field using new, individual 0.45-micron filters attached at the end of the pump discharge tubing.

Table 2-1: Groundwater Sampling Program for the November and December 2016 Monthly Events and the First Quarter 2017 Monitoring Event

Parameter	Analytical Method	Analyte(s)	Screening Criterion (µg/L)	RHMW01	RHMW02	RHMW03	RHMW04	RHMW05	RHMW06	RHMW07	RHMW08	RHMW09	RHMW2254-01	HDMW2253-03	OWDFMW01
TPH	EPA SW-846 8260	TPH-g	100	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	EPA SW-846 8015	TPH-d	100	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		TPH-o	100	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TPH with Silica Gel Cleanup ^a	EPA SW-846 3630/ 8015	TPH-d	100								✓				
		TPH-o	100								✓				
VOCs	EPA SW-846 8260	Benzene	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Ethylbenzene	30	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Toluene	40	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Total Xylenes	20	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PAHs	EPA SW-846 8270 SIM	1-Methylnaphthalene	6 ^b	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		2-Methylnaphthalene	10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Naphthalene	17	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NAPs	Field parameter	DO, ORP	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SM 3500-Fe	Ferrous Iron	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	RSK 175M	Methane	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	EPA 300.0	Nitrate, Sulfate, Chloride	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lead Scavengers ^c	SW-846 8011	1,2-Dibromoethane	0.04								✓	✓			
	SW-846 8260	1,2-Dichloroethane	5								✓	✓			
Fuel Additives	SW-846 8270	Phenol	300 ^b	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Lab Procedure	2-(2-methoxyethoxy)-ethanol	800 ^d	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
General Groundwater Chemistry ^e	EPA 6010	Total Calcium, Magnesium, Manganese, Potassium, Sodium	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	EPA 300.0	Bromide, Fluoride	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SM4500-SiD	Total and Dissolved Silica	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: A forthcoming SAP is being prepared for AOC Statement of Work Sections 6 and 7 that will include details on future sampling and any relevant updates.

COPC screening criteria were provided in the February 4, 2016, AOC Statement of Work Sections 6 and 7 scoping completion letter from the Regulatory Agencies (EPA Region 9 and DOH 2016), and updated with the most current DOH Tier 1 EALs in Table D-1b (DOH 2016a) where appropriate.

- not applicable
- ✓ analyzed
- EPA Environmental Protection Agency, United States
- TPH total petroleum hydrocarbons
- VOC volatile organic compound

^a TPH with silica gel cleanup was collected only from RHMW08, during the November 2016 event.

^b Screening criteria from DOH Tier 1 EALs, Table D-1b, Groundwater Action Levels (groundwater is a current or potential drinking water resource, and surface water body is not located within 150 meters of release site) (DOH 2016a).

^c Lead scavengers will be collected from the indicated wells for at least 1 year of sampling, and may be discontinued if sample results are below the Groundwater Action Levels established in the February 4, 2016, scoping completion letter (EPA Region 9 and DOH 2016).

^d Screening criterion from EPA Tap Water Regional Screening Levels, target hazard quotient (THQ) = 1.0, May 2016 (EPA 2016).

^e General groundwater chemistry parameters were collected to profile the groundwater aquifer. The parameters were sampled during the November 2016 groundwater monitoring event.

2.2 FIELD QUALITY ASSURANCE/QUALITY CONTROL

A quality assurance/quality control (QA/QC) program was implemented in the field in accordance with the NAVFAC Pacific *Project Procedures Manual* (DON 2015b), the DOH TGM (DOH 2016b), the project WP (DON 2015c), the AOC Statement of Work Sections 6 and 7 WP/SOW Revision 01 (DON 2016c) and Revision 02 (DON 2017a), and the SAP Revision 00 (DON 2017b) to support generating data of known and defensible quality. The QA/QC program was designed to minimize error, provide early identification and correction of potential problems, and evaluate the performance of the sampling program.

Every morning, field instruments were calibrated prior to starting field activities. The PID was calibrated with 100 parts per million (ppm) isobutylene calibration gas. The 4-gas meter was calibrated with 100 ppm isobutylene calibration gas and a 4-gas meter calibration gas. The 4-gas meter calibration gas comprised 50 ppm carbon monoxide, 25 ppm dihydrogen sulfide, 19% oxygen and 50% of the lower explosive limit of methane. The methane analyzer was calibrated using methane calibration gas comprising of 35% carbon dioxide, 50% methane, and balance nitrogen. The water quality meter was calibrated with auto calibration solution prior to recording measurements.

To assess the effectiveness of the equipment decontamination process after sampling, at least one equipment blank sample was collected in the field during each sampling event. A field blank sample was also collected to assess the quality of the store-bought Menehune Water Company distilled water used to collect the equipment blank. Prior to the January 2017 event, equipment blank samples were collected from the two rental bladder pumps in the warehouse to assess the cleanliness of the rental equipment after the initial equipment decontamination process.

The field blank was collected by pouring distilled water directly into sample containers. The equipment blanks were collected by pouring distilled water into a decontaminated rental bladder pump then into sample containers. The field blank and equipment blank samples were analyzed for the same COPCs as the groundwater samples.

To assess the precision of the data collection activity, including sampling and analysis, two field duplicates were collected. During the November and December 2016 events, one was collected from RHMW2254-01 and one from OWDFMW01, at the same approximate time as their respective primary samples. During the December 2016 resampling event, primary and duplicate samples were collected from RHMW08. During the January 2017 event, one duplicate was collected from RHMW2254-01 and one was collected from RHMW08 at the same approximate time as their respective primary samples.

During the November and December 2016 events, one trip blank was collected per day of sampling. During the January 2017 event, one trip blank was collected in the morning and one in the afternoon in order to more accurately represent the condition of the samples in each shipment. The

hermetically sealed trip blank samples were supplied “pre-filled” by Agriculture and Priority Pollutants Laboratories, Inc. (APPL) and remained in the sample cooler during the field event and transport to and from the site.

2.3 SAMPLING HANDLING AND ANALYSIS

The samples were labeled and logged in accordance with Procedure III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* (DON 2015b). Immediately after collection, all samples were labeled and logged in the field logbooks and then custody sealed, sealed with tape, and placed in a resealable plastic bag. Efforts were made to ship the groundwater and field QC samples collected in the morning of each sampling event to the laboratory the same day as sample collection in order to meet the method recommended hold time for nitrate analysis; samples not shipped on the day of collection were transported to the warehouse and stored in a secure cold storage device for shipment the next day.

Before shipping, samples were placed in a cooler with double-bagged wet ice and logged onto a chain-of-custody (CoC) form. For the November and December 2016 events, all samples and CoC forms were shipped via FedEx overnight shipping in custody sealed coolers to APPL in Clovis, CA.

The standard reference material sample (ERH155) for 2-(2-methoxyethoxy)-ethanol was submitted directly by a third-party standards manufacturer to APPL in Clovis, CA.

Split sampling was conducted during the January 2017 event. An identical duplicate set of samples was collected from each well following the same handling procedures as the November and December 2016 events. Prior to sealing the coolers, DOH personnel chose one of the identically packed coolers and took custody of the samples. DOH sent their set of custody-sealed coolers via express courier overnight shipping to the EPA Region 9 laboratory in Richmond, CA. The remaining set was sent by field personnel via express courier overnight shipping in custody sealed coolers to APPL in Clovis, CA. Sample transport and custody details are provided in the CoC records in the laboratory reports in Appendix D.

2.4 DECONTAMINATION

Decontamination activities were performed in accordance with Procedure I-F, *Equipment Decontamination* (DON 2015b). A staging and decontamination area was established near each well location. Non-disposable sampling equipment was decontaminated at the beginning of each day and after purging and sampling each well. The decontamination process included washing and scrubbing the equipment with stiff-bristled nylon brushes in a non-phosphate detergent (e.g., Alconox) solution, followed by rinsing once with isopropyl alcohol and twice with distilled water. Liquid wastes generated during decontamination activities were captured and containerized in properly labeled U.S. Department of Transportation-approved 55-gallon drums or other suitable temporary containers, and managed as investigation-derived waste (IDW).

2.5 INVESTIGATION-DERIVED WASTE MANAGEMENT

IDW generated during the sampling events consisted of purged groundwater from the monitoring wells and decontamination water. The IDW was handled, stored, and labeled in accordance with Procedure I-A-6, *Investigation-Derived Waste Management* (DON 2015b). Approximately 120 gallons of fluid from all wells and all three events were containerized in three, clearly labeled 55-gallon capacity drums, covered with a tarp, and stored on site in an area designated by the Navy. IDW is pending disposal. Disposable personal protective equipment and sampling equipment and supplies were collected in plastic trash bags and disposed of as municipal waste.

3. Data Quality Assessment

A data quality assessment, which consists of a review of the overall groundwater sample collection and analysis process, was performed in order to determine whether the analytical data generated met the quality objectives for the project. The data quality assessment was performed in accordance with the AOC Statement of Work Sections 6 and 7 WP/SOW Revision 01 (DON 2016a) and Revision 02 (DON 2017a) and the SAP (DON 2017b). The field QC program consisted of standardized sample collection and management procedures, and the collection of field duplicate samples, matrix spike (MS) samples, and trip blank samples. The laboratory QA program consisted of the use of standard analytical methods and the preparation and analyses of MS/MS duplicate (MSD) samples, surrogate spikes, blanks, and laboratory control samples (LCSs)/LCS duplicates (LCSDs).

3.1 GROUNDWATER LEVEL MEASUREMENTS

Depths to groundwater were gauged from the notched and surveyed top of casing using a Solinst oil/water interface probe in wells RHMW01 through RHMW09, OWDFMW01, and HDMW2253-03, and sampling point RHMW2254-01 prior to sampling (Table 3-1). The oil/water interface probe was decontaminated between well measurements by washing with a detergent solution and rinsing with isopropyl alcohol and distilled water to prevent cross-contamination. Groundwater elevations beneath the site ranged from 17.66 to 25.37 ft msl. Because questions on the accuracy of surveyed measuring points have been raised, the wells will be resurveyed in 2017. PID readings at the wellheads ranged from 0.0 to 45 ppm. No measurable non-aqueous-phase liquid (NAPL) was observed during the groundwater sampling event. Cumulative graphs of historical depth to water readings are presented in Appendix I.

Table 3-1: Groundwater Elevations

Monitoring Well Number	Location (relative to tunnel)	Water Level Measurement Date	PID Reading at Wellhead (ppm)	Depth to Water (ft btoc)	Top of Casing Elevation (ft msl)	Groundwater Elevation (ft msl)
RHMW01	Inside	11/14/2016	45	82.87	102.41 ^a	19.54
		12/13/2016	0.33	82.88	102.41 ^a	19.53
		01/11/2017	0.4	82.70	102.41 ^a	19.71
RHMW02	Inside	11/15/2016	0.0	85.83	105.01 ^a	19.18
		12/13/2016	0.0	85.51	105.01 ^a	19.50
		01/10/2017	0.7	85.29	105.01 ^a	19.72
RHMW03	Inside	11/15/2016	10	101.87	121.31 ^a	19.44
		12/14/2016	0.096	101.81	121.31 ^a	19.50
		01/12/2017	0.0	101.59	121.31 ^a	19.72
RHMW04	Outside	11/14/2016	—	293.22	312.57 ^a	19.35
		12/13/2016	0.0	292.61	312.57 ^a	19.96
		01/09/2017	0.0	292.48	312.57 ^a	20.09
RHMW05	Inside	11/15/2016	0.0	82.25	101.71 ^b	19.46
		12/12/2016	0.032	82.12	101.71 ^b	19.59
		01/10/2017	0.6	82.10	101.71 ^b	19.61
RHMW06	Outside	11/14/2016	0.0	240.31	259.01 ^c	18.70
		12/12/2016	0.0	240.04	259.01 ^c	18.97
		01/09/2017	0.0	239.76	259.01 ^c	19.25

Monitoring Well Number	Location (relative to tunnel)	Water Level Measurement Date	PID Reading at Wellhead (ppm)	Depth to Water (ft btoc)	Top of Casing Elevation (ft msl)	Groundwater Elevation (ft msl)
RHMW07	Outside	11/14/2016	0.0	197.56	220.29 ^c	22.73
		12/13/2016	0.0	197.13	220.29 ^c	23.16
		01/10/2017	0.1	197.02	220.29 ^c	23.27
RHMW08	Outside	11/15/2016	0.0	291.81	310.47 ^d	18.66
		12/12/2016	1.3	291.42	310.47 ^d	19.05
		12/21/2016	0.3	291.69	310.47 ^d	18.78
		01/11/2017	0.1	291.26	310.47 ^d	19.21
RHMW09	Outside	11/15/2016	0.0	377.05	394.71 ^d	17.66
		12/12/2016	0.0	376.28	394.71 ^d	18.43
		01/11/2017	0.1	376.08	394.71 ^d	18.63
RHMW2254-01	Inside	11/14/2016	0.0	80.52	105.76 ^a	25.24
		12/12/2016	0.0	80.49	105.76 ^a	25.27
		01/09/2017	0.1	80.39	105.76 ^a	25.37
HDMW2253-03	Outside	11/16/2016	0.2	206.83	226.68 ^a	19.85
		12/13/2016	0.0	206.33	226.68 ^a	20.35
		01/10/2017	0.0	206.12	226.68 ^a	20.56
OWDFMW-01	Outside	11/15/2016	0.0	119.29	138.57 ^a	19.28
		12/14/2016	0.0	119.09	138.57 ^a	19.48
		01/12/2017	0.0	118.93	138.57 ^a	19.64

— not recorded

btoc below top of casing

^a Source: DON 2007.

^b Source: RHMW05 boring and well completion log, Robert Whittier, TEC Inc. April 24, 2009.

^c Source: DON 2015a.

^d Source: AECOM internal Global Positioning System (GPS) survey (July 28, 2016).

3.2 ANALYTICAL RESULTS

The samples were analyzed for TPH-d and TPH-o using U.S. Environmental Protection Agency (EPA) Method 8015C; TPH-g, benzene, toluene, ethylbenzene, and xylenes (BTEX), and 1,2-dichloroethane using EPA Method 8260C; 1,2-dibromoethane using EPA Method 8011; PAHs using EPA Method 8270D SIM; phenol using EPA Method 8270D; and 2-(2-methoxyethoxy)-ethanol using a proprietary laboratory procedure. Copies of the laboratory reports are included as Appendix D. Copies of the third-party data validation reports are included in Appendix E.

Analytical results were compared to the current LTM screening criteria – criteria established by the February 4, 2016, AOC Statement of Work Sections 6 and 7 scoping completion letter (EPA Region 9 and DOH 2016), and updated with the most current DOH Tier 1 EALs in Table D-1b, Groundwater Action Levels (groundwater is a current or potential drinking water resource, and surface water body is not located within 150 meters of release site) (DOH 2016a) where appropriate. The results of the November 2016, December 2016, and January 2017 sampling events are summarized in Table 3-2 through Table 3-4, and QC sample results are presented in Table 3-5 through Table 3-7.

Table 3-5: Field QC Sample Results, November 2016 Groundwater Monitoring Event

Sample ID					ERH114	ERH123	ERH130	ERH131	ERH132
Location					—	—	—	—	—
Collection Date					11/14/2016	11/15/2016	11/16/2016	11/16/2016	11/16/2016
Sample Type					TB	TB	EB	FB	TB
Field Duplicate Parent Sample					—	—	—	—	—
Analyte	CAS No.	Method	Screening Criterion	Unit	Result	Result	Result	Result	Result
Benzene	71-43-2	8260B	5.0	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U
Ethylbenzene	100-41-4	8260B	30	µg/L	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
Toluene	108-88-3	8260B	40	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U
Xylenes, Total	1330-20-7	8260B	20	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U
1,2-Dichloroethane	107-06-2	8260B	5.0	µg/L	—	< 0.30 U	—	—	—
1,2-Dibromoethane	106-93-4	8011	0.04	µg/L	—	< 0.020 UJ	—	—	—
TPH-Gasoline Range C6-C10	-3534	8260B	100	µg/L	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U
TPH-Diesel Range C10-C24	-3527	8015B_E	100	µg/L	—	—	< 25.00 U	< 25.00 U	—
TPH-Diesel Range C10-C24 w/ Silica Gel Cleanup	-3527	8015B_E	100	µg/L	—	—	—	—	—
TPH-Oil Range C24-C40	-3528	8015B_E	100	µg/L	—	—	< 40.00 U	< 40.00 U	—
TPH-Oil Range C24-C40 w/ Silica Gel Cleanup	-3528	8015B_E	100	µg/L	—	—	—	—	—
1-Methylnaphthalene	90-12-0	8270D_SIM	6	µg/L	—	—	< 0.10 U	< 0.10 U	—
2-Methylnaphthalene	91-57-6	8270D_SIM	10	µg/L	—	—	< 0.10 U	< 0.10 U	—
Naphthalene	91-20-3	8270D_SIM	17	µg/L	—	—	< 0.10 U	< 0.10 U	—
Phenol	108-95-2	8270D	300	µg/L	—	—	< 4.00 U	< 4.00 U	—
2-(2-Methoxyethoxy)-Ethanol	111-77-3	8270D	800	µg/L	—	—	< 80.0 U	< 80.0 U	—
Methane	74-82-8	RSK-175	—	µg/L	< 1.00 U	< 1.00 U	—	—	< 1.00 U
Iron, Ferrous	15438-31-0	3500_FE_B	—	mg/L	—	—	—	—	—
Nitrate	14797-55-8	300.0	—	mg/L	—	—	—	—	—
Chloride	16887-00-6	300.0	—	mg/L	—	—	—	—	—
Sulfate	14808-79-8	300.0	—	mg/L	—	—	—	—	—
Alkalinity, as CaCO3	-17	2320B	—	mg/L	—	—	—	—	—
Alkalinity, Bicarbonate	71-52-3	2320B	—	mg/L	—	—	—	—	—
Alkalinity, Carbonate	3812-32-6	2320B	—	mg/L	—	—	—	—	—
Bromide	24959-67-9	300.0	—	mg/L	—	—	—	—	—
Fluoride	16984-48-8	300.0	—	mg/L	—	—	—	—	—
Calcium	7440-70-2	6010C	—	µg/L	—	—	—	—	—
Magnesium	7439-95-4	6010C	—	µg/L	—	—	—	—	—
Manganese	7439-96-5	6010C	—	µg/L	—	—	—	—	—
Potassium	7440-09-7	6010C	—	µg/L	—	—	—	—	—
Sodium	7440-23-5	6010C	—	µg/L	—	—	—	—	—
Silica, Dissolved	7631-86-9	4500_SI_D	—	mg/L	—	—	—	—	—
Silica, Total	7631-86-9	4500_SI_D	—	mg/L	—	—	—	—	—

Bold indicates analyte detected.

— = not analyzed or not applicable

µg/L = micrograms per liter

CAS = Chemical Abstracts Service

EB = equipment blank (associated with RHMW01, HDMW2253-03, and OWDFMW01)

FB = field blank (associated with RHMW01, HDMW2253-03, and OWDFMW01)

J = estimated value

mg/L = milligrams per liter

TB = trip blank

U = non-detect value (reported as less than the limit of detection [LOD])

Table 3-6: Field QC Sample Results, December 2016 Groundwater Monitoring Event

Sample ID					ERH149	ERH150	ERH134	ERH142	ERH151	ERH156	ERH155
Location					—	—	—	—	—	—	—
Collection Date					12/14/2016	12/14/2016	12/12/2016	12/13/2016	12/14/2016	12/21/2016	11/18/2016
Sample Type					EB	FB	TB	TB	TB	TB	SRM
Field Duplicate Parent Sample					—	—	—	—	—	—	—
Analyte	CAS No.	Method	Screening Criterion	Unit	Result	Result	Result	Result	Result	Result	Result
Benzene	71-43-2	8260B	5.0	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	—
Ethylbenzene	100-41-4	8260B	30	µg/L	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	—
Toluene	108-88-3	8260B	40	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	—
Xylenes, Total	1330-20-7	8260B	20	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	—
1,2-Dichloroethane	107-06-2	8260B	5.0	µg/L	—	—	< 0.30 U	< 0.30 U	—	< 0.30 U	—
1,2-Dibromoethane	106-93-4	8011	0.04	µg/L	—	—	< 0.020 U	< 0.020 U	—	< 0.020 U	—
TPH-Gasoline Range C6-C10	-3534	8260B	100	µg/L	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	—
TPH-Diesel Range C10-C24	-3527	8015B_E	100	µg/L	< 25.00 U	26 J	—	—	—	—	—
TPH-Oil Range C24-C40	-3528	8015B_E	100	µg/L	< 40.00 U	< 40.00 U	—	—	—	—	—
1-Methylnaphthalene	90-12-0	8270D_SIM	6	µg/L	< 0.10 U	< 0.10 U	—	—	—	—	—
2-Methylnaphthalene	91-57-6	8270D_SIM	10	µg/L	< 0.10 U	< 0.10 U	—	—	—	—	—
Naphthalene	91-20-3	8270D_SIM	17	µg/L	< 0.10 U	< 0.10 U	—	—	—	—	—
Phenol	108-95-2	8270D	300	µg/L	< 4.00 U	< 4.00 U	—	—	—	—	—
2-(2-Methoxyethoxy)-Ethanol	111-77-3	8270D	800	µg/L	< 80.0 U	< 80.0 U	—	—	—	—	700
Methane	74-82-8	RSK-175	—	µg/L	—	—	< 1.00 U	< 1.00 UJ	< 1.00 UJ	< 1.00 U	—
Iron, Ferrous	15438-31-0	3500_FE_B	—	mg/L	—	—	—	—	—	—	—
Nitrate	14797-55-8	300.0	—	mg/L	—	—	—	—	—	—	—
Nitrate-Nitrite as Nitrogen	-24	353.2	—	mg/L	—	—	—	—	—	—	—
Chloride	16887-00-6	300.0	—	mg/L	—	—	—	—	—	—	—
Sulfate	14808-79-8	300.0	—	mg/L	—	—	—	—	—	—	—
Alkalinity, as CaCO3	-17	2320B	—	mg/L	—	—	—	—	—	—	—
Alkalinity, Bicarbonate	71-52-3	2320B	—	mg/L	—	—	—	—	—	—	—
Alkalinity, Carbonate	3812-32-6	2320B	—	mg/L	—	—	—	—	—	—	—

Bold indicates analyte detected.

— = not analyzed or not applicable

µg/L = micrograms per liter

CAS = Chemical Abstracts Service

EB = equipment blank (associated with RHMW01, HDMW2253-03, and OWDFMW01)

FB = field blank (associated with RHMW01, HDMW2253-03, and OWDFMW01)

J = estimated value

mg/L = milligrams per liter

SRM = standard reference material

TB = trip blank

U = non-detect value (reported as less than the limit of detection [LOD])

Table 3-7: Field QC Sample Results, January 2017 Groundwater Monitoring Event

Sample ID					ERH193	ERH165	ERH167	ERH196	ERH175	ERH194	ERH163	ERH173	ERH171	ERH177	ERH185	ERH180	ERH183	ERH197	ERH198	ERH199	
Location					Warehouse	Outside Tunnel (AM)	Outside Tunnel (PM)	Inside Tunnel	Outside Tunnel (AM)	Outside Tunnel (PM)	Inside Tunnel (AM)	Inside Tunnel (PM)	Inside Tunnel	Outside Tunnel (AM)	Outside Tunnel (PM)	Inside Tunnel	Outside Tunnel	RHMW2254-01	RHMW07	RHMW08	
Collection Date					1/6/2017	1/9/2017	1/9/2017	1/9/2017	1/10/2007	1/10/2017	1/10/2017	1/10/2017	1/11/2017	1/11/2017	1/11/2017	1/12/2017	1/12/2017	1/9/2017	1/10/2017	1/11/2017	
Sample Type					TB	TB	TB	TB	TB	TB	TB	TB	TB	TB	TB	TB	TB	AB	AB	AB	
Field Duplicate Parent Sample					—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Analyte	CAS No.	Method	Screening Criterion	Unit	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	
Benzene	71-43-2	8260B	5.0	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	
Ethylbenzene	100-41-4	8260B	30	µg/L	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	
Toluene	108-88-3	8260B	40	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	
Xylenes, Total	1330-20-7	8260B	20	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	0.78 J	< 0.30 U	< 0.30 U	< 0.30 U
1,2-Dichloroethane	107-06-2	8260B	5.0	µg/L	—	—	—	—	—	—	—	—	—	< 0.30 U	< 0.30 U	—	—	—	—	—	
1,2-Dibromoethane	106-93-4	8011	0.04	µg/L	—	—	—	—	—	—	—	—	—	< 0.020	< 0.020	—	—	—	—	—	
TPH-Gasoline Range C6-C10	-3534	8260B	100	µg/L	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U	—	—	—
TPH-Diesel Range C10-C24	-3527	8015B_E	100	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
TPH-Oil Range C24-C40	-3528	8015B_E	100	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
1-Methylnaphthalene	90-12-0	8270D_SIM	6	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
2-Methylnaphthalene	91-57-6	8270D_SIM	10	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Naphthalene	91-20-3	8270D_SIM	17	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Phenol	108-95-2	8270D	300	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
2-(2-Methoxyethoxy)-Ethanol	111-77-3	8270D	800	µg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Methane	74-82-8	RSK-175	—	µg/L	—	< 1.00 U	< 1.00 UJ	< 1.00 UJ	< 1.00 UJ	< 1.00 UJ	< 1.00 UJ	< 1.00 UJ	< 1.00 U	< 1.00 UJ	< 1.00 U	< 1.00 U	< 1.00 U	< 1.00 U	—	—	—
Iron, Ferrous	15438-31-0	3500_FE_B	—	mg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Nitrate	14797-55-8	300.0	—	mg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Chloride	16887-00-6	300.0	—	mg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Sulfate	14808-79-8	300.0	—	mg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Alkalinity, as CaCO3	-17	2320B	—	mg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Alkalinity, Bicarbonate	71-52-3	2320B	—	mg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Alkalinity, Carbonate	3812-32-6	2320B	—	mg/L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

Bold indicates analyte detected.

— = not analyzed or not applicable

µg/L = micrograms per liter

AB = ambient blank

AM = morning

CAS = Chemical Abstracts Service

EB = equipment blank (associated with RHMW01, HDMW2253-03, and OWDFMW01)

FB = field blank (associated with RHMW01, HDMW2253-03, and OWDFMW01)

J = estimated value

mg/L = milligrams per liter

PM = afternoon

TB = trip blank

U = non-detect value (reported as less than the limit of detection [LOD])

Table 3-7: Field QC Sample Results, January 2017 Groundwater Monitoring Event (cont.)

Sample ID					ERH200	ERH201	ERH202	ERH203	ERH186	ERH187	ERH191	ERH192
Location					RHMMW01	RHMMW09	OWDFMW01	RHMMW03	Field	Field	Warehouse	Warehouse
Collection Date					1/11/2017	1/11/2017	1/12/2017	1/12/2017	1/10/2017	1/10/2017	1/6/2017	1/6/2017
Sample Type					AB	AB	AB	AB	FB	EB	EB	EB
Field Duplicate Parent Sample					—	—	—	—	—	—	—	—
Analyte	CAS No.	Method	Screening Criterion	Unit	Result	Result	Result	Result	Result	Result	Result	Result
Benzene	71-43-2	8260B	5.0	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U
Ethylbenzene	100-41-4	8260B	30	µg/L	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U	< 0.50 U
Toluene	108-88-3	8260B	40	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U
Xylenes, Total	1330-20-7	8260B	20	µg/L	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U	< 0.30 U
1,2-Dichloroethane	107-06-2	8260B	5.0	µg/L	—	—	—	—	—	—	—	—
1,2-Dibromoethane	106-93-4	8011	0.04	µg/L	—	—	—	—	—	—	—	—
TPH-Gasoline Range C6-C10	-3534	8260B	100	µg/L	—	—	—	—	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U
TPH-Diesel Range C10-C24	-3527	8015B_E	100	µg/L	—	—	—	—	< 25.00 U	< 25.00 U	< 25.00 U	42
TPH-Oil Range C24-C40	-3528	8015B_E	100	µg/L	—	—	—	—	< 40.00 U	< 40.00 U	< 40.00 U	< 40.00 U
1-Methylnaphthalene	90-12-0	8270D_SIM	6	µg/L	—	—	—	—	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U
2-Methylnaphthalene	91-57-6	8270D_SIM	10	µg/L	—	—	—	—	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U
Naphthalene	91-20-3	8270D_SIM	17	µg/L	—	—	—	—	< 0.10 U	< 0.10 U	< 0.10 U	< 0.10 U
Phenol	108-95-2	8270D	300	µg/L	—	—	—	—	< 4.00 U	< 4.00 U	2.5 J	< 4.00 U
2-(2-Methoxyethoxy)-Ethanol	111-77-3	8270D	800	µg/L	—	—	—	—	< 80.0 U	< 80.0 U	< 80.0 U	< 80.0 U
Methane	74-82-8	RSK-175	—	µg/L	—	—	—	—	—	—	—	—
Iron, Ferrous	15438-31-0	3500_FE_B	—	mg/L	—	—	—	—	—	—	—	—
Nitrate	14797-55-8	300.0	—	mg/L	—	—	—	—	—	—	—	—
Chloride	16887-00-6	300.0	—	mg/L	—	—	—	—	—	—	—	—
Sulfate	14808-79-8	300.0	—	mg/L	—	—	—	—	—	—	—	—
Alkalinity, as CaCO3	-17	2320B	—	mg/L	—	—	—	—	—	—	—	—
Alkalinity, Bicarbonate	71-52-3	2320B	—	mg/L	—	—	—	—	—	—	—	—
Alkalinity, Carbonate	3812-32-6	2320B	—	mg/L	—	—	—	—	—	—	—	—

Bold indicates analyte detected.

— = not analyzed or not applicable

µg/L = micrograms per liter

AB = ambient blank

AM = morning

CAS = Chemical Abstracts Service

EB = equipment blank (associated with RHMMW01, HDMW2253-03, and OWDFMW01)

FB = field blank (associated with RHMMW01, HDMW2253-03, and OWDFMW01)

J = estimated value

mg/L = milligrams per liter

PM = afternoon

TB = trip blank

U = non-detect value (reported as less than the limit of detection [LOD])

1 In general, COPCs were not detected in RHMW04, RHMW05, RHMW06, RHMW07, and
2 HDMW2253-03. However, TPH-d, 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene
3 remain above screening criteria in RHMW02. Figure 2 presents detections and exceedances in
4 COPC concentrations, and Figure 3 presents the natural attenuation parameter (NAP) results at all
5 wells; TPH-d and TPH-o results are included for reference. A cumulative groundwater COPC table
6 containing analytical chemistry results from the beginning of the LTM program is presented in
7 Appendix C. A description of laboratory data qualifiers, definitions of the terms detection limit (DL),
8 limit of detection (LOD), and limit of quantitation (LOQ), and basic concepts of those terms are
9 presented in the Fact Sheet included as Appendix F.

10 November 2016, December 2016 and January 2017 groundwater sampling results are summarized
11 below:

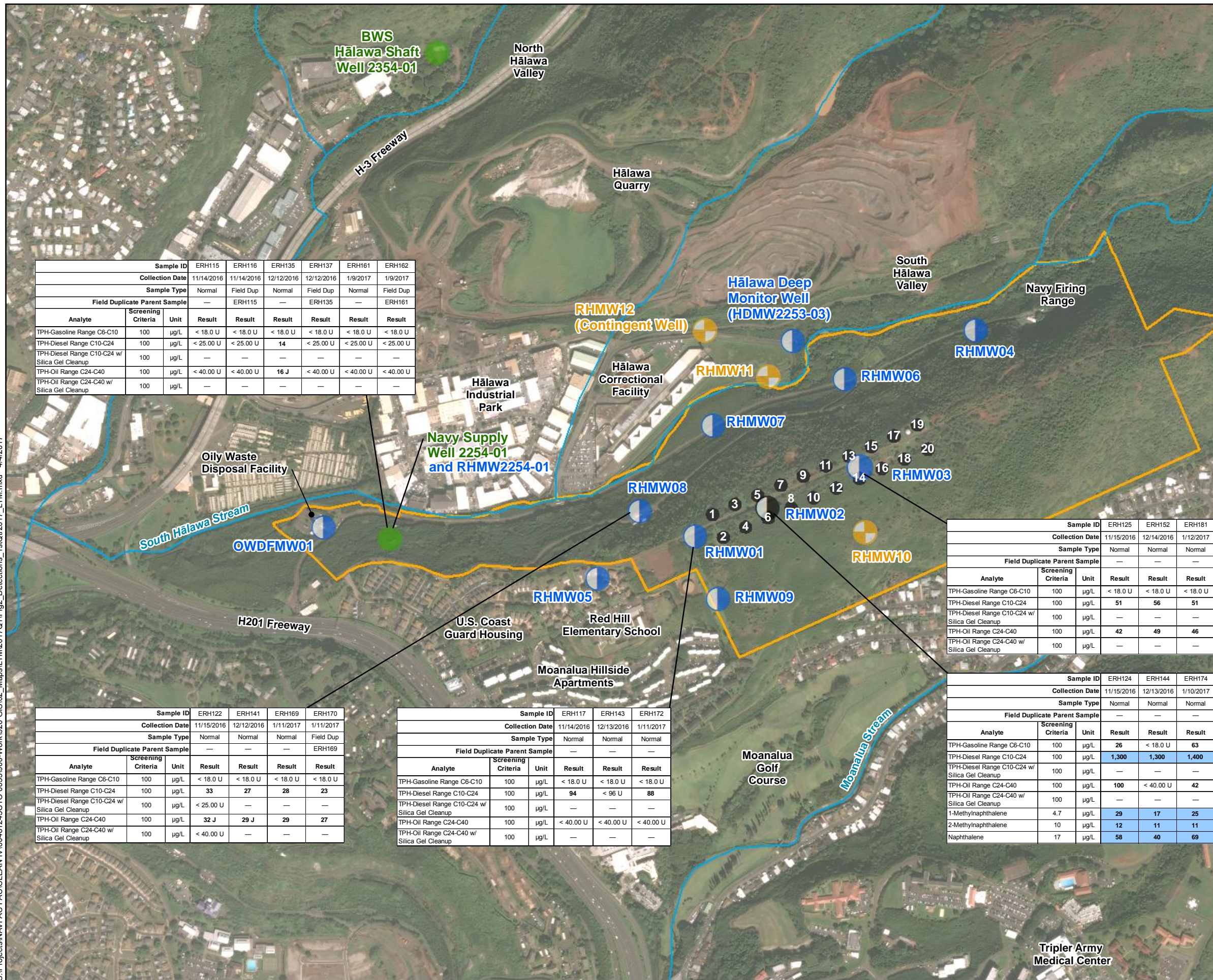
- 12 • *RHMW01*: The only analyte detected in groundwater was TPH-d (ranging from 88 µg/L to
13 94 µg/L) below the screening criterion.
- 14 • *RHMW02*: Concentrations of TPH-d (1,300–1,400 µg/L), 1-methylnaphthalene
15 (17–29 µg/L), 2-methylnaphthalene (11–12 µg/L), and naphthalene (40–69 µg/L) were
16 detected exceeding their respective screening criteria during all three events. The
17 concentrations of TPH-d did not exceed the SSRBL of 4,500 µg/L. Concentrations of TPH-o
18 (42–100 µg/L), TPH-g (26–63 µg/L), and total xylenes (0.19–0.26 µg/L) were also detected,
19 but below their respective screening criteria in two out of the three events.
- 20 • *RHMW03*: The only analytes detected in groundwater were TPH-d (51–56 µg/L) and TPH-o
21 (42–49 µg/L). Both analytes were detected below the screening criteria in all three events.
- 22 • *OWDFMW01*: The only analyte detected in groundwater was TPH-o (45–46 µg/L) during
23 the December and January events. The concentration of TPH-o did not exceed the screening
24 criterion.
- 25 • *RHMW08*: The only analytes detected in groundwater were TPH-d (27–63 µg/L) and TPH-o
26 (29–32 µg/L). The concentrations of both analytes did not exceed the screening criteria.
- 27 • *RHMW09*: The only analyte detected in groundwater was phenol (1.1 µg/L) during the
28 December 2016 sampling event at a concentration below the screening criterion.
- 29 • *RHMW2254-01*: The only analytes detected in groundwater were TPH-d (14 µg/L) and
30 TPH-o (16 µg/L) during the December 2016 event. The concentrations of both analytes did
31 not exceed the screening criteria.

32 **3.3 RECENT GROUNDWATER CONTAMINANT CONCENTRATIONS**

33 The historical groundwater contaminant concentrations for TPH-g, TPH-d, TPH-o, BTEX,
34 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene are illustrated in Appendix G. No
35 graphs were created for lead scavengers, fuel additives, and analytes that have been discontinued and
36 are no longer COPCs for the LTM program. A table of cumulative historical groundwater results is
37 included as Appendix C. Figure 4 shows the TPH and PAH trends. Figure 5 displays the natural
38 attenuation parameters measured during the last four sampling events.

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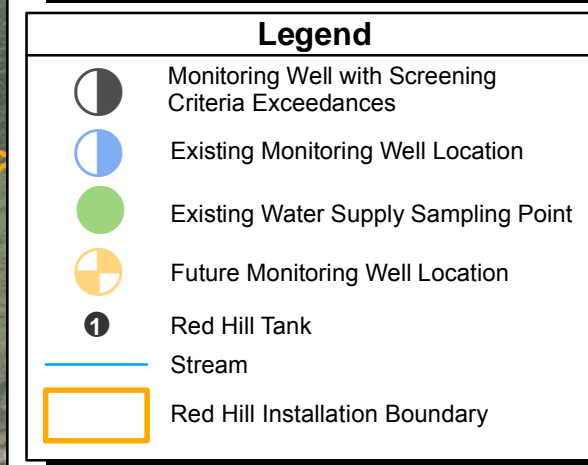
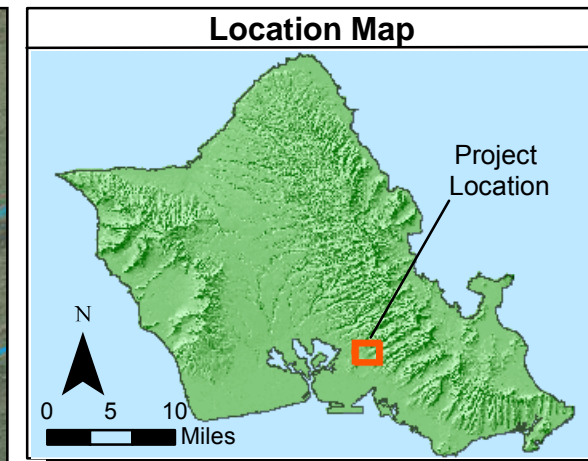
Sample ID	ERH115	ERH116	ERH135	ERH137	ERH161	ERH162
Collection Date	11/14/2016	11/14/2016	12/12/2016	12/12/2016	1/9/2017	1/9/2017
Sample Type	Normal	Field Dup	Normal	Field Dup	Normal	Field Dup
Field Duplicate Parent Sample	—	ERH115	—	ERH135	—	ERH161
Analyte	Screening Criteria	Unit	Result	Result	Result	Result
TPH-Gasoline Range C6-C10	100	µg/L	< 18.0 U	< 18.0 U	< 18.0 U	< 18.0 U
TPH-Diesel Range C10-C24	100	µg/L	< 25.00 U	< 25.00 U	14	< 25.00 U
TPH-Diesel Range C10-C24 w/ Silica Gel Cleanup	100	µg/L	—	—	—	—
TPH-Oil Range C24-C40	100	µg/L	< 40.00 U	< 40.00 U	16 J	< 40.00 U
TPH-Oil Range C24-C40 w/ Silica Gel Cleanup	100	µg/L	—	—	—	—

Sample ID	ERH122	ERH141	ERH169	ERH170
Collection Date	11/15/2016	12/12/2016	1/11/2017	1/11/2017
Sample Type	Normal	Normal	Normal	Field Dup
Field Duplicate Parent Sample	—	—	—	ERH169
Analyte	Screening Criteria	Unit	Result	Result
TPH-Gasoline Range C6-C10	100	µg/L	< 18.0 U	< 18.0 U
TPH-Diesel Range C10-C24	100	µg/L	33	27
TPH-Diesel Range C10-C24 w/ Silica Gel Cleanup	100	µg/L	< 25.00 U	—
TPH-Oil Range C24-C40	100	µg/L	32 J	29 J
TPH-Oil Range C24-C40 w/ Silica Gel Cleanup	100	µg/L	< 40.00 U	—

Sample ID	ERH117	ERH143	ERH172
Collection Date	11/14/2016	12/13/2016	1/11/2017
Sample Type	Normal	Normal	Normal
Field Duplicate Parent Sample	—	—	—
Analyte	Screening Criteria	Unit	Result
TPH-Gasoline Range C6-C10	100	µg/L	< 18.0 U
TPH-Diesel Range C10-C24	100	µg/L	94
TPH-Diesel Range C10-C24 w/ Silica Gel Cleanup	100	µg/L	—
TPH-Oil Range C24-C40	100	µg/L	< 40.00 U
TPH-Oil Range C24-C40 w/ Silica Gel Cleanup	100	µg/L	—

Sample ID	ERH125	ERH152	ERH181
Collection Date	11/15/2016	12/14/2016	1/12/2017
Sample Type	Normal	Normal	Normal
Field Duplicate Parent Sample	—	—	—
Analyte	Screening Criteria	Unit	Result
TPH-Gasoline Range C6-C10	100	µg/L	< 18.0 U
TPH-Diesel Range C10-C24	100	µg/L	51
TPH-Diesel Range C10-C24 w/ Silica Gel Cleanup	100	µg/L	—
TPH-Oil Range C24-C40	100	µg/L	42
TPH-Oil Range C24-C40 w/ Silica Gel Cleanup	100	µg/L	—

Sample ID	ERH124	ERH144	ERH174
Collection Date	11/15/2016	12/13/2016	1/10/2017
Sample Type	Normal	Normal	Normal
Field Duplicate Parent Sample	—	—	—
Analyte	Screening Criteria	Unit	Result
TPH-Gasoline Range C6-C10	100	µg/L	26
TPH-Diesel Range C10-C24	100	µg/L	1,300
TPH-Diesel Range C10-C24 w/ Silica Gel Cleanup	100	µg/L	1,300
TPH-Oil Range C24-C40	100	µg/L	100
TPH-Oil Range C24-C40 w/ Silica Gel Cleanup	100	µg/L	< 40.00 U
1-Methylnaphthalene	4.7	µg/L	29
2-Methylnaphthalene	10	µg/L	12
Naphthalene	17	µg/L	58



Notes

- Map projection: NAD 1983 UTM Zone 4N
- Base Map: DigitalGlobe, Inc. (DG) and NRCS. Publication Date: 2015
- Installation of monitoring well RHMW12 is contingent pending subsurface conditions encountered during installation of RHMW11.

ABBREVIATIONS:

J estimated value

U non-detect value (reported as less than the limit of detection [LOD])

µg/L microgram per liter

1300 Exceeds screening criteria

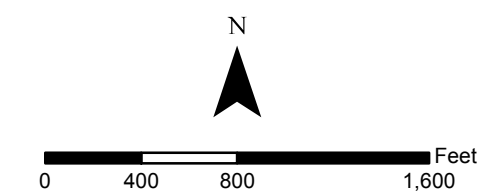
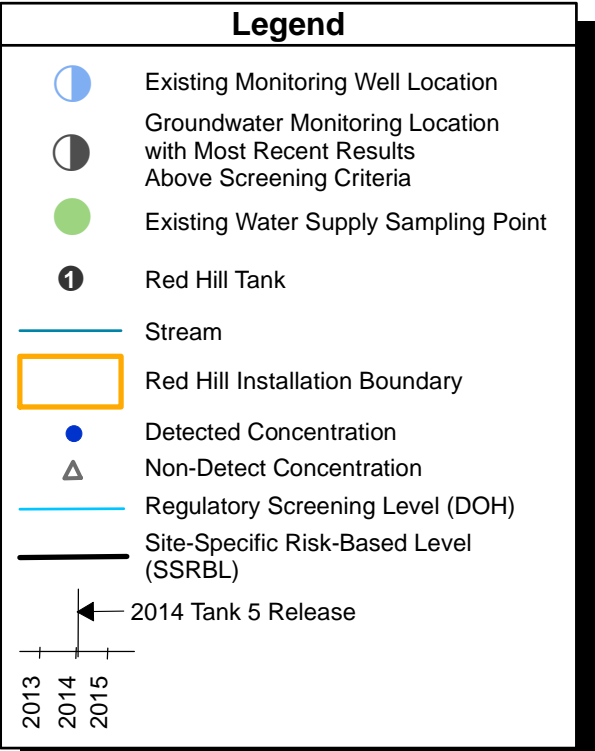
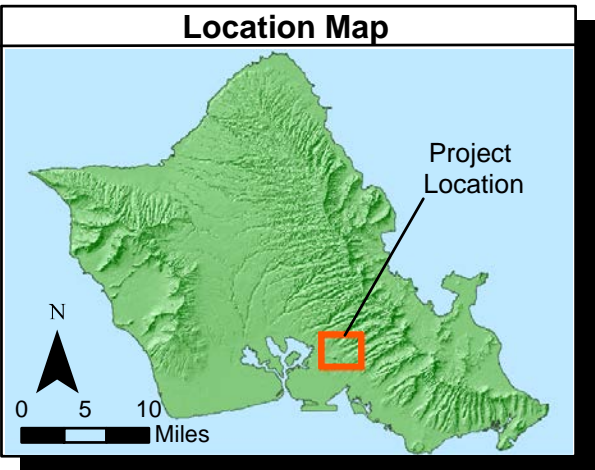
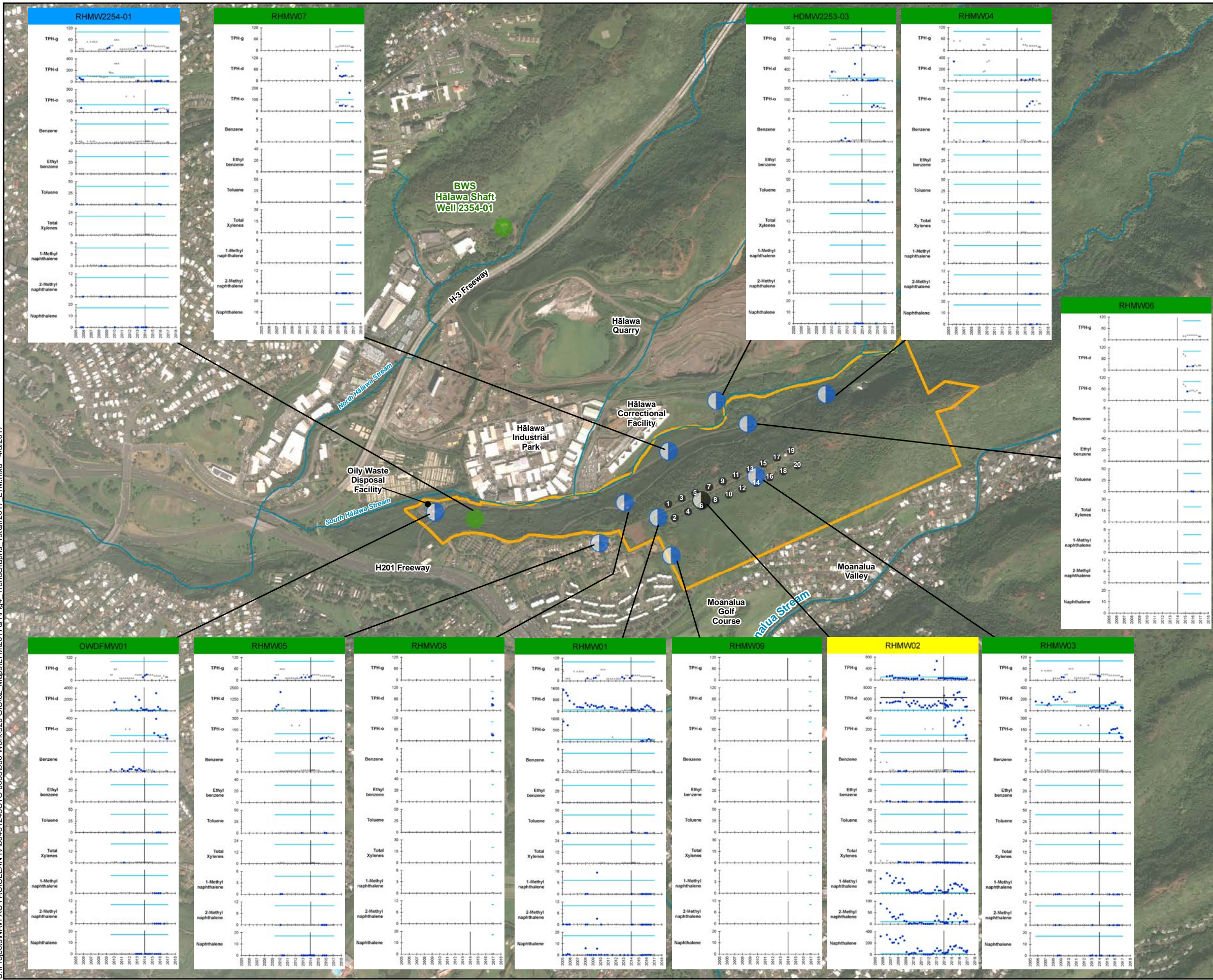


Figure 2
COPC Detections
1st Qtr 2017 Groundwater LTM Report
Red Hill Bulk Fuel Storage Facility
JBPHH, O'ahu, Hawai'i

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Notes

1. Map projection: NAD 1983 UTM Zone 4N
2. Base Map: DigitalGlobe, Inc. (DG) and NRCS. Publication Date: 2015
3. All results in parts per billion (ppb or micrograms per liter)

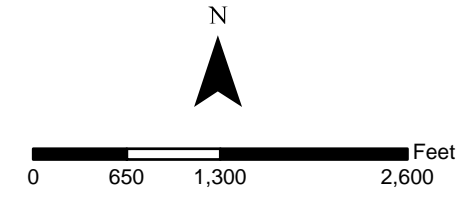
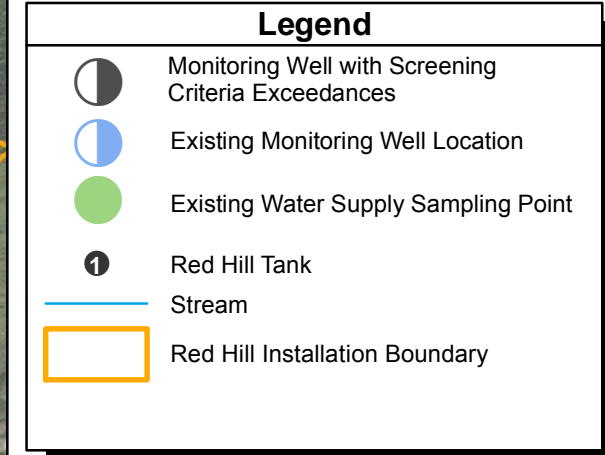
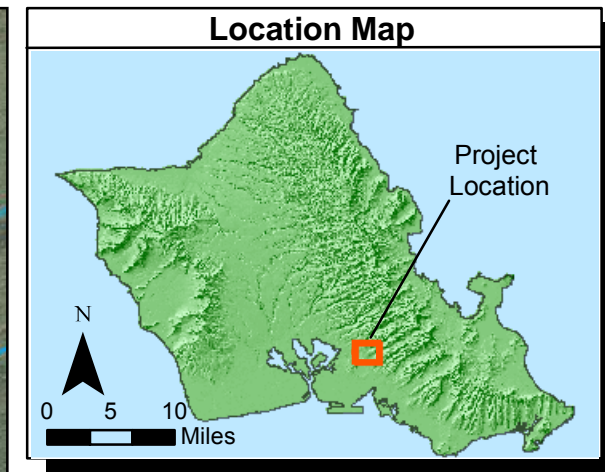
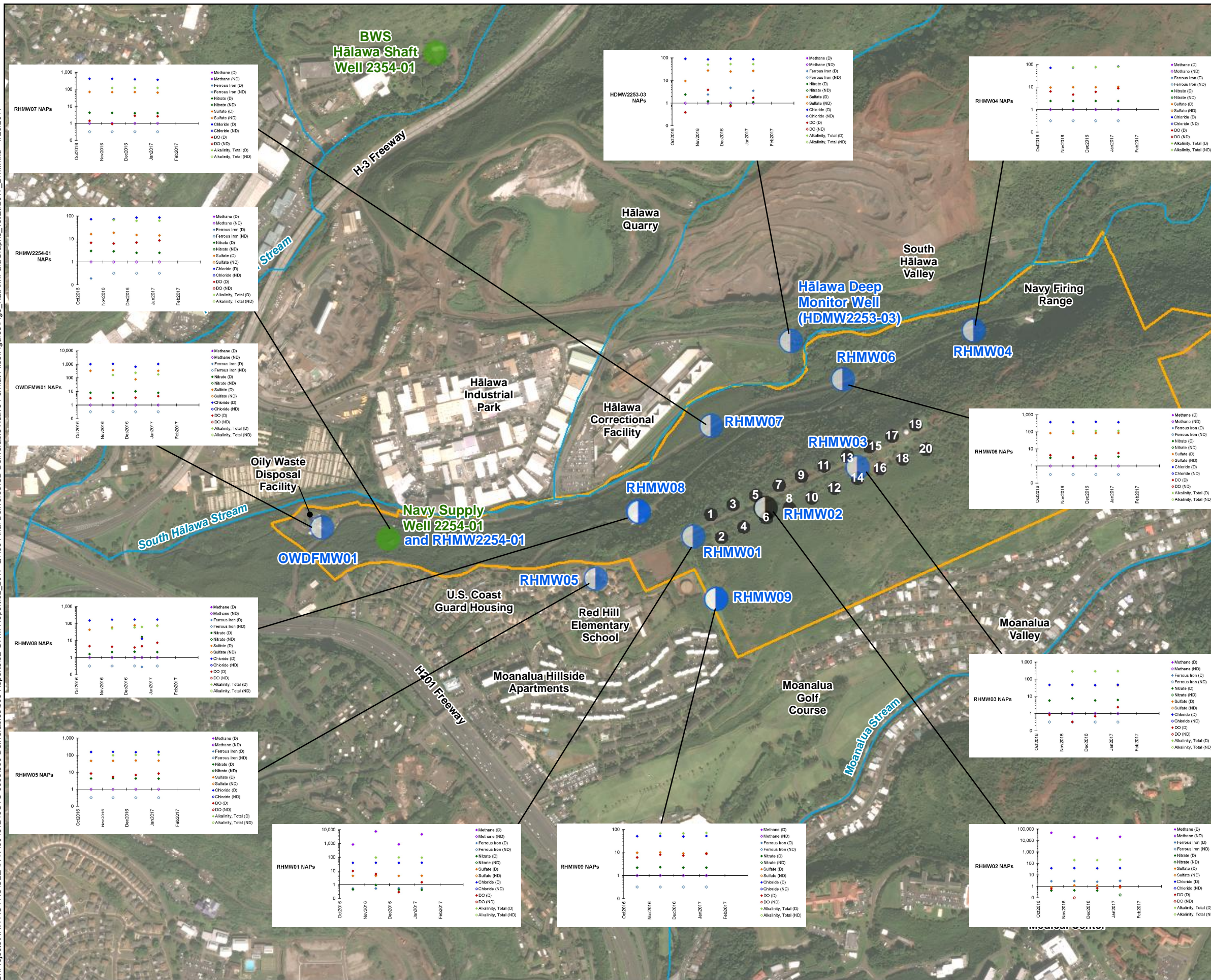


Figure 4
Concentration Graphs
1st Qtr 2017 Groundwater LTM Report
Red Hill Bulk Fuel Storage Facility
JBPHH, O'ahu, Hawai'i

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Notes

- Map projection: NAD 1983 UTM Zone 4N
- Base Map: DigitalGlobe, Inc. (DG) and NRCS. Publication Date: 2015
- Methane in µg/L. All others in mg/L.

ABBREVIATIONS:

- D detect
- J estimated value
- mg/L milligrams per liter
- mV millivolts
- NA not analyzed or not applicable
- ND non-detect
- U non-detect value (reported as less than the limit of detection [LOD])
- µg/L microgram per liter

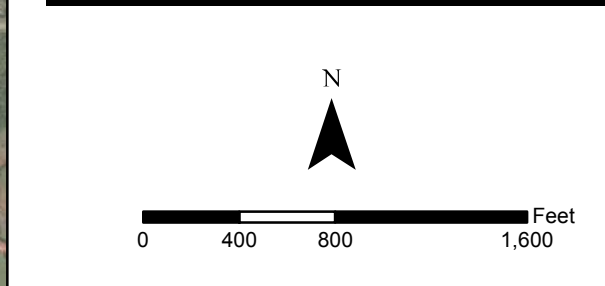


Figure 5
Natural Attenuation Parameters Graphs
1st Qtr 2017 Groundwater LTM Report
Red Hill Bulk Fuel Storage Facility
JBPHH, O'ahu, Hawai'i

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1 The following summary of groundwater contaminant concentrations focuses on the 2016
2 groundwater results, before and during the reduced or no pumping status of Navy Supply
3 Well 2254-01 pumps that began in February 2016.

- 4 • *RHMW2254-01*: COPCs (TPH-d and TPH-o) were detected only in RHMW2254-01 during
5 the December 2016 monitoring event, and TPH-d was detected for the first time since the
6 First Quarter 2016 monitoring event. Although the method reporting limits for TPH-d were
7 above the screening criterion in several results prior to August 2010, TPH-d has not been
8 detected in RHMW2254-01 at a concentration above the screening criterion.
- 9 • *RHMW01*: TPH-d was the only COPC detected in RHMW01, and groundwater COPC
10 concentrations are declining since the First Quarter 2016 monitoring event. TPH-d has
11 historically been detected at concentrations above the screening criterion during most
12 sampling events, but has not exceeded the screening criterion since October 2016.
- 13 • *RHMW02*: TPH-g, TPH-d, TPH-o, 1-methylnaphthalene, 2-methylnaphthalene, and
14 naphthalene have historically been detected at concentrations above the screening criteria.
15 Starting from the Second Quarter 2016 event, concentrations of TPH-d decreased to a level
16 below the SSRBL, which was exceeded during quarterly events in 2015 and the First Quarter
17 2016 event. The concentrations of TPH-g, TPH-d, 1-methylnaphthalene,
18 2-methylnaphthalene, and naphthalene are showing a general decline since the First Quarter
19 2016 monitoring event; similarly, TPH-o, which was historically detected at RHMW02 and
20 at concentrations above the screening criterion, was detected during the November 2016 and
21 January 2017 events at concentrations below the screening criterion.
- 22 • *RHMW03*: TPH-d and TPH-o, which have historically been detected at concentrations above
23 the screening criteria, were detected below screening criteria and show a general decline
24 since the First Quarter 2016 monitoring event.
- 25 • *RHMW04, RHMW05, RHMW06, and HDMW2253-03*: No COPCs were detected during this
26 round of quarterly sampling at these four wells. Several of the COPCs have been detected in
27 previous monitoring events, but the results show that TPH has not been detected after the
28 First Quarter 2016 monitoring event.
- 29 • *RHMW07*: COPC results during this round of quarterly sampling were generally consistent
30 with the historical data for RHMW07 with the exception of TPH-o from the Third Quarter
31 2016 monitoring event. The unusually high concentration of TPH-o from that event was
32 significantly higher than results for other sampling events. Similar to other wells, most
33 COPCs show no detections since the First Quarter 2016 event.
- 34 • *RHMW08*: The First Quarter 2017 groundwater monitoring consisted of the second
35 (November 2016), third (December 2016), and fourth (January 2017) sampling events for
36 this newly installed well. No COPCs were detected during the initial sampling event
37 (October 2016), but TPH-d was detected in RHMW08 below the screening criterion during
38 all subsequent sampling events. TPH-o was detected below the screening criterion during the
39 three First Quarter 2017 sampling events; however, the December 21, 2016 resample did not
40 confirm the December 12, 2016 detection. Notably, the December 21, 2016 event’s NAP
41 results were significantly different from the previous monitoring events results; the cause of
42 the different NAP results and their effect on the COPC concentrations are currently
43 unknown.
- 44 • *RHMW09*: The First Quarter 2017 groundwater monitoring consisted of the second
45 (November 2016), third (December 2016), and fourth (January 2017) sampling events for
46 this newly installed well. No COPCs were detected in the initial sampling event (October

1 2016). Phenol was detected below its screening criterion during the December 2016 event.
2 No other COPCs were detected during the First Quarter 2017.

- 3 • *OWDFMW01*: TPH-d and TPH-o have periodically been detected significantly above
4 screening criteria since the start of monitoring activities at *OWDFMW01* in 2009. The low
5 concentration of TPH-d in the First Quarter 2017 groundwater monitoring event seems
6 consistent with the pattern of very high detections historically followed by sharp declines in
7 concentration in the monitoring events directly after. The concentrations of TPH-o, which
8 did not exceed the screening criterion in the First Quarter 2017 event, also seem consistent
9 with previous results; however, unlike TPH-d, TPH-o has been consistently analyzed for
10 only since the Second Quarter 2015 groundwater monitoring event.

11 **3.4 GROUNDWATER CHEMISTRY PARAMETERS**

12 During the November 2016 monitoring event, the groundwater monitoring wells were sampled for
13 major ions to profile the aquifer chemistry within the site (shown on Figure 6). Based on
14 concentrations of bromide, fluoride, calcium, magnesium, manganese, potassium, sodium, total
15 silica, and dissolved silica:

- 16 • *OWDFMW01* exhibited comparatively very high concentrations of bromide, calcium,
17 magnesium, potassium, and sodium. The ion concentrations indicate that aquifer tapped into
18 by the *OWDFMW01* consists of very hard water.
- 19 • *RHMW06* and *RHMW07* had similar groundwater ion concentrations indicative of hard
20 water.
- 21 • *RHMW05* and *RHMW08* had similar groundwater ion concentrations indicative of
22 moderately hard water.
- 23 • *RHMW01* and *RHMW02* had ion concentrations indicative of soft water, and *RHMW03* had
24 ion concentrations indicative of moderately hard water. However, the presence of manganese
25 at these monitoring locations may be indicative of fuel attenuation in the subsurface
26 mobilizing manganese from the soil, a probable cause as TPH has been detected in these
27 monitoring locations.
- 28 • *HDMW2253-03* ion concentrations were indicative of soft water; however, much lower
29 potassium concentrations were found at *HDMW2253-03* compared to any other monitoring
30 location; additionally, the presence of manganese ion may be indicative of fuel attenuation,
31 although this is unlikely as TPH has not been detected at *HDMW2253-03* since the Second
32 Quarter 2016 monitoring event.
- 33 • *RHMW2254-01*, *RHMW04*, and *RHMW09* showed similar groundwater ion concentrations,
34 the concentrations much lower compared to the other monitoring locations and indicative of
35 soft water.

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1 **3.5 DATA VALIDATION AND ASSESSMENT**

2 The analytical laboratory data were submitted to a third-party data validator (Laboratory Data
 3 Consultants, Inc.) for data validation and assessment. The objective of data validation is to provide
 4 data of known quality for project decisions. Data quality is judged in terms of precision, accuracy,
 5 representativeness, completeness, comparability, and sensitivity (PARCCS) and performed in
 6 accordance with the data validation procedures in the NAVFAC Pacific *Project Procedures Manual*
 7 (DON 2015b) and consistent with the protocol in the Department of Defense (DoD) QSM
 8 Version 5.0 (DoD 2013). A number of factors may affect the quality of data, including sample
 9 collection methods, sample analysis methods, and adherence to established procedures for sample
 10 collection, preservation, management, shipment, and analysis. Data validation reports are presented
 11 in Appendix E.

12 **Precision**

13 Precision is defined as the reproducibility of replicate measurements. Precision is evaluated by
 14 relative percent difference (RPD) of field duplicates, LCS/LCSD, and MS/MSD results. Field
 15 duplicate and MS/MSD samples were collected at a rate of approximately 10 percent (%) of primary
 16 samples. Field duplicates were sent to the laboratory along with the primary samples.

17 No PAHs or fuel additives were detected in the following primary and field duplicate samples for
 18 three wells, thus no RPDs can be calculated for these samples: RHMW2254-01 (ERH115 and
 19 ERH116 [November 2016 event], ERH135 and ERH137 [December 2016 event], and ERH161 and
 20 ERH162 [January 2017 event]); OWDFMW01 (ERH118 and ERH119 [November 2016 event], and
 21 ERH147 and ERH148 [December 2016 event]); and RHMW08 (ERH157 and ERH158 [December
 22 2016 resample event], and ERH169 and ERH170 [January 2017 event]). TPH-o was detected in both
 23 OWDFMW01 duplicates ERH147 and ERH148 with an RPD of 2%, and TPH-d and TPH-o were
 24 detected in both RHMW08 duplicates ERH169 and ERH170 with RPDs of 7% and 2%, respectively;
 25 these three sets of duplicate RPDs were within the 50% measurement performance criteria (MPC). In
 26 two cases, analytes were detected in either the primary or duplicate sample but not in the other,
 27 yielding RPDs at 200% exceeding the MPC: TPH-d and TPH-o for ERH135 and ERH137; and
 28 TPH-d for ERH157 and ERH158 (see Table 3-8).

29 **Table 3-8: Field Duplicate RPD Exceedances**

Monitoring Event	Sampling Location	Analyte	Screening Criterion	Sample ID	Concentration (µg/L)	RPD
December 2016	RHMW2254-01	TPH-d	100	ERH135	14 J	200 %
				ERH137	< 25 U	
		TPH-o	100	ERH135	16 J	200 %
				ERH137	< 40 U	
December 2016 (resample)	RHMW08	TPH-d	100	ERH157	< 25 U	200 %
				ERH158	63	

30 µg/L microgram per liter
 31 J estimated value
 32 RPD relative percent difference
 33 U non-detect value (shown as less than [<] the LOD)

34 No other precision concerns were identified during validation. Data usability of the samples is
 35 discussed in Section 3.6.

1 Accuracy

2 Accuracy is defined as the degree of conformity of a measurement to a standard or true value.
3 Accuracy is evaluated through measurement of the percent recovery (%R) of an analyte in a
4 reference standard or spiked sample. Accuracy limits for surrogates, laboratory control spike, MS,
5 and MSD samples are either prescribed by the DoD or established by the individual laboratory. The
6 acceptance criteria for accuracy are dependent on the analytical method and are based on historical
7 laboratory or DoD data.

8 A standard reference material (SRM) for 2-(2-methoxyethoxy)-ethanol (ERH155) was submitted by
9 a third-party standards manufacturer to the laboratory for the December 2016 event to validate the
10 extraction and analysis of the 2-(2-methoxyethoxy)-ethanol. The laboratory result was 700 µg/L
11 compared to the 1,000 µg/L SRM actual concentration, indicating 70% recovery of the analyte using
12 the laboratory procedure. The RPD between the true value and the laboratory result is 35%, which is
13 below 50% MPC and is deemed acceptable.

14 The initial calibration verification (ICV) percent difference (%D) was 22% in the 1,2-dibromoethane
15 analysis during the November 2016 event, recovering outside of acceptance criteria of 20%. The
16 results for ERH122, ERH123, and ERH129 were qualified as non-detect estimated (UJ) due to
17 indeterminate bias.

18 The continuing calibration verification (CCV) %D exceeded the acceptance criteria of 20% for
19 several samples analyzed during the December 2016 and January 2017 events. Nine December 2016
20 and seventeen January 2017 methane results for groundwater and trip blank samples were qualified
21 as estimated due to indeterminate bias.

22 The MS and MSD percent recoveries (%R) exceeded laboratory acceptance limits for the following:
23 total silica and chloride in ERH115 (RHMW2254-01, November 2016 event) and chloride for
24 ERH135 (RHMW2254-01, December 2016 event). Results for these analytes in ERH115 and
25 ERH135 were qualified as estimated due to possible high bias introduced by the matrix.

26 The MSD %R was below laboratory acceptance limits for nitrate-nitrite as nitrogen in sample
27 ERH135 (RHMW2254-01, December 2016 event). The result was qualified as estimated due to
28 possible low bias introduced by the matrix.

29 No other accuracy concerns were identified during validation. Data usability is discussed in Section
30 3.6.

31 Representativeness

32 Representativeness is the degree that data accurately and precisely represents a characteristic of a
33 population, parameter variations at a sampling point, or an environmental condition.
34 Representativeness was achieved by conducting sampling in accordance with the sample collection
35 procedures described in the project WP/SOW, including standardized sample collection methods
36 identified in Procedure I-C-3, *Monitoring Well Sampling* (DON 2015b).

37 Representativeness is also evaluated through the compliance with the method-recommended sample
38 holding time and sample preservation methods, and through the analysis of blank samples, including
39 method blank and trip blank samples. For the First Quarter 2017 sampling events, all sample holding
40 times and sample preservation were consistent with EPA SW-846 method recommendations and
41 DoD QSM Version 5.0 (DoD 2013).

1 All samples were associated with a method blank and trip blank. No COPCs were found in the
 2 method blanks and trip blanks with the exception of the following: alkalinity in the laboratory
 3 preparation blank for the December 2016 event; and total xylenes in the outside tunnel trip blank for
 4 January 12, 2017. No data were qualified for the alkalinity laboratory contamination due to the
 5 sample concentrations exceeding 5 times the concentration of the laboratory blank; similarly, no data
 6 were qualified for xylenes as this were not detected in any of the associated samples.

7 For RHMW01, OWDFMW01, and HDMW2253-03, field blank and equipment blanks were
 8 collected and analyzed to demonstrate field equipment decontamination efficiency. The only COPCs
 9 found in the field and equipment blanks were TPH-d in the field blank for the December 2016 event
 10 and phenol and TPH-d in the warehouse equipment blanks for the January 2017 event. No data were
 11 qualified for phenol, as it was not detected in any of the associated samples. Four TPH-d results for
 12 the December 2016 event (ERH143 for RHMW01; ERH147 and ERH148 for OWDFMW01; and
 13 ERH149 for the equipment blank) were qualified as non-detect (U) due to the field blank TPH-d
 14 contamination.

15 All holding times were met with the exception of the following: four November 2016, four
 16 December 2016, and six January 2017 nitrate results were qualified as estimated due to extraction up
 17 to 179 hours after the sample collection dates, thus exceeding the 48-hour method recommended
 18 holding time. Only two of these nitrate results (ERH141 and ERH135 from the December 2016
 19 event) exceeded 2× the 48-hour recommended hold time due to laboratory error. To confirm
 20 representativeness of the nitrate results, the laboratory also performed nitrate-nitrite as nitrogen
 21 analyses on these two samples (see Table 3-9). Laboratory results for nitrate-nitrite as nitrogen
 22 recovered at 68% and 73% of the calculated equivalent, indicating possible low bias of the nitrate
 23 result due the hold time exceedance.

24 **Table 3-9: Nitrate Result Confirmation**

Sample ID	Nitrate Result (mg/L)	Nitrate-Nitrite as N Result (mg/L)	Calculated Equivalent Nitrate-Nitrite as Nitrogen Concentration Based on Nitrate Result (mg/L) ^a	%R
ERH135	2.5	0.40	0.550	73
ERH141	2.2	0.33	0.484	68

25 ^a To convert the nitrate-nitrite as nitrogen result to nitrate, multiply nitrate-nitrite as nitrogen result by a factor of 4.43.

26 The representativeness of the data is considered acceptable after qualification for holding time. Data
 27 usability is discussed in Section 3.6.

28 **Completeness**

29 Completeness is defined as the overall percentage of valid analytical results (including estimated
 30 results) compared to the total number of analytical results reported by the analytical laboratory.

31 Of the 1,222 total results reported, none of the results was rejected. The completeness of the data
 32 (100%) met the 90% completeness goal.

33 **Comparability**

34 Comparability expresses the confidence with which one data set can be compared to another data set.
 35 Comparability can be related to accuracy and precision because these quantities are measures of data

1 reliability. Data with acceptable precision and accuracy are considered comparable if collection
2 techniques, analytical procedures, methods and reporting are equivalent.

3 All samples collected from October 2010 to February 2015 were analyzed by Calscience
4 Environmental Laboratories in Garden Grove, CA (now Eurofins Calscience). Starting from
5 April 2015, samples were analyzed by ALS Environmental in Kelso, WA. Starting from
6 October 2016, samples were analyzed by APPL in Clovis, CA. Analytical method detection limits
7 (MDLs), limits of detection (LODs), and LOQs for the Fourth Quarter 2016 event were lower for
8 most analytes than they had been during previous events. The method used to analyze TPH-g was
9 changed from 8015 to 8260 to improve sensitivity. The significantly improved reporting limits
10 should be considered when results are compared to data from previous events.

11 The laboratory used standard analytical methods for all of the analyses. In all cases, the DLs and LODs
12 attained were below the specified LOQs. Target analytes detected below the LOQs flagged (J) by the
13 laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

14 **Sensitivity**

15 The LOQs are established by the laboratory based on the LODs or instrument DLs, historical data,
16 and EPA limits established for the various methods. The LOQs and LODs for samples may require
17 adjustment by the laboratory due to matrix interference or if high levels of target analytes necessitate
18 dilution before analysis. Matrix interference and sample dilutions have the effect of decreasing
19 sensitivity and increasing the LOQs/LODs. No results in this data set have increased LOQs or LODs
20 that have impacted sensitivity and data usability.

21 **3.6 DATA ASSESSMENT AND USABILITY CONCLUSIONS**

22 The PARCCS criteria were evaluated, and with some exceptions, all criteria were met. Results associated
23 with QC data that failed acceptance criteria are discussed in detail in Section 1.1 of this report. Data
24 quality issues that need to be taken into account for project decisions are summarized below.

25 The 200% RPD for the TPH-d and TPH-o results was caused by non-detect results in one of the field
26 duplicate pair. The field duplicate imprecision indicate that sampling bias may exist in the collected
27 sample volumes, but that the exact nature of the bias (high or low) cannot be determined due to the
28 nature of the RPD exceedance. Due to the imprecision, there is uncertainty in the true concentration
29 of the TPH-d and TPH-o. Nonetheless, the TPH-d and TPH-o results for ERH135 (RHMW2254-01,
30 December 2016 event) and ERH158 (RHMW08, December 2016 resample) were below screening
31 criteria. The detected values for these monitoring wells were conservatively used as the TPH-d and
32 TPH-o values in the cumulative COPC graphs in Appendix G, and will continue to be used to
33 determine TPH trends for the monitoring network.

34 The ICV %D and CCV %D recoveries outside of acceptance criteria (for 1,2-dibromoethane and
35 methane, respectively) indicates indeterminate bias affecting several 1,2-dibromoethane and methane
36 results. In all cases for the affected 1,2-dibromoethane, all associated results were non-detect, which
37 are consistent with the October and December 2016 and January 2017 results, thus it is unlikely that
38 the bias caused false non-detects in the November 2016 results. Similarly, the affected methane
39 results were non-detect with the exception of the December 2016 and January 2017 RHMW02
40 results. In all cases, the results were consistent with the October and November 2016 results,
41 indicating that the bias is unlikely to have caused false non-detects, and that the RHMW02 methane
42 results are significantly elevated that the bias does not affect the usability of the methane results in
43 determining the natural attenuation conditions at RHMW02.

1 The MS and MSD %R exceedances for total silica, chloride, and nitrate-nitrite as nitrogen in the
2 November and December 2016 RHMW2254-01 groundwater samples indicate possible bias due to
3 matrix effects. The affected results were flagged as estimated to denote the possible bias and are
4 deemed usable.

5 The TPH-d contamination in the field blank for the December 2016 event affected TPH-d results for
6 RHMW01 and OWDFMW01, flagging the results as non-detect. It is of note that other existing
7 TPH-d data for both wells indicate that the TPH-d results for these two monitoring wells are
8 consistent with previous events, thus it is possible that the contamination may have little actual
9 contribution to the TPH-d results. However, as the contributed contamination cannot be quantified,
10 per the validation procedures of the NAVFAC Pacific *Project Procedures Manual* (DON 2015b)
11 results less than 5× the blank concentration are flagged as non-detect. Additionally, the affected
12 TPH-d results are below the screening criteria, and future groundwater sampling events will provide
13 more data to evaluate the concentration trends.

14 The holding time exceedances for the nitrate results indicate a possible low bias may have been
15 introduced to the data. However, the data were deemed usable with qualification as the sample
16 extractions did not exceed the method-recommended holding time by a factor of 2 for most of the
17 associated samples; for the two samples extracted outside of 2× the method-recommended holding
18 time, the nitrate-nitrite as nitrogen results confirm the nitrate results. The usability nitrate data is
19 deemed acceptable after the data are qualified as estimated.

20 The third-party data assessment concludes that all data generated during this event are usable for the
21 intended purpose, with the limitations described above.

22 **4. Natural Attenuation Evaluation**

23 The natural attenuation evaluation uses lines of evidence, as follows:

- 24 • The use of historical groundwater primary indicators (COPC data) to demonstrate
25 contaminant concentration over time.
- 26 • The use of secondary indicators (hydrogeologic and geochemical data) can demonstrate
27 natural attenuation processes are active at the site, and the rate at which such processes will
28 reduce contaminant concentration to required levels.
- 29 • The analysis of TPH-d and TPH-o with and without the use of silica gel cleanup to
30 determine fraction of polar weathered hydrocarbons and total recoverable hydrocarbons.

31 Two of the objectives of analyzing for the NAPs are to assess whether natural attenuation is
32 occurring on site, and whether there is the potential for natural attenuation to reduce the
33 concentration of the petroleum-related constituents in groundwater. For the First Quarter 2017
34 groundwater monitoring event, the decline in TPH concentrations at RHMW01, RHMW02, and
35 RHMW03 within the last five groundwater events may be attributable to changed aquifer conditions
36 and pumping scenarios at the Red Hill Shaft, characteristic contaminant pulse from a declining
37 source, natural attenuation, changes in precipitation, or a combination of one or more of these
38 factors. Secondary lines of evidence for natural attenuation are based on additional information
39 collected during the groundwater monitoring event and include DO, ORP, pH, specific conductance,
40 dissolved ferrous iron, methane, nitrate, and sulfate.

1 Fuel hydrocarbons can be biodegraded by microorganisms in the subsurface under aerobic or
2 anaerobic conditions. Biodegradation is the result of microbial-mediated redox reactions in which
3 coupling of oxidation of an electron donor and reduction of an electron acceptor occurs.

4 Biodegradation of fuel hydrocarbons causes changes to the groundwater geochemistry. During
5 aerobic biodegradation of hydrocarbons, DO concentrations are depleted as aerobic respiration
6 occurs because DO is the most thermodynamically favored electron acceptor used in biodegradation.
7 ORP is a measure of electron activity and is an indicator of the relative tendency of a solute species
8 to gain or lose electrons. Higher ORP measurements suggest aerobic respiration is occurring.

9 In methanogenic anaerobic respiration, potential electron acceptors include nitrate, ferric iron,
10 sulfate, and carbon dioxide. Use of the electron acceptors proceeds along a natural succession in the
11 order listed above because of decreasing energetic efficiency (Leeson et al. 2004). Nitrate is the most
12 thermodynamically favored electron acceptor of the anaerobic pathways, biodegrading to nitrite
13 (followed by nitrogen gas) and carbon dioxide. Ferric iron in soil can be consumed by anaerobic
14 biodegradation when both DO and nitrate have been depleted in anaerobic groundwater, yielding
15 dissolved ferrous iron in groundwater. Sulfate can be consumed by anaerobic degradation after DO,
16 nitrate, and ferric iron are depleted, yielding precipitated iron sulfides. Lower concentrations of
17 sulfate in groundwater compared to background levels indicate that sulfate reduction is an ongoing
18 biological process for petroleum hydrocarbon degradation within plume areas. When all the soluble
19 electron acceptors (i.e., DO, nitrate, ferric iron, and sulfate) are depleted, groundwater conditions
20 become conducive to fermentation and methane is generated by methanogenesis.

21 Alkalinity is a general indicator of buffering capacity of an aquifer system against pH changes due to
22 attenuation processes in the groundwater. Alkalinity is used in conjunction with pH measurements to
23 determine if the groundwater is sufficient to neutralize metabolic acids produced by biodegradation.
24 Production of carbon dioxide during biodegradation causes carbonate minerals to dissolve,
25 increasing alkalinity concentrations in the groundwater.

26 Both aerobic and anaerobic biodegradation may be occurring at the site, and geochemical parameters
27 indicative of biodegradation may vary with location and with time (Wiedemeier et al. 1999).

28 For the November 2016, December 2016, and January 2017 sampling events, the field water quality
29 data parameters are included on the field sampling logs (Appendix A). Table 3-2 through Table 3-4
30 summarize DO, ORP, and other geochemical parameters (ferrous iron, methane, nitrate, and sulfate)
31 indicative of evidence of biodegradation. Graphs of the DO, ORP, and NAPs are presented in
32 Appendix H.

33 **4.1 EVALUATION USING GROUNDWATER COPC CONCENTRATIONS**

34 The groundwater COPC concentrations shown in Appendix G indicate a general decline in
35 concentration in most monitoring wells since the First Quarter 2016 monitoring event. The general
36 decline seems to start immediately after the First Quarter 2016 monitoring event. Historical TPH-d
37 concentrations from 2007 and onwards show, especially in RHMW02, that seasonal increases and
38 decreases occur respectively during the beginning and end of wet-season sampling (October through
39 May). However, the recent decline in concentrations may also be attributable to other factors such as
40 the reduced pumping activity at the Red Hill Shaft starting from February 2016.

4.2 EVALUATION USING NATURAL ATTENUATION PARAMETERS

NAPs were collected during the groundwater monitoring field activities and include DO, ORP, ferrous iron, methane, nitrate, sulfate, and chloride. These parameters indicate the conditions under which natural attenuation is likely occurring.

4.2.1 Dissolved Oxygen and Oxidation Reduction Potential

The November and December 2016 DO and ORP concentrations for most wells were generally consistent with October 2016 measurements, but the January 2017 measurements were markedly different in some wells, which may be due to the different multi-parameter sensor used during the January 2017 compared to that used in the previous monitoring events.

The background (RHMW04) DO measurement for the November 2016, December 2016, and the January 2017 sampling events ranged between 4.62 and 8.73 mg/L, and ORP ranged between 101 and 205.7 millivolts (mV). DO concentrations for RHMW01 shows a downward trend, which when evaluated in conjunction with the downward trend in the TPH-d concentrations since the Fourth Quarter 2016 event, may indicate a possible increase in natural attenuation processes at RHMW01. The ORP values were consistently negative and fluctuating in both RHMW01 (-17 mV to -18mV) and RHMW02 (-48 mV to -109 mV), but consistently positive in RHMW03 where the ORP has been rising (48 mV to 195.5 mV).

In RHMW01 and RHMW02, DO was depleted in the groundwater, especially when evaluated in conjunction with other NAPs such as the high dissolved methane concentrations (>1,000 µg/L), and indicates that anaerobic respiration is likely occurring. DO conditions at RHMW03 are hovering around 1 µg/L and do not show whether ORP and DO concentrations at RHMW03 are more indicative of conditions conducive to aerobic rather than anaerobic degradation.

4.2.2 Nitrate

Nitrate is the most thermodynamically favored electron acceptor of the anaerobic pathways, in which petroleum hydrocarbons are biodegrading to nitrogen gas. RHMW01 and RHMW02 consistently have had nitrate at concentrations below 1 mg/L. This suggests that anaerobic respiration is likely occurring. The rest of the wells have nitrate at concentrations greater than the consistent background level of 2.4 mg/L in RHMW04, which, evaluated in conjunction with the DO and ORP results, suggests that no attenuation is likely occurring (for wells that show no TPH detections) or that aerobic conditions are likely occurring (for wells with TPH detections, including RHMW03 and OWDFMW01).

4.2.3 Ferrous Iron

Bacteria will typically break down ferric iron in soil once oxygen is depleted, which causes ferrous iron to be detected in groundwater. During the First Quarter 2017 sampling events, ferrous iron was present in wells HDMW2253-03, RHMW01, RHMW02, and RHMW08 at concentrations ranging from 0.28 mg/L to 4.7 mg/L. Ferrous iron was not detected in any other wells.

The ferrous iron concentrations in RHMW01 and RHMW02 are in line with other NAPs discussed above, suggesting that anaerobic respiration may be occurring at these locations. The presence of ferrous iron and other NAPs at HDMW2253-03 and RHMW08 does not appear indicative of anaerobic biological activity at these locations because TPH has not been reported for these wells in the last three monitoring events. Future groundwater sampling events will provide more data to evaluate the ferrous iron trends at all the monitoring well locations.

1 **4.2.4 Methane**

2 An additional line of evidence for biological degradation of petroleum hydrocarbons includes the
3 presence of methane, a reaction byproduct of fermentative biological reactions. Methane was
4 detected in the samples from RHMW01 and RHMW02 at concentrations ranging from 860 µg/L to
5 7,500 µg/L and 16,000 µg/L to 21,000 µg/L, respectively. This evidence of methane concentrations
6 suggests that methanogenic, anaerobic biodegradation is occurring in these wells. Methane was not
7 detected in any of the other wells.

8 **4.2.5 Sulfate**

9 Sulfate is usually consumed by bacteria only when DO, nitrate, and ferric iron have been depleted.
10 Concentrations of sulfate lower than background concentrations when evaluated in conjunction with
11 depressed DO and nitrate concentrations suggest that anaerobic activity is occurring. The
12 concentrations of sulfate in groundwater at RHMW01 and RHMW02 were 4.4 to 4.5 mg/L and
13 0.79 to 1.20 mg/L, respectively, which are much lower than the sulfate concentrations in RHMW04
14 (9.8 to 10.10 mg/L). The sulfate results in RHMW01 and RHMW02 suggest that anaerobic activity
15 is likely actively occurring. The concentrations of sulfate at the other wells are equal to or greater
16 than the background concentration at RHMW04.

17 **4.2.6 Chloride**

18 Chloride is a general water quality parameter and is also usually produced by anaerobic
19 dechlorination of chlorinated compounds. Elevated levels of chloride may indicate that
20 dechlorination is occurring, but only if background concentrations of chloride in the aquifer do not
21 mask the production of chloride due to dechlorination. In addition, elevated chloride levels may also
22 inhibit certain microbial activity. As such, chloride is generally considered as an indicator parameter
23 only. Chloride concentrations in RHMW04 (background well) and RHMW2254-01 (sampling point
24 near Navy Supply Well 2254-01) were approximately 2× higher than chloride concentrations in
25 RHMW01, RHMW02, and RHMW03 (the monitoring wells where biodegradation is likely
26 occurring based on results of other NAPs). Additionally, chloride concentrations in RHMW05
27 through RHMW08, HDMW2253-03 and OWDFMW01 are higher than in RHMW04. Thus, chloride
28 results may not provide a strong line of evidence to support conclusions on natural attenuation at the
29 facility. Future groundwater sampling events will provide more data to evaluate the chloride trends at
30 all the monitoring well locations.

31 **4.2.7 Alkalinity**

32 Alkalinity was added to the NAP list during the November 2016 monitoring event. Total and
33 bicarbonate alkalinity concentrations in RHMW02, RHMW03, and OWDFMW01 are significantly
34 higher than in other monitoring well locations. During the First Quarter 2017 events, the alkalinity
35 ranged from 196 mg/L to 211 mg/L in RHMW02 and 285 mg/L to 294 mg/L in RHMW03, which
36 are much higher than the background concentrations ranging from 75.2 mg/L to 78.7 mg/L. The
37 elevated alkalinity in RHMW02 and RHMW03 may be attributable to natural attention process
38 occurring at these locations.

39 In contrast, high alkalinity concentrations were detected in OWDFMW01 (ranging from 161 mg/L to
40 234 mg/L), but the location did not have other NAP measurements that support evidence of natural
41 attenuation. Thus the alkalinity concentrations in OWDFMW01 may be attributed to the
42 groundwater conditions existing at OWDFMW01, which profiles differently compared to the other
43 monitoring locations (see Section 3.4).

4.3 TPH-d AND TPH-o WITH SILICA GEL CLEANUP

Unweathered petroleum tends to contain nonpolar hydrocarbons that, when weathered in the environment create polar hydrocarbons as byproducts of biological sources and processes. Silica gel cleanup is commonly used to separate polar from nonpolar hydrocarbons. Polar compounds will preferentially adsorb to silica, while non-polar compounds will not. DOH TGM Section 9.3.1.2, Total Petroleum Hydrocarbons, discusses the use of silica gel cleanup to separate out the polar TPH fraction and compare the remaining non-polar TPH fraction to the screening criteria: “*Comparison of data for groundwater samples tested with and without silica gel cleanup could be useful for assessing the state of natural biodegradation within a plume of petroleum-contaminated groundwater and optimizing remedial and monitoring actions*” (DOH 2016b).

The first instance of TPH-d and TPH-o detections at RHMW08 occurred during the November 2016 groundwater monitoring event. To further characterize the TPH-d and TPH-o found at RHMW08, silica-gel-cleaned TPH-d and TPH-o analysis was performed on the RHMW08 November 2016 event sample. Silica-gel-cleaned TPH-d and TPH-o results were non-detect compared to the results without silica gel cleanup, which were 33 µg/L and 32 J µg/L, respectively. These results indicate that the RHMW08 TPH-d and TPH-o concentrations are composed of weathered fuel.

5. Summary, Conclusions, and Recommendations

5.1 SUMMARY

During November 14–17, 2016, December 12–15, 2016, and January 9–12, 2017, groundwater samples were collected from 11 monitoring wells in the Red Hill groundwater monitoring network (RHMW01 through RHMW09, HDMW2253-03, and OWDFMW01) and one sampling point at Red Hill Shaft (RHMW2254-01). Monitoring well RHMW08 was resampled on December 21, 2016. During the November and December 2016 sampling events, one primary and one duplicate sample were collected from sampling point RHMW2254-01 and well OWDFMW01. During the December 2016 resampling event, one primary and one duplicate sample were collected from RHMW08. During the January 2017 sampling event, one primary and one duplicate sample were collected from sampling point RHMW2254-01 and well RHMW08.

The groundwater sampling was conducted as part of the long-term groundwater monitoring program at the Facility. A summary of the analytical results for the sampling locations with the highest and most frequent historical detections is as follows:

- *RHMW01*: The only analyte detected in groundwater was TPH-d (88–94 µg/L) below screening criteria.
- *RHMW02*: Concentrations of TPH-d (1,300–1,400 µg/L), 1-methylnaphthalene (17–29 µg/L), 2-methylnaphthalene (11–12 µg/L), and naphthalene (40–69 µg/L) were detected exceeding their respective screening criteria during all three events. The concentrations of TPH-d did not exceed the SSRBL of 4,500 µg/L. Concentrations of TPH-o (42–100 µg/L), TPH-g (26–63 µg/L), and total xylenes (0.19–0.26 µg/L) were also detected, but below their respective screening criteria in two of the three events.
- *RHMW03*: The only analytes detected in groundwater were TPH-d (51–56 µg/L) and TPH-o (42–49 µg/L). Both analytes were detected below the screening criteria in all three events.
- *OWDFMW01*: The only analyte detected in groundwater was TPH-o (45–46 µg/L) during the December and January events. The concentration of TPH-o did not exceed the screening criterion.

1 A table of cumulative historical groundwater results is included as Appendix C, and historical
2 groundwater COPC concentration graphs are included in Appendix G. The historical groundwater
3 COPC concentration graphs indicate a general decline in COPC concentrations since the First
4 Quarter 2016 event.

5 The groundwater chemistry parameters collected at the 12 monitoring locations indicate that
6 different groundwater profiles exist at the site. The groundwater found at OWDFMW01 was
7 composed of very hard water and was significantly different from the other monitoring locations.
8 RHMW06, RHMW07, RHMW05, and RHMW08 had hard or moderately hard water.
9 RHMW2254-01, RHMW04, and RHMW09 had soft water; HDMW2253-03 had soft water as well,
10 but also had much lower potassium concentrations and showed presence of manganese, unlike the
11 other three locations with soft water. Of note, RHMW01, RHMW02, and RHMW03 showed
12 manganese concentrations indicative of fuel attenuation when evaluated in conjunction with TPH
13 and NAP concentrations.

14 The NAPs also present evidence of anaerobic biodegradation occurring at RHMW02 at significant
15 levels based on depleted DO, very high dissolved methane concentrations, depleted nitrate and
16 sulfate concentrations, and high alkalinity concentrations. The concentrations of NAPs and
17 silica-gel-cleaned TPH-d and TPH-o at RHMW01 and RHMW02 also indicate that biodegradation
18 (likely both aerobic and anaerobic) is also occurring.

19 Some evidence of anaerobic biodegradation is present in RHMW01, based on the presence of
20 methane and ferrous iron in the groundwater results, and the depleted nitrate. However, the DO
21 concentrations at RHMW01 fluctuate between falling within background range and being depleted
22 similar to RHMW02. Evidence of biodegradation may be inferred at RHMW03 based on the
23 presence of TPH in the groundwater and depleted DO concentrations; however, none of the other
24 NAPs support evidence of anaerobic biodegradation. Similarly, the other monitoring wells showed
25 very low or no TPH detections, which when evaluated into consideration with the NAP results
26 indicate no evidence of biodegradation. Additionally, silica-gel-cleaned TPH-d and TPH-o results for
27 the RHMW08 November 2016 samples indicate that the TPH is composed of weathered fuel.

28 **5.2 CONCLUSIONS AND RECOMMENDATIONS**

29 During the November 2016, December 2016, and January 2017 sampling events, there were no
30 SSRBL exceedances, although TPH-d exceeded the DOH EAL screening criterion at RHMW02.
31 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene also exceeded their respective DOH
32 EAL screening criteria at RHMW02. TPH-d concentrations continue to drop at OWDFMW01 from a
33 high during Third Quarter 2015 to levels below the screening criterion, similar to the pattern seen
34 during 2012 and 2013 quarterly sampling events. RHMW08 showed low detections of TPH-d and
35 TPH-o during the November and December 2016 events and the January 2017 event, unlike the
36 initial sampling event in October 2016. Groundwater contaminant concentrations in other wells
37 generally remained at non-detect or at low concentrations and did not change significantly from the
38 previous event.

39 Based on the groundwater monitoring results and in accordance with AOC Statement of Work
40 Sections 6 and 7, continued groundwater monitoring at the wells in the Red Hill groundwater
41 monitoring network is recommended. Monthly sampling of the Red Hill monitoring network was
42 initiated in November 2016 in response to information obtained that the Red Hill Shaft pumps have
43 been relatively inoperable since February 2016 due to equipment (i.e., transformer) malfunction.
44 Pumping at a reduced capacity was initiated in November 2016 using temporary equipment, and the
45 permanent equipment is scheduled to be replaced early 2017, at which time pumping will return to

1 normal capacity. To evaluate potential impacts the changed pumping conditions may have on COPC
2 concentrations in groundwater at and around the Facility, monthly sampling was conducted in
3 November and December 2016, and January 2017 was a regularly scheduled quarterly sampling
4 event. Split sampling was also conducted during the January 2017 event. The next additional
5 monitoring events are scheduled for February and March 2017, followed by another quarterly event
6 in April 2017. It is anticipated that split sampling will be conducted during each event until April
7 2017. It is also anticipated that equipment repairs will have been completed by early 2017 and that
8 only quarterly monitoring events will be conducted after the April 2017 sampling event. Results of
9 the monthly sampling events will be included in the scheduled quarterly monitoring reports.

10 It is recommended that the groundwater chemistry profile for the monitoring locations be further
11 evaluated in conjunction with other geologic and hydrogeologic data to be collected under
12 subsequent deliverables published under AOC Statement of Work Sections 6 and 7.

13 It is recommended that the groundwater monitoring program continue testing for the NAPs at each
14 monitoring event, and inclusion of the silica-gel-cleaned TPH-d and TPH-o analysis if (1) TPH-d
15 and TPH-o results increase by a factor of 2 from the previous monitoring event and the results are
16 above screening criteria, or (2) during the first finding of TPH-d and TPH-o in the newly installed
17 monitoring wells. At this time, pumping effects of Red Hill Shaft will be evaluated and included in
18 relevant and applicable deliverables pursuant to AOC Statement of Work Sections 6 and 7.

19 Future work includes the February and March 2017 additional monthly groundwater sampling
20 events, and the Second Quarter 2017 groundwater monitoring event that is scheduled for April 2017.

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**Appendix A:
Groundwater Sampling Logs**

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Red Hill Groundwater Sampling Log

WELL NO. **RHMW2254-01**

LOCATION: Inside Tunnel

PROJECT NO. 60481245

DATE: 11/14/16

TIME: 1045

CLIMATIC CONDITIONS:

DF/TQ

PID reading (ppm)	Depth to groundwater		Depth to bottom		Flow rate (mL/min)	Start Time	Purge		Nitrogen used
	Previous (ft btoc)	Current (ft btoc)	Previous (ft btoc)	Current (ft btoc)			Total Volume (gal)		
0.0	80.68	80.52	Unk	-	200	1050	2.0		600 psi
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)			
Previous/Actual		70	45	20	20	20	20		

LENGTH OF SATURATED ZONE:

N/A

LINEAR FT.

PUMP INTAKE:

N/A

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP.		TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
					COND. (mS/cm)	D.O. (mg/L)				
1055	N/A	2.0	0.284	7.56	0.432	6.95	0.0	20.42	150	0.2
1103	N/A	3.0	0.283	7.60	0.435	6.64	0.0	21.22	154	0.2
1105	N/A	3.25	0.283	7.61	0.436	6.38	0.0	21.42	154	0.2
1110	N/A	3.5	0.285	7.61	0.439	6.35	0.0	21.53	155	0.2
1115	N/A	3.75	0.286	7.57	0.438	6.37	0.0	21.49	151	0.2
1120	N/A	4.0	0.285	7.61	0.438	6.33	0.0	21.53	152	0.2

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT:

OTHER:

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 47 total

TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl, Br/F by 300.0, total silica by SM 4500-SID, HCO ₃ /alkalinity by SM2320B	Dissolved Silica by SM45000-SID	Total Ca/Mg/Mn /K/Na by 6010
4x4x4x4x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	4 x 4 x 4 x 4 x 1-L Amber	1 x 250-ml w/HCl	2 x 250-ml np	1 x 250-ml np	1 x 500-ml HNO ₃

SAMPLE IDENTIFICATION NUMBER(S) **ERH115 and ERH 116 (Duplicate + MS/MSD)**

DATE: 11/14/16

TIME: 1120

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES:

Transferred 500mL HNO₃ to a new bottle

SAMPLED BY: DF/TQ

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW01** LOCATION: Inside Tunnel PROJECT NO. 60481245
 DATE: 11/14/16 TIME: 1430 CLIMATIC CONDITIONS: N/A

PID reading (ppm)	Depth to groundwater		Depth to bottom		Purge			
	Previous (ft btoc)	Current (ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
45	83.00	82.87			100	1445	60	
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		140	118	20	10	20	10	

LENGTH OF SATURATED ZONE: _____ LINEAR FT.

PUMP INTAKE: _____ 19.5 ft _____

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP.	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
					COND. (mS/cm)					
1525	82.87	0.25	0.227	7.39	0.347	10.93	0.0	24.03	-76	0.2
1530		0.5	0.229	7.38	0.355	7.68	0.0	23.96	-65	0.2
1535		0.6	0.232	7.31	0.359	7.11	0.0	23.65	-69	0.2
1540		0.7	0.234	7.30	0.360	6.89	0.0	23.57	-70	0.2
1545		0.8	0.235	7.28	0.364	6.45	0.0	23.44	-75	0.2
1550		0.9	0.239	7.25	0.366	6.09	0.0	23.37	-79	0.2
1555		1.0	0.240	7.23	0.366	5.99	0.0	23.33	-80	0.2

SAMPLING EQUIPMENT: Bladder Pump
 APPEARANCE OF SAMPLE: COLOR: Clear @ 1600
 SEDIMENT: _____
 OTHER: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 17 total

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl, Br/F by 300.0, total silica by SM 4500-SID, HCO ₃ /alkalinity by SM2320B	Dissolved Silica by SM45000-SID	Total Ca/Mg/Mn /K/Na by 6010
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	2 x 250-ml np	1 x 250-ml np	1 x 500-ml HNO ₃

SAMPLE IDENTIFICATION NUMBER(S) ERH117
 DATE: 11/14/16 TIME: 1600
 DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash
 NOTES: Controller maxed at 118 psi, flow started at 50 mL/min @ 118 psi 20/20, could not adjust – pulled bladder pump; problems with water flow with oil water interface
 SAMPLED BY: DF/TQ
 SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW02** LOCATION: Inside Tunnel PROJECT NO. 60481245
 DATE: 11/15/16 TIME: 1030 CLIMATIC CONDITIONS: N/A

PID reading (ppm)	Depth to groundwater		Depth to bottom		Purge			
	Previous (ft btoc)	Current (ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
0.0	85.97	85.83			200	1030	2	1600 psi
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		60	60	30	30	25	25	

LENGTH OF SATURATED ZONE: _____ LINEAR FT.

PUMP INTAKE: _____

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	SP.		D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
				pH	COND. (mS/cm)					
1045	85.38	0.25	0.333	6.52	0.520	0.15	0.0	23.53	-100	0.2
1050	85.39	0.75	0.331	6.40	0.518	0.0	0.0	23.27	-113	0.2
1055	85.45	1.0	0.332	6.48	0.518	0.0	0.0	23.22	-106	0.2
1100	85.41	1.25	0.332	6.53	0.519	0.0	0.0	23.17	-106	0.2
1105	85.41	1.5	0.333	6.54	0.519	0.0	0.0	23.16	-111	0.2
1110	85.42	2.0	0.333	6.49	0.519	0.0	0.0	23.15	-112	0.2
1115	85.42	2.0	0.332	6.45	0.519	0.0	0.0	23.08	-109	0.2
1200	85.64									

SAMPLING EQUIPMENT: Bladder Pump
 APPEARANCE OF SAMPLE: COLOR: Clear
SEDIMENT: None
OTHER:

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 17 total
 TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl, Br/F by 300.0, total silica by SM 4500-SID, HCO ₃ /alkalinity by SM2320B	Dissolved Silica by SM45000-SID	Total Ca/Mg/Mn /K/Na by 6010
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	2 x 250-ml np	1 x 250-ml np	1 x 500-ml HNO ₃

SAMPLE IDENTIFICATION NUMBER(S) ERH124
 DATE: 11/15/16 TIME: 1130

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Oxygen at 9% in well, possible fuel odor to water, during refill, water level dropped to 85.6, returns to 85.4 during discharge.

SAMPLED BY: DF/KE

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW03** LOCATION: Inside Tunnel PROJECT NO. 60481245
 DATE: 11/15/16 TIME: 1240 CLIMATIC CONDITIONS: N/A

PID reading (ppm)	Depth to groundwater		Depth to bottom		Purge			
	Previous (ft btoc)	Current (ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
10	102.21	101.87			250		4.0	1000 psi
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		60	55	40	30	25	25	

LENGTH OF SATURATED ZONE: _____ LINEAR FT.

PUMP INTAKE: _____

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	SP.		D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
				pH	COND. (mS/cm)					
1315	102.07	1.0	0.516	6.71	0.803	1.04	0.0	25.97	76	0.4
1320	102.08	1.25	0.513	6.63	0.802	0.49	0.0	25.78	65	0.4
1325	102.09	2.0	0.511	6.71	0.797	0.44	0.0	25.72	67	0.4
1330	102.10	2.25	0.511	6.54	0.797	0.40	0.0	25.65	59	0.4
1335	102.11	2.5	0.510	6.72	0.797	0.38	0.0	25.58	60	0.4
1340	101.95	2.5	0.504	6.86	0.788	0.55	0.0	25.45	60	0.4
1345	102.11	2.75	0.509	6.75	0.796	0.50	0.0	26.16	66	0.4
1355	102.32	3.25	0.507	6.75	0.792	0.34	0.0	25.47	64	0.4
1400	102.32	3.75	0.507	6.74	0.792	0.36	0.0	25.37	56	0.4
1405	102.20	4.0	0.507	6.61	0.792	0.33	0.0	25.37	48	0.4
1440	102.19									

SAMPLING EQUIPMENT: Bladder Pump
 APPEARANCE OF SAMPLE: COLOR: Clear
 SEDIMENT: None
 OTHER: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 17 total

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl, Br/F by 300.0, total silica by SM 4500-SID, HCO ₃ /alkalinity by SM2320B	Dissolved Silica by SM45000-SID	Total Ca/Mg/Mn /K/Na by 6010
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	2 x 250-ml np	1 x 250-ml np	1 x 500-ml HNO ₃

SAMPLE IDENTIFICATION NUMBER(S) ERH125

DATE: 11/15/16 TIME: 1415

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Recorded DTW at the end of discharge

SAMPLED BY: DF/KE

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW04**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 11/14/16

TIME: 1520

CLIMATIC CONDITIONS:

PID reading (ppm)	Depth to groundwater		Depth to bottom		Purge			
	Previous (ft btoc)	Current (ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
	293.61	293.22	305	--	250	1531	7.5	800 psi
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		170	138	30	30	40	30	

LENGTH OF SATURATED ZONE: _____

LINEAR FT. _____

PUMP INTAKE: _____

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP.		TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
					COND. (mS/cm)	D.O. (mg/L)				
1545	293.25	1.0	0.267	7.63	0.412	8.83	0.0	23.55	94	0.2
1550	293.25	1.3	0.409	7.51	0.411	5.83	0.0	23.72	105	0.2
1555	293.25	1.7	0.410	7.56	0.410	5.79	0.0	23.63	107	0.2
1600	293.25	2.0	0.266	7.64	0.410	5.30	0.0	23.72	104	0.2
1605	293.25	2.4	0.267	7.72	0.410	5.15	0.0	23.64	103	0.2
1610	293.25	2.8	0.269	7.80	0.412	5.01	0.0	23.49	102	0.2
1620	293.25	3.5	0.269	7.68	0.414	4.63	0.0	23.84	109	0.2
1625	293.25	3.8	0.269	7.70	0.414	4.55	0.0	23.80	110	0.2
1630	293.25	4.1	0.269	7.74	0.414	4.53	0.0	23.77	109	0.2
1635	293.25	4.5	0.269	7.78	0.414	4.31	0.0	23.70	108	0.2
1640	293.25	4.9	0.269	7.89	0.414	4.13	0.0	23.69	104	0.2
1645	293.25	5.2	0.269	7.91	0.414	4.62	0.0	23.65	104	0.2
1650	293.25	5.5	0.270	7.96	0.415	4.47	0.0	23.68	101	0.2

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: _____

SEDIMENT: _____

OTHER: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 17 total

TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl, Br/F by 300.0, total silica by SM 4500-SID, HCO ₃ /alkalinity by SM2320B	Dissolved Silica by SM45000-SID	Total Ca/Mg/Mn /K/Na by 6010
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	2 x 250-ml np	1 x 250-ml np	1 x 500-ml HNO ₃

SAMPLE IDENTIFICATION NUMBER(S) **ERH128**

DATE: 11/14/16

TIME: 1730

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES:

SAMPLED BY: CB/RG

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW05** LOCATION: Inside Tunnel PROJECT NO. 60481245
 DATE: 11/15/16 TIME: 0840 CLIMATIC CONDITIONS:

PID reading (ppm)	Depth to groundwater		Depth to bottom		Purge			
	Previous (ft btoc)	Current (ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
0	Unk	82.25			225	0840	3.75	2000 psi
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		50	40	20	20	20	20	

LENGTH OF SATURATED ZONE: _____ LINEAR FT.

PUMP INTAKE: _____

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP.	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
					COND. (mS/cm)					
0910	82.28	2.0	0.549	7.14	0.859	7.26	0.0	22.98	194	0.4
0915	82.32	2.5	0.545	7.73	0.852	5.60	0.0	22.93	159	0.4
0920	82.32	3.0	0.545	7.77	0.852	5.35	0.0	22.93	151	0.4
0925	82.32	3.25	0.545	7.75	0.851	5.39	0.0	22.93	145	0.4
0930	82.32	3.75	0.545	7.77	0.851	5.32	0.0	22.91	144	0.4
1005	82.32									

SAMPLING EQUIPMENT: Bladder Pump
 APPEARANCE OF SAMPLE: COLOR: Clear
 SEDIMENT: None
 OTHER: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 17 total
 TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl, Br/F by 300.0, total silica by SM 4500-SID, HCO ₃ /alkalinity by SM2320B	Dissolved Silica by SM45000-SID	Total Ca/Mg/Mn /K/Na by 6010
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	2 x 250-ml np	1 x 250-ml np	1 x 500-ml HNO ₃

SAMPLE IDENTIFICATION NUMBER(S) ERH126

DATE: 11/15/16 TIME: 0940

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: _____

SAMPLED BY: DF/KE

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW06**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 11/14/16

TIME: 0900

CLIMATIC CONDITIONS:

PID reading (ppm)	Depth to groundwater		Depth to bottom		Purge			
	Previous (ft btoc)	Current (ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
0.0	240.69	240.31	Unk	--	300	0928	6	900 psi
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		130	115	30	30	20	30	

LENGTH OF SATURATED ZONE: _____

LINEAR FT. _____

PUMP INTAKE: _____

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	SP.		D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
				pH	COND. (mS/cm)					
0945	240.32	1.5	1.01	6.45	1.58	3.97	95	24.71	95	0.8
0950	240.33	2.0	1.01	6.46	1.57	3.94	104	24.79	104	0.8
0955	240.35	2.3	1.00	6.48	1.57	3.76	110	24.92	110	0.8
1000	240.35	2.5	0.996	6.50	1.56	3.80	109	24.98	109	0.8
1005	240.35	3.0	0.999	6.52	1.56	3.93	109	25.05	109	0.8
1010	240.35	3.4	0.996	6.54	1.56	3.99	110	24.95	110	0.8
1020	240.33									
1025	240.31	4.0	0.987	6.53	1.55	3.20	117	26.13	117	0.8
1030	240.35	4.2	0.996	6.65	1.56	3.62	109	25.69	109	0.8
1035	240.31	4.5	0.995	6.66	1.56	3.43	107	25.30	107	0.8
1040	240.33	4.8	0.999	6.69	1.56	3.30	97	25.15	97	0.8
1045	240.35	5.2	0.999	6.72	1.56	3.34	97	25.10	97	0.8
1050	240.35	5.6	0.997	6.76	1.56	3.26	97	25.20	97	0.8

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: _____

OTHER: No odor, no sheen

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 17 total

TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl, Br/F by 300.0, total silica by SM 4500-SID, HCO ₃ /alkalinity by SM2320B	Dissolved Silica by SM45000-SID	Total Ca/Mg/Mn /K/Na by 6010
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	2 x 250-ml np	1 x 250-ml np	1 x 500-ml HNO ₃

SAMPLE IDENTIFICATION NUMBER(S) **ERH120**

DATE: 11/14/16

TIME: 1055

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: 1148- completed sampling

DTW= 240.31

SAMPLED BY: CB/RG

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW07**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 11/14/16

TIME: 1235

CLIMATIC CONDITIONS:

PID reading (ppm)	Depth to groundwater		Depth to bottom		Purge			
	Previous (ft btoc)	Current (ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
0.0	198.24	197.56	Unk		275	1238	5	800 psi
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		110	95	40	30	30	30	

LENGTH OF SATURATED ZONE: _____

LINEAR FT. _____

PUMP INTAKE: _____

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	SP.		D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
				pH	COND. (mS/cm)					
1250	197.86	1.0	1.13	7.68	1.79	3.33	0.0	25.20	47	0.9
1255	197.92	1.5	1.17	7.67	1.83	1.96	0.0	25.15	49	0.9
1300	197.94	2.0	1.17	7.70	1.83	2.09	0.0	25.08	49	0.9
1305	197.96	2.4	1.17	7.76	1.83	1.37	0.0	25.11	52	0.9
1310	197.95	2.8	1.17	7.73	1.82	1.31	0.0	25.25	51	0.9
1315	197.96	3.0	1.17	7.76	1.83	1.16	0.0	25.17	56	0.9
1320	197.96	3.3	1.16	7.71	1.82	1.13	0.0	25.28	56	0.9
1325	197.96	3.8	1.16	7.74	1.81	1.03	0.0	25.31	54	0.9
1330	197.96	4.2	1.16	7.72	1.81	0.90	0.0	25.32	55	0.9
1335	197.96	4.5	1.15	7.79	1.80	0.90	0.0	25.34	55	0.9
1340	197.98	4.9	1.15	7.79	1.79	0.91	0.0	25.39	59	0.9

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

OTHER: No odor, no sheen

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 17 total

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl, Br/F by 300.0, total silica by SM 4500-SID, HCO ₃ /alkalinity by SM2320B	Dissolved Silica by SM45000-SID	Total Ca/Mg/Mn /K/Na by 6010
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	2 x 250-ml np	1 x 250-ml np	1 x 500-ml HNO ₃

SAMPLE IDENTIFICATION NUMBER(S) **ERH121**

DATE: 11/14/16

TIME: 1350

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES:

SAMPLED BY: CB/TV

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW08**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 11/15/16

TIME: 0800

CLIMATIC CONDITIONS:

Partly sunny, breezy, 70's

PID reading (ppm)	Depth to groundwater		Depth to bottom		Purge			
	Previous (ft btoc)	Current (ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
0.0	291.94	291.81	318.21	--	280	0830	4.7	900 psi
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		150	--	25	--	25	--	

LENGTH OF SATURATED ZONE: _____

LINEAR FT. _____

PUMP INTAKE: _____

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALS REMOVE	TDS	pH	SP.	D.O.	TURB.	TEMP.	ORP	SAL
		D	(g/L)		COND.					
0850	291.94	1.0	0.566	8.49	0.883	3.64	0.0	25.07	35	0.4
0855	291.95	1.3	0.565	8.54	0.883	3.63	0.0	25.02	37	0.4
0900	291.95	1.8	0.565	8.55	0.882	3.68	0.0	25.00	38	0.4
0905	291.95	2.3	0.564	8.60	0.881	3.40	0.0	24.99	35	0.4
0910	291.95	2.7	0.563	8.51	0.880	4.62	0.0	24.98	40	0.4
0915	291.95	3.1	0.562	8.52	0.878	4.66	0.0	24.99	39	0.4
0920	291.95	3.5	0.561	8.49	0.877	4.38	0.0	25.02	40	0.4
0925	291.96	3.9	0.560	8.50	0.875	4.33	0.0	25.12	37	0.4
0930	292.00	4.3	0.558	8.50	0.873	4.45	0.0	25.22	34	0.4
0935	292.00	4.7	0.557	8.50	0.871	4.35	0.0	25.27	35	0.4

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: --

OTHER: No odor, no sheen

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 21 total

TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	EDB by 8011	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl, Br/F by 300.0, total silica by SM 4500-SID, HCO ₃ /alkalinity by SM2320B	Dissolved Silica by SM45000-SID	Total Ca/Mg/Mn /K/Na by 6010
5 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCL	3 x 40-ml VOA np	6 x 1-L Amber	1 x 250-ml w/HCl	2 x 250-ml np	1 x 250-ml np	1 x 500-ml HNO ₃

SAMPLE IDENTIFICATION NUMBER(S) **ERH122**

DATE: 11/15/16

TIME: 0940

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES:

DTW= 291.95 ft btoc @1025

SAMPLED BY: CB/RG

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW09**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 11/15/16

TIME: 1050

CLIMATIC CONDITIONS: Partly sunny, breezy, low 80s

PID reading (ppm)	Depth to groundwater		Depth to bottom		Purge			
	Previous (ft btoc)	Current (ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
0.0	377.09	377.05			300	1113	10	1800 psi
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		185	185	35	35	35	35	

LENGTH OF SATURATED ZONE: _____

LINEAR FT. _____

PUMP INTAKE: _____

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	SP.						
				pH	COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
1135	376.92	1	0.230	7.27	0.354	9.01	0.0	25.32	91	0.2
1140	376.92	1.3	0.230	7.35	0.354	8.74	0.0	25.21	85	0.2
1145	376.92	1.8	0.231	7.41	0.355	8.64	0.0	25.17	81	0.2
1150	376.92	2.2	0.231	7.37	0.355	8.64	0.0	25.07	84	0.2
1155	376.92	2.5	0.231	7.34	0.355	8.51	0.0	25.04	86	0.2
1200	376.92	2.7	0.231	7.32	0.355	8.45	0.0	25.12	87	0.2
1210	376.92	3.5	0.230	7.38	0.354	8.36	0.0	25.12	85	0.2
1215	376.92	4.0	0.231	7.36	0.355	8.31	0.0	25.12	87	0.2
1225	376.92	4.5	0.230	7.36	0.354	8.22	0.0	25.26	88	0.2
1230	376.92	5.1	0.230	7.38	0.354	8.13	0.0	25.27	87	0.2
1235	376.92	5.8	0.231	7.31	0.355	8.08	0.0	25.31	91	0.2
1240	376.92	6.2	0.232	7.35	0.356	8.02	0.0	25.25	89	0.2
1245	376.92	6.5	0.228	7.35	0.356	8.02	0.0	25.32	90	0.2

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: --

OTHER: No odor, no sheen

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 21 total

TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	EDB by 8011	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl, Br/F by 300.0, total silica by SM 4500-SID, HCO ₃ /alkalinity by SM2320B	Dissolved Silica by SM45000-SID	Total Ca/Mg/Mn /K/Na by 6010
5 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCL	3 x 40-ml VOA np	6 x 1-L Amber	1 x 250-ml w/HCl	2 x 250-ml np	1 x 250-ml np	1 x 500-ml HNO ₃

SAMPLE IDENTIFICATION NUMBER(S) **ERH129**

DATE: 11/15/16

TIME: 1340

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Complete sample at 1425, DTW = 39.93 @ 1430,
Changed nitrogen tank at 1300

SAMPLED BY: CB/RG

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **HDMW2253-03**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 11/16/16

TIME: 0805

CLIMATIC CONDITIONS: Mostly Sunny, high 70's low 80's

PID reading (ppm)	Depth to groundwater		Depth to bottom		Purge			
	Previous (ft btoc)	Current (ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
0.2	207.42	206.83	1575		300	0839		
Pump settings:		Pressure (PSI)		Discharge (sec)			Fill (sec)	
Previous/Actual		140		20		20		

LENGTH OF SATURATED ZONE: _____

LINEAR FT. _____

PUMP INTAKE: _____

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP.		TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
					COND. (mS/cm)	D.O. (mg/L)				
0850	206.86	0.25	0.312	7.50	0.479	8.23	16.4	22.01	146	0.2
0855	206.86	0.40	0.312	6.47	0.479	7.87	18.3	21.88	-13	0.2
0900	206.86		0.311	6.42	0.483	7.25	17.0	21.80	-12	0.2
0905	206.86		0.310	6.41	0.478	6.45	16.9	21.76	-27	0.2
0910	206.86		0.310	6.45	0.476	6.28	16.3	21.76	-24	0.2
0915	206.86		0.309	6.30	0.476	5.84	16.0	21.75	-20	0.2
0920	206.86		0.308	6.30	0.475	5.60	16.1	21.75	-24	0.2
0925	206.86		0.309	6.42	0.473	5.26	16.6	21.78	-24	0.2
0930	206.86		0.307	6.43	0.472	4.94	16.7	21.79	-26	0.2
0935	206.86		0.307	6.43	0.473	4.66	16.2	21.79	-28	0.2
0940	206.86		0.308	6.44	0.474	4.27	15.4	21.82	-34	0.2
0945	206.86		0.308	6.47	0.474	4.10	15.9	21.83	-36	0.2
0950	206.86		0.309	6.44	0.474	3.83	16.4	21.84	-30	0.2

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Slightly cloudy

SEDIMENT: _____

OTHER: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 17 total

TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl, Br/F by 300.0, total silica by SM 4500-SID, HCO ₃ /alkalinity by SM2320B	Dissolved Silica by SM45000-SID	Total Ca/Mg/Mn /K/Na by 6010
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	2 x 250-ml np	1 x 250-ml np	1 x 500-ml HNO ₃

SAMPLE IDENTIFICATION NUMBER(S) **ERH127**

DATE: 11/16/16

TIME: 1150

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES:

SAMPLED BY: DF/TV

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **OWDFMW01** LOCATION: Outside Tunnel PROJECT NO. 60481245

DATE: 11/15/16 TIME: 1520 CLIMATIC CONDITIONS:

PID reading (ppm)	Depth to groundwater		Depth to bottom		Purge			
	Previous (ft btoc)	Current (ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
0.0	119.82	119.29	144.74		260	1550	4.5	
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		80	70	12	15	20	25	

LENGTH OF SATURATED ZONE: _____ LINEAR FT.

PUMP INTAKE: _____

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP.	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
					COND. (mS/cm)					
1620	120.35	1.2	2.35	8.96	3.67	3.78	0.00	26.58	4	1.9
1625	120.15	1.5	2.36	8.97	3.68	3.73	13.2	26.44	4	1.9
1630	120.25	2.0	2.48	8.82	3.83	3.78	4.77	26.62	6	2.0
1635	120.35	2.2	2.75	8.25	4.30	3.43	0.00	26.35	17	2.3
1640	120.35	2.5	2.76	8.17	4.31	3.41	0.00	26.33	24	2.3
1645	120.35	2.9	2.70	8.25	4.21	3.41	0.00	26.35	28	2.2
1650	120.45	3.2	2.74	8.21	4.28	3.31	0.00	26.16	29	2.3
1655	120.35	3.5	2.66	8.39	4.15	3.32	0.00	26.07	29	2.2
1700	120.45	3.8	2.72	8.32	4.25	3.21	0.00	26.00	27	2.3
1705	120.60	4.5	2.66	8.34	4.15	3.25	0.00	25.87	30	2.2

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: _____

SEDIMENT: _____

OTHER: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 27 total
 TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl, Br/F by 300.0, total silica by SM 4500-SID, HCO ₃ /alkalinity by SM2320B	Dissolved Silica by SM45000-SID	Total Ca/Mg/Mn /K/Na by 6010
2 x 4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	2 x 6 x 1-L Amber	1 x 250-ml w/HCl	2 x 250-ml np	1 x 250-ml np	1 x 500-ml HNO ₃

SAMPLE IDENTIFICATION NUMBER(S) **ERH118 and ERH119**

DATE: 11/15/16 TIME: 1715 and 1720

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES:

Complete sampling at 1820, DTW at 1830 = 119.99

SAMPLED BY: CB/RG

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW2254-01**

LOCATION: Inside Tunnel

PROJECT NO. 60481245

DATE: 12/12/16

TIME: 0940

CLIMATIC CONDITIONS:

N/A

Depth to groundwater		Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
80.52	80.49 @ 0930	None	115.79	--	200	0935	1.25	29.84 Hg
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		45	48	20	20	20	20	

PID Reading 0.0 ppm

Methane 0.0 %

Length of saturated zone: -- linear ft.

Pump intake: --

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	SP.		D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
				pH	COND. (mS/cm)					
0955		1.25	0.368	6.73	0.575	82.7*	0.0	22.12	216	0.3
1000		1.5	0.368	6.76	0.576	82.5*	0.0	22.12	215	0.3
1005		1.75	0.368	6.79	0.576	82.7*	0.0	22.14	215	0.3
1010		2	0.368	6.81	0.575	6.87	0.0	22.12	217	0.3
1015		2.25	0.368	6.83	0.575	6.80	0.0	22.19	216	0.3
1020		2.50	0.368	6.85	0.575	7.00	0.0	22.19	215	0.3

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

OTHER: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 14 Primary, 10 MS, 10 MSD, 10 duplicate

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO3/SO4/Cl by 300.0
4 x 4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	4 x 6 x 1-L Amber	1 x 250-ml w/HCl	1 x 250-ml np

SAMPLE IDENTIFICATION NUMBER(S) ERH135 (N, MS/MSD) and ERH137 (Duplicate)

DATE: 12/12/16 TIME: 1020

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Ended sampling at 1240

* Units are in percentage

SAMPLED BY: KE/TQ

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW01** LOCATION: Inside Tunnel PROJECT NO. 60481245
 DATE: 12/13/16 TIME: 0920 CLIMATIC CONDITIONS: N/A

Depth to groundwater		Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
82.87	82.88	None	100	--	65	1015	0.90	29.87 Hg
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		118	118	10	5	10	10	

PID Reading 0.330 (well head) 0.351 (ambient) ppm

Methane 0.0 %

Length of saturated zone: -- linear ft.

Pump intake: 90 Ft btoc

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP.	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
					COND. (mS/cm)					
1020	82.89	0.50	0.288	6.38	0.447	1.00	0.0	23.92	-9	0.2
1025	82.89	0.60	0.282	6.46	0.433	0.50	0.0	23.91	-19	0.2
1030	82.91	0.70	0.282	6.46	0.433	0.50	0.0	23.91	-19	0.2
1035	82.91	0.80	0.276	6.36	0.424	0.20	0.0	23.90	-19	0.2
1040	82.91	0.90	0.275	6.30	0.423	0.29	0.0	23.87	-17	0.2
1220	82.86									

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

OTHER:

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 14 total

TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO3/SO4/Cl by 300.0
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	1 x 250-ml np

SAMPLE IDENTIFICATION NUMBER(S) **ERH143**

DATE: 12/13/16 TIME: 1040

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Used one partially filled nitrogen canister and one full tank, 800 psi left.

SAMPLED BY: KE/TQ

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW02** LOCATION: Inside Tunnel PROJECT NO. 60481245
 DATE: 12/13/16 TIME: 1310 CLIMATIC CONDITIONS: N/A

Depth to groundwater		Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
85.35	85.51	None	92.91	--	240	1315	4.25	29.76 Hg
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		60	50	30	20	25	10	

PID Reading 0.0 (well head) 0.115 ppm
 (ambient)

Methane 0.0 %

Length of saturated zone: -- linear ft.

Pump intake: --

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	SP.		D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
				pH	COND. (mS/cm)					
1330	85.49	1.0	0.415	6.15	0.648	3.11	0.0	24.28	-20	0.3
1335	85.49	1.25	0.415	6.10	0.649	2.12	0.0	24.28	-25	0.3
1340	85.49	1.5	0.416	6.04	0.649	1.88	0.0	24.24	-23	0.3
1345	85.49	1.75	0.415	6.10	0.649	1.63	0.0	24.21	-27	0.3
1350	85.50	2.0	0.416	6.13	0.650	2.08	0.0	24.21	-30	0.3
1355	85.51	2.25	0.415	6.13	0.649	2.08	0.0	24.21	-30	0.3
1400	85.49	2.5	0.414	6.38	0.647	1.78	0.0	24.17	-40	0.3
1405	85.49	2.75	0.411	6.38	0.642	1.53	0.0	24.18	-48	0.3
1410	85.50	3.0	0.410	6.37	0.640	1.23	0.0	24.18	-52	0.3
1415	85.50	3.25	0.409	6.44	0.639	0.92	0.0	24.15	-48	0.3
1420	85.49	3.5	0.407	6.36	0.636	0.85	0.0	24.17	-48	0.3

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Slight yellow tinge

SEDIMENT: None

OTHER:

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 14 total

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO3/SO4/Cl by 300.0
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	1 x 250-ml np

SAMPLE IDENTIFICATION NUMBER(S) **ERH144**

DATE: 12/13/16 TIME: 1435

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Sample end time is 1518

SAMPLED BY: KE/TQ

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW03**

LOCATION: Inside Tunnel

PROJECT NO. 60481245

DATE: 12/14/16

TIME: 0920

CLIMATIC CONDITIONS:

N/A

Depth to groundwater		Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
101.87	101.81	None	110.12	N/A	225	0925	3.5	29.80 Hg
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		55	65	30	50	25	10	

PID Reading 0.096 (well head), 0.061 (ambient) ppm

Methane 0.0 %

Length of saturated zone: -- linear ft.

Pump intake: --

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
0945	102.04	1	0.624	6.56	0.974	2.28	0.0	26.61	168	0.5
0950	101.96	1.5	0.623	6.59	0.973	2.96	0.0	26.58	149	0.5
0955	102.7	1.75	0.622	6.65	0.975	1.77	0.0	26.55	125	0.5
1000	102.02	1.80	0.623	6.78	0.974	1.61	0.0	26.50	118	0.5
1005	102.04	2	0.622	6.72	0.972	1.17	0.0	26.76	123	0.5
1010	101.94	2.25	0.620	6.68	0.969	1.11	0.0	26.74	114	0.5
1015	101.94	2.5	0.622	6.78	0.972	1.27	0.0	26.78	113	0.5
1020	101.92	2.75	0.621	6.78	0.970	0.93	0.0	26.80	110	0.5
1025	101.92	3	0.619	6.67	0.968	0.82	0.0	26.79	110	0.5
1030	101.92	3.25	0.617	6.59	0.965	0.73	0.0	26.81	113	0.5
1035	101.92	3.5	0.617	6.53	0.965	0.70	0.0	26.83	114	0.5

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

OTHER:

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 14 total

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO3/SO4/Cl by 300.0
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	1 x 250-ml np

SAMPLE IDENTIFICATION NUMBER(S) **ERH152**

DATE: 12/14/16

TIME: 1035

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Adjusted flow rate at 0955 to 150 mL/min. End sample time at 1125.

SAMPLED BY: KE/TQ

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. RHMW04 LOCATION: Outside Tunnel PROJECT NO. 60481245
DATE: 12/13/16 TIME: 1405 CLIMATIC CONDITIONS:

Depth to groundwater		Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
293.22	292.61 @ 1325	None	305	--	200	1340	4	--
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		138	140	30	20	30	40	

PID Reading 0.0 ppm
Methane 0.0 %
Length of saturated zone: -- linear ft.
Pump intake: --

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP.	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
					COND. (mS/cm)					
1405	292.60	2.5	0.222	6.84	0.341	6.19	0.0	22.15	97	0.2
1410	292.60		0.222	6.90	0.341	6.15	0.0	22.09	102	0.2
1415	292.60		0.222	6.94	0.341	6.12	0.0	22.06	103	0.2
1420	292.60	4	0.221	6.96	0.341	6.11	0.0	22.08	101	0.2
1510	292.60									

SAMPLING EQUIPMENT: Dedicated Bladder Pump
APPEARANCE OF SAMPLE: COLOR: --
SEDIMENT: --
OTHER: --

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 14 total

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO3/SO4/Cl by 300.0
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	1 x 250-ml np

SAMPLE IDENTIFICATION NUMBER(S) ERH138
DATE: 12/13/16 TIME: 1430
DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash
NOTES: Started sampling at 1430, ended at 1510
SAMPLED BY: AM/TV
SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW05** LOCATION: Inside Tunnel PROJECT NO. 60481245
 DATE: 12/12/16 TIME: 1405 CLIMATIC CONDITIONS: n/a

Depth to groundwater		Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
82.25	82.12	None	124.7	--	250	1410	2.5	29.73 Hg
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		40	40	20	20	20	10	

PID Reading: 0.032 (well head), 0.355 (ambient) ppm

Methane: 0.0 %

Length of saturated zone: -- linear ft.

Pump intake: --

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	SP.		D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
				pH	COND. (mS/cm)					
1417	82.12	1.25	0.632	7.42	0.989	7.79	0.0	23.97	189	0.5
1425	82.13	1.5	0.633	7.39	0.989	6.91	0.0	23.90	194	0.5
1430	82.13	1.75	0.633	7.36	0.989	6.99	0.0	23.89	195	0.5
1435	82.12	2	0.633	7.36	0.989	6.86	0.0	23.87	197	0.5
1440	82.12	2.25	0.633	7.36	0.989	6.81	0.0	23.87	198	0.5
1445	82.12	2.5	0.633	7.35	0.989	6.85	0.0	23.90	198	0.5
1520	82.12									

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

OTHER:

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 14 total

TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO3/SO4/Cl by 300.0
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	1 x 250-ml np

SAMPLE IDENTIFICATION NUMBER(S) **ERH136**

DATE: 12/12/16 TIME: 1445

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: End sample time 1520

SAMPLED BY: KE/TQ

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. RHMW06 LOCATION: Outside Tunnel PROJECT NO. 60481245
 DATE: 12/12/16 TIME: 1300 CLIMATIC CONDITIONS: _____

Depth to groundwater		Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
240.31	240.04 @ 1218	None	280	--	200	1225	3	--
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		115	115	30	22	20	38	

PID Reading 0.0 ppm

Methane 0.1 %

Length of saturated zone: -- linear ft.

Pump intake: --

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP.	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
					COND. (mS/cm)					
1300	239.94	1.2	1.03	7.10	1.61	4.47	14.7	25.70	160	0.8
1305	239.95		1.02	6.80	1.60	5.51	9.47	24.33	153	0.8
1310	239.95		1.02	6.98	1.60	4.41	9.41	24.48	149	0.8
1315	239.94	2	1.02	6.93	1.60	4.08	13.6	23.98	157	0.8
1320	239.95		1.03	6.92	1.60	4.07	8.51	24.02	147	0.8
1409	239.94	3								

SAMPLING EQUIPMENT: Dedicated Bladder Pump
 APPEARANCE OF SAMPLE: COLOR: Clear
 SEDIMENT: N/A
 OTHER: No odor

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 14 total

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO3/SO4/Cl by 300.0
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	1 x 250-ml np

SAMPLE IDENTIFICATION NUMBER(S) ERH139
 DATE: 12/12/16 TIME: 1330
 DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash
 NOTES: Started sampling at 1330, finished at 1409
 SAMPLED BY: AM/TV
 SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW07**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 12/13/16

TIME:

CLIMATIC CONDITIONS:

Depth to groundwater		Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
197.56	197.13 @ 1552	None	240	--	200	1600	3	
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		95	100	30	25	30	35	

PID Reading 0.0 ppm

Methane 0.0 %

Length of saturated zone: -- linear ft.

Pump intake: --

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	SP.		D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
				pH	COND. (mS/cm)					
1630	197.48		1.14	6.95	1.78	3.68	0.0	23.48	89	0.9
1635	197.47		1.13	6.90	1.77	3.29	0.0	23.54	93	0.9
1640	197.47	2	1.13	6.89	1.76	3.09	0.0	23.67	87	0.9
1645	197.44		1.13	6.89	1.76	2.95	0.0	23.69	82	0.9
1650	197.46		1.12	6.89	1.75	2.87	0.0	23.69	89	0.9
1655	197.43	3	1.12	6.89	1.75	2.77	0.0	23.20	88	0.9

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: --

SEDIMENT: --

OTHER: --

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 17 total

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO3/SO4/Cl by 300.0
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	1 x 250-ml np

SAMPLE IDENTIFICATION NUMBER(S) ERH140

DATE: 12/13/16 TIME: 1700

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Flow rate dropped to 160 mL/min at 1635
Started sampling at 1700, ended at 1805

SAMPLED BY: AM/TV

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW08**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 12/12/16

TIME:

CLIMATIC CONDITIONS:

Depth to groundwater		Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
291.81	291.42 @ 0910	None	318.21	318.4 @ 0913	240	0945	3.5	300 cf
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		150	150	25	23	25	37	

PID Reading 1.3 ppm

Methane 0.2 %

Length of saturated zone: -- linear ft.

Pump intake: --

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	SP.		D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
				pH	COND. (mS/cm)					
1005	291.47	1.0	0.463	6.30	0.734	4.67	3.88	23.60	206	0.4
1010	291.47	1.25	0.464	6.36	0.725	5.20	3.95	23.60	206	0.4
1015	291.41	1.5	0.461	7.81	0.722	3.76	3.95	23.74	152	0.4
1020	291.47	1.8	0.484	7.80	0.719	4.47	2.94	23.99	147	0.3
1025	291.46	2.0	0.456	7.90	0.719	4.48	3.66	24.10	145	0.3
1030	291.46	2.1	0.461	8.05	0.718	4.42	3.22	24.23	142	0.3
1035	291.41		0.463	8.24	0.724	3.85	2.27	24.49	140	0.4
1040	291.39	2.25	0.470	8.23	0.734	3.70	3.30	24.58	139	0.4
1045	291.37	2.3	0.464	8.21	0.724	3.91	3.42	24.59	135	0.4
1138	291.39									

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: N/A

OTHER: No odor

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 18 total

TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	EDB by 8011	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO3/SO4/Cl by 300.0
5 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	3 x 40-ml VOA np	6 x 1-L Amber	1 x 250-ml w/HCl	1 x 250-ml np

SAMPLE IDENTIFICATION NUMBER(S) **ERH141**

DATE: 12/12/16

TIME: 1050

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Sample start 1050, end at 1138

SAMPLED BY: AM/TV

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW09**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 12/12/16

TIME:

CLIMATIC CONDITIONS:

Depth to groundwater		Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
377.05	376.28 @ 1538	None	405	--	200	1545	3.5	
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		185	185	35	35	35	45	

PID Reading 0.0 ppm

Methane 0.0 %

Length of saturated zone: -- linear ft.

Pump intake: --

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
1620	376.27	1	0.174	6.87	0.266	6.05	0.95	25.02	181	0.1
1625	376.27		0.154	7.65	0.261	7.12	0.26	25.59	162	0.1
1630	376.26		0.172	7.61	0.265	7.65	0.34	23.75	171	0.1
1635	376.27		0.162	7.72	0.265	7.75	0.31	23.70	171	0.1
1640	376.27	2	0.173	7.68	0.266	7.60	0.51	23.65	164	0.1
1645	376.26	2.25	0.173	7.73	0.266	7.34	0.48	23.78	163	0.1
1745	376.26	3.5								

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: --

SEDIMENT: --

OTHER: --

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 18 total

TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	EDB by 8011	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO3/SO4/Cl by 300.0
5 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCL	3 x 40-ml VOA np	6 x 1-L Amber	1 x 250-ml w/HCl	1 x 250-ml np

SAMPLE IDENTIFICATION NUMBER(S) **ERH146**

DATE: 12/12/16 TIME: 1655

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Ants in discharge line
Started filling at 1655, ended at 1745

SAMPLED BY: AM/TV

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **HDMW2253-03**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 12/13/16

TIME: 0955

CLIMATIC CONDITIONS:

Depth to groundwater		Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
206.83	206.33 @ 0835	None	1575	--	200	0915	5.5	--
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		140	140	20	15	20	30	

PID Reading 0.0 ppm

Methane 0.1 %

Length of saturated zone: -- linear ft.

Pump intake: --

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	SP.		D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
				pH	COND. (mS/cm)					
0955	206.34	2	0.225	5.98	0.392	2.15	57.6	22.04	12	0.2
1000	206.34		0.251	6.11	0.385	1.70	56.6	22.13	-2	0.2
1005	206.34		0.249	6.19	0.383	1.36	54.6	22.16	-8	0.2
1010	206.34		0.248	6.24	0.381	1.18	55.4	22.17	-14	0.2
1015	206.34		0.246	6.19	0.380	1.05	54.2	22.14	-15	0.2
1020	206.34		0.247	6.23	0.379	0.97	55.1	22.17	-19	0.2
1025	206.34	4	0.245	6.25	0.378	0.90	54.4	22.18	-19	0.2
1030	206.34		0.245	6.26	0.378	0.84	53.0	22.20	-19	0.2
1035	206.34		0.245	6.24	0.378	0.79	52.7	22.21	-19	0.2
1040	206.34		0.245	6.23	0.378	0.77	51.9	22.22	-23	0.2
1045	206.34		0.245	6.26	0.377	0.73	49.5	22.23	-21	0.2

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: _____

SEDIMENT: _____

OTHER: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND 14 total

TYPES OF SAMPLE CONTAINERS USED:

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO3/SO4/Cl by 300.0
4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	6 x 1-L Amber	1 x 250-ml w/HCl	1 x 250-ml np

SAMPLE IDENTIFICATION NUMBER(S) **ERH145**

DATE: 12/13/16 TIME: 1050

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Final depth to water at 1135 = 206.32 ft btoc, Started sampling at 1050, ended at 1135

SAMPLED BY: AM/TV

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **OWDFMW01** LOCATION: Outside Tunnel PROJECT NO. 60481245
 DATE: 12/14/16 TIME: 0900 CLIMATIC CONDITIONS: _____

Depth to groundwater		Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
119.29	119.09 @ 0715	None	144.74	--	150	0830	2.75	--
Pump settings:		Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual		70	70	15	15	25	15	

PID Reading: 0.0 ppm
 Methane: 0.0 %
 Length of saturated zone: -- linear ft.
 Pump intake: --

Stabilization: +/- 0.2 C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/- 10 mv ORP, turb=as low as possible (< 10 NTU ideal) All for 3 consecutive readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
0900	119.89		1.99	11.39	3.11	4.47	0.0	23.58	-89	1.6
0905	119.89		2.01	11.42	3.15	3.87	0.0	23.83	-97	1.6
0910	119.95	1.5	2.02	11.35	3.15	3.71	0.0	24.01	-97	1.6
0915	119.94		2.02	11.43	3.16	3.71	0.0	24.07	-95	1.6
0920	119.96	2	2.02	11.38	3.16	3.43	0.0	24.10	-95	1.6
1105	121.74									

SAMPLING EQUIPMENT: Bladder Pump
 APPEARANCE OF SAMPLE: COLOR: --
 SEDIMENT: --
 OTHER: --

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 14 primary
10 duplicate

VOCs/TPH by 8260	Methane by RSK175M	TPH/PAH SVOC by 8270	Iron (filtered) by SM3500Fe	NO3/SO4/Cl by 300.0
2 x 4 x 40-ml VOA w/HCl	2 x 40-ml VOA w/HCl	2 x 6 x 1-L Amber	1 x 250-ml w/HCl	1 x 250-ml np

SAMPLE IDENTIFICATION NUMBER(S) ERH147 and ERH148 (Duplicate)

DATE: 12/14/16 TIME: 0930

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Motor running nearby
Started sample at 0930, ended at 1105

SAMPLED BY: AM/TV

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW2254-01** LOCATION: Inside Tunnel PROJECT NO. 60481245
 DATE: 1/9/17 TIME: 0935 CLIMATIC CONDITIONS: N/A

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
80.49	80.39		None	115.79	--	290	0950		2000 psi (1 tank)
Pump settings:			Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual			48	50	20	5	20	15	

Headspace PID: 0.1 ppm Ambient PID: 0.5 ppm
 Pump intake: -- linear ft. btoc Barometric Pressure: 29.99 in. Hg
 Saturated Zone Length: -- linear ft. Methane: 0.0 %

Stabilization: +/- 0.2 °C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
0955		0.75	0.296	7.35	0.455	8.46	-4.5	22.07	156.6	0.22
1000		1	0.296	7.43	0.456	8.54	-4.5	21.98	159.7	0.22
1005		1.25	0.296	7.47	0.456	8.57	-4.5	21.91	162.9	0.22
1010		2	0.296	7.50	0.456	8.57	-4.5	21.89	165.2	0.22
1015		2.5	0.296	7.52	0.456	8.58	-4.5	21.86	167.2	0.22
1020		2.75	0.296	7.53	0.455	8.58	-4.5	21.85	169.1	0.22
1025		3	0.296	7.54	0.454	8.59	-4.4	21.84	170.9	0.22
1030	Reduced flow to 100 mL/min to collect VOAs									
1230	Increased flow to 290 mL/min to collect ambers									
1545	Collected ERH197 ambient field blank									

SAMPLING EQUIPMENT: Dedicated Bladder Pump
 APPEARANCE OF SAMPLE: COLOR: Clear
 SEDIMENT: None
 OTHER: No odor

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 15 primary + 15 SS primary + 10 dup + 10 SS dup + 20 MS/MSD + 20 SS MS/MSD = 90

VOCs/TPH by 8260, Methane by RSK175M	TPH/PAH SVOC by 8270	Total Ca/Mg/Mn /K/Na by 6010	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl by 300.0
(6 + 6) + (4 + 4) + (8 + 8) x 40-ml VOA w/HCl	(6 + 6) + (6 + 6) + (12 + 12) x 1-L Amber	1 + 1 x 500-ml HNO ₃	1 + 1 x 250-ml w/HCl	1 + 1 x 250-ml np
36 total	48 total	2 total	2 total	2 total

SAMPLE IDENTIFICATION NUMBER(S) **ERH161 (N, MS/MSD) and ERH162 (Duplicate)**
 DATE: 1/9/17 TIME: 1030

DECONTAMINATION PROCEDURES:
 NOTES: Samples split by putting each sample bottle into alternating coolers
 Sample end time: 1530

SAMPLED BY: KE/TQ
 SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW01**

LOCATION: Inside Tunnel

PROJECT NO. 60481245

DATE: 1/11/17

TIME: 1032

CLIMATIC CONDITIONS:

N/A

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
82.88	82.70	82.69	None	99.8	--	120	1100	2.5	3100 psi
Pump settings:			Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual			118	60	5	5	10	5	

Headspace PID: 0.4 ppm Ambient PID: 0.4 ppm

Pump intake: 88 linear ft. btoc Barometric Pressure: 29.98 in. Hg

Saturated Zone Length: -- linear ft. Methane (well/ambient): 0.0/0.0 %

Stabilization: +/- 0.2 °C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
1115	82.70	0.25	0.214	7.20	0.329	3.77	-1.3	24.28	-6.2	0.16
1120	82.70	0.50	0.213	7.07	0.328	2.53	-1.3	23.97	-23.2	0.16
1125	82.70	0.75	0.213	7.02	0.327	2.43	-1.3	23.83	-29.1	0.16
1130	82.70	<1.00	0.212	7.00	0.327	2.06	-1.3	23.74	-33.0	0.16
1135	82.70	<1.00	0.212	6.99	0.326	1.74	-1.4	23.66	-35.1	0.15
1140	82.70	<1.00	0.212	6.99	0.326	1.74	-1.4	23.64	-35.7	0.15
1145	82.70	1.00	0.212	6.98	0.326	1.66	-1.3	23.62	-35.4	0.15
1150	82.70	1.10	0.211	6.98	0.325	1.54	-1.3	23.60	-33.7	0.15
1155	82.70	1.20	0.211	6.98	0.325	1.50	-1.3	23.59	-32.2	0.15
1200	82.70	1.30	0.211	6.97	0.325	1.51	-1.3	23.58	-31.3	0.15
1205	Reduced flow from 120 to 100 mL/min									
1240	Increased flow from 120 to 100 mL/min									
1500	82.69	Sampling complete								

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

OTHER: N/A

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 15 primary + 15 SS primary = 30 total

VOCs/TPH by 8260, Methane by RSK175M	TPH/PAH SVOC by 8270	Total Ca/Mg/Mn /K/Na by 6010	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl by 300.0
6 + 6 x 40-ml VOA w/HCl	6 + 6 x 1-L Amber	1 + 1 x 500-ml HNO ₃	1 + 1 x 250-ml w/HCl	1 + 1 x 250-ml np
12 total	12 total	2 total	2 total	2 total

SAMPLE IDENTIFICATION NUMBER(S) ERH172

DATE: 1/11/17

TIME: 1205

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Sample end time: 1500; Dust = 0.112 mg/m³; TWA = 0.87

SAMPLED BY: AM/TQ

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW02**

LOCATION: Inside Tunnel

PROJECT NO. 60481245

DATE: 1/10/17

TIME: 1305

CLIMATIC CONDITIONS:

N/A

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
85.51	85.29	85.26	None	99	--	250	1315	3.0	800 psi
Pump settings:			Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual			50	50	20	20	10	10	

Headspace PID: 0.7 ppm Ambient PID: 2.9 ppm

Pump intake: 96 linear ft. btoc Barometric Pressure: 29.91 in. Hg

Saturated Zone Length: -- linear ft. Methane: 0.0 %

Stabilization: +/- 0.2 °C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
1330	85.28	0.5	0.326	6.51	0.502	1.35	-4.1	24.33	-72.5	0.24
1335		0.75	0.327	6.50	0.504	1.24	-4.2	24.26	-75.3	0.24
1340		1.0	0.331	6.51	0.509	1.16	-4.2	24.22	-74.3	0.24
1345		1.25	0.333	6.51	0.512	1.11	-4.2	24.20	-72.3	0.25
1350	85.28	1.75	0.335	6.52	0.515	1.09	-4.2	24.21	-66.8	0.25
1355	85.28	2.25	0.336	6.52	0.517	1.07	-4.3	24.18	-63.5	0.25
1400	85.28	2.50	0.337	6.52	0.518	1.06	-4.3	24.17	-63.3	0.25
1405	85.29	2.75	0.338	6.52	0.520	1.05	-4.3	24.16	-60.6	0.25
1410	85.29	3.0	0.339	6.53	0.520	1.05	-4.3	24.14	-60.4	0.25
1415	Adjusted flow to 100 mL/min for VOC collection									
1440	Adjusted flow from 100 to 250 mL/min									

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: --

OTHER: No odor

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 15 primary + 15 SS primary = 30 total

VOCs/TPH by 8260, Methane by RSK175M	TPH/PAH SVOC by 8270	Total Ca/Mg/Mn /K/Na by 6010	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl by 300.0
6 + 6 x 40-ml VOA w/HCl	6 + 6 x 1-L Amber	1 + 1 x 500-ml HNO ₃	1 + 1 x 250-ml w/HCl	1 + 1 x 250-ml np
12 total	12 total	2 total	2 total	2 total

SAMPLE IDENTIFICATION NUMBER(S) ERH174

DATE: 1/10/17

TIME: 1415

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Initial slug of water was dark brown in color

Sample end time: 1540

SAMPLED BY: KE/TQ

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW03**

LOCATION: Inside Tunnel

PROJECT NO. 60481245

DATE: 1/12/17

TIME: 0910

CLIMATIC CONDITIONS:

N/A

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
101.81	101.59 @ 0919	101.73	None	117.30	--	150	0920	1.3	
Pump settings:			Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual			65		50		10		

Headspace PID: 0.0 ppm Ambient PID: 0 ppm

Pump intake: 112 linear ft. btoc Barometric Pressure: 29.93 in. Hg

Saturated Zone Length: -- linear ft. Methane: 0.0 %

Stabilization: +/- 0.2 °C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
0940	101.89	0.5	0.521	6.78	0.801	3.31	2.2	27.31	196.4	0.39
0945	101.77		0.522	6.77	0.803	2.74	2.1	27.43	198.2	0.39
0950	101.69		0.522	6.76	0.803	2.48	1.4	27.41	198.7	0.39
0955	101.68	1.0	0.522	6.76	0.803	2.38	0.1	27.34	197.8	0.39
1000	101.70		0.522	6.76	0.803	2.35	-0.3	27.26	196.7	0.39
1005	101.68	1.3	0.521	6.77	0.802	2.35	-0.5	27.27	195.5	0.39
1247	101.73									

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: _____

SEDIMENT: _____

OTHER: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 15 primary + 15 SS primary = 30 total

VOCs/TPH by 8260, Methane by RSK175M	TPH/PAH SVOC by 8270	Total Ca/Mg/Mn /K/Na by 6010	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl by 300.0
6 + 6 x 40-ml VOA w/HCl	6 + 6 x 1-L Amber	1 + 1 x 500-ml HNO ₃	1 + 1 x 250-ml w/HCl	1 + 1 x 250-ml np
12 total	12 total	2 total	2 total	2 total

SAMPLE IDENTIFICATION NUMBER(S) **ERH181**

DATE: 1/12/17 TIME: 1015

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Pump cycle output raised from 70-140 mL/min, dropped flow to 90 mL/min at 0940

Sample end time: 1247

SAMPLED BY: AM/TQ

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW04**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 1/9/17

TIME: 0900

CLIMATIC CONDITIONS:

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
292.61	292.48 @ 0851	292.44	None	305	--		0900	3.25	
Pump settings:			Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual			140	140	20	25	40	35	

Headspace PID: 0.0 ppm Ambient PID: 0.0 ppm

Pump intake: 304 linear ft. btoc Barometric Pressure: 29.74 in. Hg

Saturated Zone Length: -- linear ft. Methane: 0 %

Stabilization: +/- 0.2 °C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
0900	--	--	--	--	--	--	--	--	--	--
0903	Water at surface		--	--	--	--	--	--	--	--
0910	292.47		0.302	6.61	0.465	0.0	-0.1	21.20	221.1	0.22
0930	292.49		0.302	6.99	0.464	8.60	-0.4	21.72	204.8	0.22
0935	292.49		0.303	7.06	0.468	8.67	0.1	21.83	205.3	0.23
0940	292.49		0.304	7.13	0.468	8.68	-0.1	21.88	204.5	0.23
0945	292.49	1.5	0.304	7.16	0.468	8.72	-0.1	21.96	205.1	0.23
0950	292.49	1.7	0.304	7.18	0.468	8.73	-0.4	21.94	205.3	0.23
0955	292.48	1.9	0.304	7.21	0.468	8.73	-0.2	21.91	205.7	0.23
1142	292.44	3.75	End sample							

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: --

OTHER: No odor, no sheen

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 15 primary + 15 SS primary = 30 total

VOCs/TPH by 8260, Methane by RSK175M	TPH/PAH SVOC by 8270	Total Ca/Mg/Mn /K/Na by 6010	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl by 300.0
6 + 6 x 40-ml VOA w/HCl	6 + 6 x 1-L Amber	1 + 1 x 500-ml HNO ₃	1 + 1 x 250-ml w/HCl	1 + 1 x 250-ml np
12 total	12 total	2 total	2 total	2 total

SAMPLE IDENTIFICATION NUMBER(S) **ERH166**

DATE: 1/9/17 TIME: 1000

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: Adjusted flow rate from .75 to 200 mL/min at 0940

Sample end time: 1142

SAMPLED BY: CB/AM

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW05**

LOCATION: Inside Tunnel

PROJECT NO. 60481245

DATE: 1/10/17

TIME: 0935

CLIMATIC CONDITIONS:

N/A

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
82.12	82.10	--	None	93	--	240	0945	2.25	600 psi
Pump settings:			Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual			40	45	20		20	10	10

Headspace PID: 0.6 ppm Ambient PID: 3.7 ppm

Pump intake: 90 linear ft. btoc Barometric Pressure: 29.99 in. Hg

Saturated Zone Length: -- linear ft. Methane: 0.0 %

Stabilization: +/- 0.2 °C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
1000	82.10	0.25	0.541	7.73	0.831	8.31	-4.2	24.07	177.2	0.41
1005	82.10	0.5	0.540	7.83	0.830	8.35	-4.2	24.05	178.5	0.41
1010	82.08	0.75	0.539	7.87	0.829	8.35	-4.3	24.04	178.8	0.41
1015	82.09	1.25	0.538	7.91	0.828	8.34	-4.1	24.04	179.2	0.41
1020	82.09	1.75	0.538	7.93	0.828	8.35	-4.1	24.03	179.7	0.41
1025	82.09	2.25	0.538	7.94	0.828	8.34	-4.1	24.03	179.9	0.41
1030	Flow rate adjusted for collection of VOAs									
1155	82.09	End sample								

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: None

OTHER: None

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 15 primary + 15 SS primary = 30 total

VOCs/TPH by 8260, Methane by RSK175M	TPH/PAH SVOC by 8270	Total Ca/Mg/Mn /K/Na by 6010	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl by 300.0
6 + 6 x 40-ml VOA w/HCl	6 + 6 x 1-L Amber	1 + 1 x 500-ml HNO ₃	1 + 1 x 250-ml w/HCl	1 + 1 x 250-ml np
12 total	12 total	2 total	2 total	2 total

SAMPLE IDENTIFICATION NUMBER(S) ERH164

DATE: 1/10/17 TIME: 1030

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES:

Sample end time: 1155

SAMPLED BY: KE/TQ

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW06** LOCATION: Outside Tunnel PROJECT NO. 60481245
 DATE: 1/9/17 TIME: 1240 CLIMATIC CONDITIONS: Sunny, low 80's

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
240.04	239.76	239.7	None	263.20	--		1256	3.0	
Pump settings:			Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual			115		22		38		

Headspace PID: 0 ppm Ambient PID: 0.0 ppm
 Pump intake: 254 linear ft. btoc Barometric Pressure: in. Hg
 Saturated Zone Length: -- linear ft. Methane: 0 %

Stabilization: +/- 0.2 °C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
1250	249.76									
1256	Begin purge									
1300	Water at surface									
1320	239.72	1	1.122	7.03	1.727	5.90	58.6	24.22	189.5	0.87
1325	239.75		1.119	6.94	1.722	5.77	73.3	24.27	186.3	0.87
1330	239.72		1.117	6.88	1.717	5.23	43.4	24.28	186.3	0.87
1335	239.72	1.7	1.114	6.86	1.715	5.71	22.4	24.29	187.9	0.86
1340	239.72	2	1.115	6.84	1.712	5.73	9.8	24.28	191.3	0.86
1345	239.72		1.114	6.82	1.713	5.72	4.5	24.29	196.1	0.86
1350	239.72	2.5	1.112	6.82	1.707	5.67	3.2	24.28	200.4	0.86
1355	239.72	2.6	1.111	6.81	1.712	5.75	2.5	24.23	203.3	0.86
1400	239.74	3.0	1.108	6.80	1.704	5.72	1.8	24.34	206.8	0.86

SAMPLING EQUIPMENT: Dedicated Bladder Pump
 APPEARANCE OF SAMPLE: COLOR: Clear
 SEDIMENT: --
 OTHER: No odor, no sheen

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 15 primary + 15 SS primary = 30 total

VOCs/TPH by 8260, Methane by RSK175M	TPH/PAH SVOC by 8270	Total Ca/Mg/Mn /K/Na by 6010	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl by 300.0
6 + 6 x 40-ml VOA w/HCl	6 + 6 x 1-L Amber	1 + 1 x 500-ml HNO ₃	1 + 1 x 250-ml w/HCl	1 + 1 x 250-ml np
12 total	12 total	2 total	2 total	2 total

SAMPLE IDENTIFICATION NUMBER(S) **ERH168**
 DATE: 1/9/17 TIME: 1410

DECONTAMINATION PROCEDURES:
 NOTES:

Sample end time:1602

SAMPLED BY: CB/AM
 SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW07**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 1/10/17

TIME:

CLIMATIC CONDITIONS:

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
197.13	197.02 @ 1627	192.23	None	217.76	--	300	1635	4	
Pump settings:			Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual			100		25		35		

Headspace PID: 0.1 ppm Ambient PID: 0 ppm

Pump intake: 210 linear ft. btoc Barometric Pressure: 29.75 in. Hg

Saturated Zone Length: -- linear ft. Methane (well/ambient): 0.0/0.0 %

Stabilization: +/- 0.2 °C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
1635	Start purge									
1637	Water at surface									
1645	197.33	1.0	1.235	6.92	1.902	4.19	1.9	24.00	162.0	0.97
1650	197.37		1.263	6.93	1.948	3.46	4.8	23.03	163.3	0.99
1655	197.42	1.7	1.248	6.96	1.920	2.97	4.8	23.72	165.4	0.99
1700	197.48	2.0	1.258	6.97	1.932	2.93	6.1	23.41	167.1	0.97
1705	197.57	2.5	1.248	6.99	1.902	2.96	-0.3	23.32	169.6	0.97
1710	197.53	3	1.232	7.00	1.894	2.88	-0.8	23.33	172.1	0.96
1715	197.51		1.244	7.01	1.917	2.85	-0.6	23.39	172.4	0.97
1720	197.50	3.5	1.226	7.02	1.878	2.84	-1.2	23.39	174.0	0.95
1725	197.51	3.75	1.212	7.04	1.864	2.73	-1.7	23.39	174.6	0.95
1730	197.52	4.0	1.201	7.05	1.848	2.59	-1.6	23.38	175.0	0.95

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: --

OTHER: No odor, no sheen

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 15 primary + 15 SS primary = 30 total

VOCs/TPH by 8260, Methane by RSK175M	TPH/PAH SVOC by 8270	Total Ca/Mg/Mn /K/Na by 6010	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl by 300.0
6 + 6 x 40-ml VOA w/HCl	6 + 6 x 1-L Amber	1 + 1 x 500-ml HNO ₃	1 + 1 x 250-ml w/HCl	1 + 1 x 250-ml np
12 total	12 total	2 total	2 total	2 total

SAMPLE IDENTIFICATION NUMBER(S) ERH179

DATE: 1/10/17

TIME: 1735

DECONTAMINATION PROCEDURES: _____

NOTES: Sun going down

Sample end time: 1903

SAMPLED BY: CB/AM

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW08**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 1/11/17

TIME: 0835

CLIMATIC CONDITIONS:

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
291.42	291.26 @ 0842		None	311.30	--	250	0848	5.5	1 tank
Pump settings:			Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual			150	150	23	25	37	35	

Headspace PID: 0.1 ppm Ambient PID: 0.0 ppm

Pump intake: 303 linear ft. btoc Barometric Pressure: 29.75 in. Hg

Saturated Zone Length: -- linear ft. Methane: 0.0 %

Stabilization: +/- 0.2 °C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
0852	Water at surface									
0910	291.32	1.5	0.656	7.70	1.009	5.04	-22.3	23.79	174.4	0.50
0915	291.33		0.656	7.76	1.009	5.06	-22.0	23.79	174.2	0.50
0920	291.33	2.0	0.656	7.87	1.009	5.03	-21.8	23.82	171.5	0.50
0925	291.36	2.5	0.656	8.00	1.011	4.98	-22.5	23.82	169.6	0.50
0930	291.36		0.656	8.04	1.007	4.94	-22.8	23.85	169.2	0.50
0935	291.35	2.8	0.654	8.09	1.008	4.86	-22.8	23.83	168.7	0.50
0940	291.35	3.0	0.653	8.14	1.004	4.81	-23.1	23.86	168.2	0.50
0945	291.34	3.4	0.651	8.17	1.002	4.75	-23.0	23.92	167.6	0.49
0950	291.34	3.9	0.651	8.20	1.001	4.70	-22.8	24.01	167.6	0.49
0955	291.34	4.3	0.649	8.22	0.979	4.64	-23.1	24.06	167.6	0.49

SAMPLING EQUIPMENT: Dedicated Bladder Pump

APPEARANCE OF SAMPLE: COLOR: Clear

SEDIMENT: --

OTHER: No odor, no sheen

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 18 primary + 18 SS primary + 13 dup + 13 SS dup + 14 MS/MSD + 14 SS MS/MSD = 90

VOCs/TPH/DCA by 8260, Methane by RSK175M	EDB by 8011	TPH/PAH SVOC by 8270	Total Ca/Mg/Mn /K/Na by 6010	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl by 300.0
(6 + 6) + (4 + 4) + (8 + 8) x 40-ml VOA w/HCl	(3 + 3) + (3 + 3) + (6 + 6) x 40 ml VOA np	(6 + 6) + (6 + 6) x 40-ml VOA w/HCl	1 + 1 x 500-ml HNO ₃	1 + 1 x 250-ml w/HCl	1 + 1 x 250-ml np
36 total	24 total	24 total	2 total	2 total	2 total

SAMPLE IDENTIFICATION NUMBER(S) **ERH169 (N, MS/MSD) and ERH170 (Duplicate)**

DATE: 1/11/17

TIME: 1000

DECONTAMINATION PROCEDURES:

NOTES: Sample end time: 1317

SAMPLED BY: CB/GM/MH

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **RHMW09** LOCATION: Outside Tunnel PROJECT NO. 60481245
 DATE: 1/11/17 TIME: 1445 CLIMATIC CONDITIONS: Sunny, High 70's

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
376.28	376.08 @ 1452	376.08 @ 1820	None	396.69	--	290	1500	3.30	
Pump settings:			Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual			185	180	35	35	45	40	

Headspace PID: 0.1 ppm Ambient PID: 0.1 ppm
 Pump intake: 389 linear ft. btoc Barometric Pressure: 29.59 in. Hg
 Saturated Zone Length: -- linear ft. Methane: 0.0 %

Stabilization: +/- 0.2 °C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
1500	Start pumping									
1503	Water at surface									
1515	376.11	0.75	0.234	7.84	0.361	8.22	-23.9	24.48	177.6	0.17
1520	376.11	1	0.236	7.78	0.359	8.66	-23.6	24.32	187.2	0.17
1523	Recalibrated DO to 751.15 mmHg pressure and 99.2% O ₂ ambient									
1528	376.11	1.25	0.234	7.80	0.358	8.65	-23.4	24.91	197.4	0.17
1533	376.11	1.75	0.234	7.74	0.359	8.75	-23.9	24.47	206.6	0.17
1538	376.11	2.00	0.233	7.73	0.358	8.79	-23.9	24.45	213.1	0.17
1543	376.11	2.3	0.232	7.72	0.357	8.77	-23.5	24.31	221.7	0.17
1550	376.11	2.7	0.233	7.71	0.361	8.89	-23.8	24.36	233.3	0.17
1555	376.11	3.0	0.232	7.71	0.358	8.76	-23.9	24.22	236.6	0.17
1600	376.11	3.30	0.234	7.72	0.360	8.73	-24.0	24.24	243.1	0.17

SAMPLING EQUIPMENT: Dedicated Bladder Pump
 APPEARANCE OF SAMPLE: COLOR: _____
 SEDIMENT: _____
 OTHER: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 18 primary + 18 SS primary = 36 total

VOCs/TPH/DCA by 8260, Methane by RSK175M	EDB by 8011	TPH/PAH SVOC by 8270	Total Ca/Mg/Mn /K/Na by 6010	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl by 300.0
6 + 6 x 40-ml VOA w/HCl	3 + 3 x 40 ml VOA np	6 + 6 x 40-ml VOA w/HCl	1 + 1 x 500-ml HNO ₃	1 + 1 x 250-ml w/HCl	1 + 1 x 250-ml np
12 total	6 total	12 total	2 total	2 total	2 total

SAMPLE IDENTIFICATION NUMBER(S) **ERH178**
 DATE: 1/11/17 TIME: 1605
 DECONTAMINATION PROCEDURES: _____
 NOTES: Sample end time: 1815
 SAMPLED BY: CB/GM/MH
 SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **HDMW2253-03** LOCATION: Outside Tunnel PROJECT NO. 60481245
 DATE: 1/10/17 TIME: 0820 CLIMATIC CONDITIONS: Sunny, High 70's

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
206.33	206.12	206.00	None	1575	--	200	0927	5	1000 psi
Pump settings:			Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual			140	140	15	15	30	30	

Headspace PID: 0.0 ppm Ambient PID (start/end): 0.0/0.2 ppm

Pump intake: 250 linear ft. btoc Barometric Pressure: 29.87 in. Hg

Saturated Zone Length: -- linear ft. Methane: 0.0 %

Stabilization: +/- 0.2 °C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
0927	Start purging									
0930	Water to surface									
0935	Purging bubbles – checked O-rings, replaced bladder									
1015	Restart purging									
1025	206.12		0.330	6.34	0.508	5.50	33.8	23.31	22.2	0.24
1030	206.12	1.5	0.330	6.34	0.508	4.05	93.5	23.17	17.6	0.24
1035	206.12		0.330	6.35	0.507	3.15	91.2	23.09	12.2	0.24
1040	206.11	2.0	0.329	6.36	0.507	2.73	92.1	23.04	8.2	0.24
1045	206.11		0.330	6.37	0.507	2.42	111.4	23.10	6.1	0.24
1050	206.10	2.5	0.329	6.38	0.507	2.26	100.9	23.07	3.5	0.24
1055	206.10		0.329	6.38	0.506	2.14	111.3	23.10	9.1	0.25

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: _____

SEDIMENT: _____

OTHER: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 15 primary + 15 SS primary = 30 total

VOCs/TPH by 8260, Methane by RSK175M	TPH/PAH SVOC by 8270	Total Ca/Mg/Mn /K/Na by 6010	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl by 300.0
6 + 6 x 40-ml VOA w/HCl	6 + 6 x 1-L Amber	1 + 1 x 500-ml HNO ₃	1 + 1 x 250-ml w/HCl	1 + 1 x 250-ml np
12 total	12 total	2 total	2 total	2 total

SAMPLE IDENTIFICATION NUMBER(S) **ERH176**

DATE: 1/10/17 TIME: 1130

DECONTAMINATION PROCEDURES: Alconox, DI water, and Alcohol wash

NOTES: End DTW: 206.00 ft btoc

Sample end time: 1322

SAMPLED BY: CB, AM

SAMPLES DELIVERED TO: APPL TRANSPORTER: FedEx

Red Hill Groundwater Sampling Log

WELL NO. **OWDFMW01**

LOCATION: Outside Tunnel

PROJECT NO. 60481245

DATE: 1/12/17

TIME:

CLIMATIC CONDITIONS:

Sunny, 69°

Depth to groundwater		Final Depth	Depth to Product	Depth to bottom		Purge			
Previous (ft btoc)	Current (ft btoc)	(ft btoc)	(ft btoc)	Previous (ft btoc)	Current (ft btoc)	Flow rate (mL/min)	Start Time	Total Volume (gal)	Nitrogen used
119.09	118.93	119.98	None	144.74	--	140	0908	3.5	
Pump settings:			Pressure (PSI)		Discharge (sec)		Fill (sec)		
Previous/Actual			70	70	15	15	15	15	

Headspace PID: 0.0 ppm Ambient PID (start/end): 0.0/0.3 ppm

Pump intake: 138 linear ft. btoc Barometric Pressure: -- in. Hg

Saturated Zone Length: -- linear ft. Methane: 0.0 %

Stabilization: +/- 0.2 °C, +/- 3% conductivity, +/- 10% DO, +/- 0.1 pH, +/-10 mv ORP, turb=as low as possible (< 10 NTU ideal) for 3 consecutive readings following a min of 5 readings

TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
0900	Start purge									
0912	Water at surface									
0920	119.86	1	2.780	8.64	4.279	5.89	29.8	24.60	174.0	2.27
0925	119.85	1.35	2.797	8.55	4.304	5.13	28.6	24.69	176.9	2.29
0930	119.91	1.5	2.799	8.52	4.304	4.88	17.6	24.70	177.6	2.28
0935	119.98	2	2.813	8.44	4.330	4.70	13.6	24.66	179.6	2.30
0940	120.04	2.3	2.804	8.44	4.312	4.60	-1.6	24.76	181.1	2.29
0945	120.08	2.5	2.804	8.43	4.314	4.56	7.5	24.70	183.4	2.29
0950	120.11	2.8	2.805	8.43	4.313	4.52	1.6	24.75	186.3	2.29
0955	120.13	3.1	2.806	8.41	4.322	4.50	1.5	24.77	189.4	2.30
1000	120.16	3.5	2.809	8.39	4.324	4.48	-3.1	24.85	192.0	2.30

SAMPLING EQUIPMENT: Bladder Pump

APPEARANCE OF SAMPLE: COLOR: _____

SEDIMENT: _____

OTHER: _____

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES / NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 15 primary + 15 SS primary = 30 total

VOCs/TPH by 8260, Methane by RSK175M	TPH/PAH SVOC by 8270	Total Ca/Mg/Mn /K/Na by 6010	Iron (filtered) by SM3500Fe	NO ₃ /SO ₄ /Cl by 300.0
6 + 6 x 40-ml VOA w/HCl	6 + 6 x 1-L Amber	1 + 1 x 500-ml HNO ₃	1 + 1 x 250-ml w/HCl	1 + 1 x 250-ml np
12 total	12 total	2 total	2 total	2 total

SAMPLE IDENTIFICATION NUMBER(S) ERH184

DATE: 1/12/17 TIME: 1005

DECONTAMINATION PROCEDURES: _____

NOTES: _____

Sample end time: 1115

SAMPLED BY: CB/GM/MH

SAMPLES DELIVERED TO: APPL

TRANSPORTER: FedEx

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2
3

**Appendix B:
Field Notes
(on CD-ROM at end of document)**

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11/10/16

1130 - Water at surface, pump until air bubbles are flushed from the line.

1140 - ~~CB~~ Stop pumping cleanup.

1150 - while pulling water level meter it got stuck at ~140ft bTOC, likely on small bit of excess tubing. Retest pump to make sure no leaks in line from WL getting stuck.

1200 - No apparent leaks, pumping water to surface. Clean up site

1230 - all off site mob to warehouse.

1300 - at warehouse and prepare equipment for next week's groundwater sampling event.

1600 - CB mob to AECOM office.
End of Field day

[Handwritten signature]
11-10-16

11/14/16

0630 - CB, TV and DF at warehouse to mobilize equipment.

0705 - mob to site.

0730 - TQ at Red Hill Gate, RG on the way. Mob to Adit 3.

0745 - at Adit 3. CB conducts tailgate safety briefing. Waiting for NAVFAC personnel to access Red Hill Shaft well 225401.

Objective: collect Groundwater Samples from RHMW2254-01, RHMW01 and OWDFMWO1 for TQ+DF, RHMW06, 07 and 08 for CB, TV. RG will be support.

Personnel: R. Gannigan, T. Vernon, T. Quintel, D. Frerich, C. Byrd.

Weather: Mostly Sunny, Breezy High 70's.

-DF+TQ calibrate Multi-gas meters + Aniba. See Book 1 for specifics.

0820 - ~~BC~~ NAVFAC personnel has not arrived at Adit 3. TQ, DF and TV mob to RHMW2254-01 to see if NAVFAC has already gone to well.

0830 - CB mob to RHMW01.

0928 - Begin Furging. RG onsite.

0930 - Water at surface.

11/14/16

0940 - set pumping rate to 250 ml/min.

115 psi, 30/30 recharge/discharge. See Sampling log for details.

1055 - Begin sampling RHMW06. See sample + QC log for details.

1150 - complete sample collection at RHMW06. Clean up. Mob to RHMW07.

1235 - collect water level at RHMW07.

1240 - Begin purge and set rate to 250 ml/min at 95 psi, 30/30 second recharge/discharge. See sample log for purge details.

1350 - Begin sampling RHMW07, ID = ERH121. See QC log for details.

1455 - complete clean up at RHMW07. Sampling complete at ¹⁴1445. Mob to RHMW04.

1530 - Begin purging RHMW04, see Sample/Purge log for details.

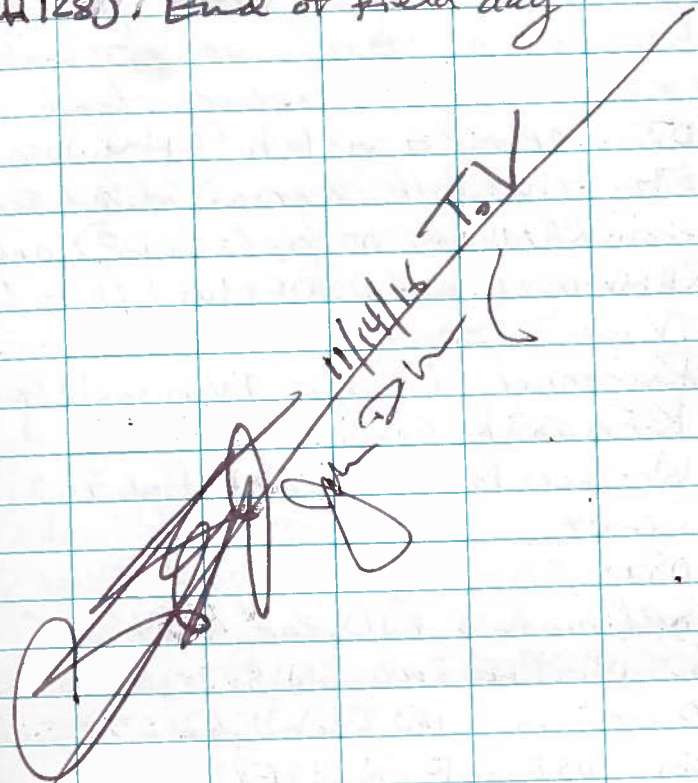
1730 - Begin sampling RHMW04 (ERH128) - see QC log for details.

1820 - complete sampling RHMW04. Clean up then mob to Adit 3 to help demob equipment.

11/14/16

1900 - mob offsite to warehouse.

1935 - offload equipment and samples from RHMW01 (ERH117); RHMW07 (ERH121) and RHMW04 (ERH128). End of field day.



11/15/16

0630-AB, TV, KE+DF at warehouse.

Load supplies.

0700- CB gives tailgate safety briefing to DF+KE. DF+KE then mob to

Adit 3 to sample RHMW05, 02 + 03.

0715- RG at Warehouse. TV mob to air gas to pick up nitrogen tanks.

0720- CB + RG mob to RHMW08.

Objectives: Collect groundwater samples from RHMW05, 02, 03 (KE+DF), and RHMW08+09 and OWDF MW01 (RG+CB)

TV as support.

Personnel: C Beigel, T Vernon, D Frerich, K Ernst, R. Gannigan.

Weather: Partly Sunny, High 70's, Breezy.

0800- CB gives tailgate to TV+RG.

calibrate's PID and Horiba.

PID: ~~MIRA~~ RAE 3000 SN: 592-600290

O.D = Zero 100 Isobutylene = 99.5 ppm.

HORIBA U53: Probe SN 877FYTCJ

Display SN: REY56JNB

cal'd to 4.04 pH (4.00), 4.52 μ S/cm (4.49) O.D

NTU (0.0) DO = 9.17 mg/L (103.5%)

11/15/16

0830- Begin purge at RHMW08.

0836- Water at surface. Purge. See Purge log for details. See Book 1 for Details of tunnel well sampling.

0940- Begin sampling RHMW08 (ERH122)

See QC log for details

1020- Complete sampling RHMW08.

Cleanup.

1045- mob to RHMW09 (RG + CB). RHMW05 has been sampled by KE+DF.

1050- set up at RHMW09. Begin purge at 1113. See Purge log for details.

1135- Begin readings. DO was continuing to drop throughout. Readings were w/in 10% but dropping. Had to change NO₂ tank at 1300- caused DO to drop significantly after return to pumping. All parameters stable after 10 gallons at 1335.

1340- Begin sampling RHMW09 (ERH129) see QC log for details.

1425- complete sampling RHMW09. Cleanup then mob to OWDF MW01. TV continues helping in tunnel.

1550- Begin purging OWDF MW01. DF+KE have completed all tunnel wells. Mob to warehouse.

11/15/16.

1620 - Begin readings at ~~ERH~~ ^{OWDF MW01}

See Purge Log for details.

1715 - collect samples from OWDF MW01 (ERH 118) + ERH 119 (Dup), see Q Log.

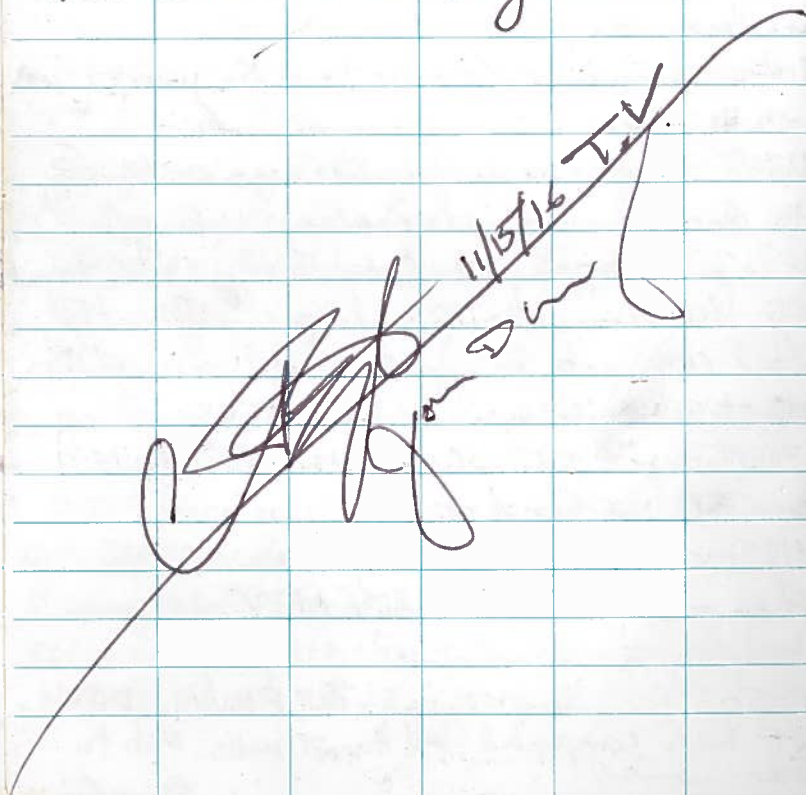
1820 - complete sampling OWDF MW01.

Clean up

1900 - CB + RG mob off site. Mob to warehouse

1940 - at warehouse. off load samples.

1955 - End of field day



11/16/16

0630 - TV, CB + DF at warehouse. Load supplies to sample HDMW2253-03.

0700 - Mob to parking lot at Halawa Prison.

0750 - all at parking lot.

Objective: Collect sample from HDMW2253-03.

Personnel: D. Frerich, T. Vernon, C. Bezel.

Weather: Mostly Sunny, High 70's, Breezy.

0755 - DLNR at Parking Lot. Mob to well.

0800 - at HDMW2253-03. CB gives tailgate safety. Set up to sample well.

0839 - Begin purge at HDMW2253-03.

See purge log for details

1150 - Sample MW2253-03 (ERH 127)

1220 - Complete sampling

1245 - Fill 3 vials for trip blank ERH 132

1250 - Collect equipment blank ERH 130

w/ DI over decon bladder pump

1310 - Collect field blank ERH 131

w/ DI

1340 - Depart for warehouse w/ supplies

1400 Collect LDW

1500 Soil ERH 113

1430 Depart

11-16

1430 - Placing Win LDW Staging Area

- Sunny, Snowy Mtn, 85° 11-17-16
- 0830 Arrive @ Red Hill Gate
Don French (DF) and Tom Gunn (TG)
- 0845 Conduct H's target meeting;
Discuss Planned work: pull
dedicated pumps out of 8 Mals
- 0900 DF & TG enter Adit 3 to meet
w/ Navy pump station personnel
@ Red Hill Shaft
- 0930 Pull tubing and pump ^{up} ^{JK}
well casing @ 2254-01; find
that it is not possible to remove
the pump out of the top of casing
due to inadequate space
between top of casing and bulk
head about 8" above.
- 0945 Run dedicated tubing and
pump back down into the
infiltration gallery (2254-01)
continue up lower access
tunnel and remove dedicate
pumps from RHMW05, RHMW02
and RHMW03
- 1130 Out of tunnel @ Adit 5 and
drive to RHMW09.
- 1200 Pull Dedicated pump @
RHMW09

- 1300 Pull dedicated pumps 11-17-16
@ RHMW08, Randy Gonzalez arrives
- 1345 Call Red Hill Gate security
to have gate near Adit 6
opened in order to access
RHMW04
- 1400 Pull dedicated pump @
RHMW06
- 1430 Pull dedicated pump
@ RHM04
- 1515 Pull dedicated pump @
RHMW07
- Note: all dedicated sample
tubing was reeled onto
wooden spools
- 1600 Depart Site

Jack Kronen

11-17-16
DF
TG

Clouds, At Rain, Windy 92° 11-21-16

1430^{JK}
~~1430~~
 1500^{JK}
 1530

Arrive @ Red Hill Gate
 Jack Kraus (SK) and Eric Wadgsten (EW) meet w/ Junior of PLS. Conduct tailgate H₂S analysis planned site recon into proposed location for access road to RAMWIS drill pad.

1515 Walk into proposed area which is vegetated w/ dense haaha koa and tall grass. Inspect proposed route and PLS finds it will be possible to perform w/ clearing without any subsurface excavation/earth moving required prior to conducting the geophysical survey.

1530 At location of proposed drill pad for RAMWIS and PLS determines that drill pad will be buildable

1540 Walk back to van

1600 Junior w/ PLS departs; SK & EW perform site inspections @ Adit 1, RAMWIS04, RAMWIS04 Adit 3 / OWDF
 Depart Site 11-21-16

1700

0645 Jacket meeting: slips, trips, heat & Keeping Clean Temp: Sunny & Hot 86° 12-6-16

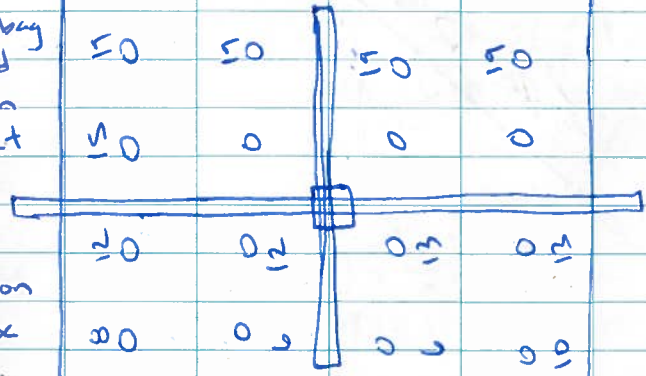
0700 collect gear at AECOM whrs
 0940 Discharge Rain water on top of Plastic tarp

1133 Finish discharge water

1140 Begin sampling from Roll off Bin using 4" PVC Pipe 1/4" Pipe to collect sample. Pounded 1" PVC Pipe with hammer see print below ↓

Sample taken at 1:00, ERH154

8x4	20	20	20	20
32 samples into	50	50	20	20
garbage bag lined	50	50	50	50
5 gallon bucket	10	0	0	0
	20	0	0	0
-2 gallon ziploc bags	20	0	0	0
	20	0	0	0



Distance from top of roll off to top of line
 Pile in the Rain

- 1240 See Photo For Rolloff tent
 1350 Clean up at RHMW-08
 • See Photo of RHMW
 of Tarp & Tall grass
 1420 off site Red Hill
 14:34 Back at AECOM whrs
 • unload gear
 Trip Blank = ERH153

11/16 Dec 6, 2016 GMH

1195

1700

Rite in the Rain

GW Sampling - Tunnel

12/12/16

- 0600 Meet at warehouse
 0630 leave warehouse for site
 0700 Arrive at Adit 3. Begin unloading
 and calibration
 0708 Calibrate Horika using Autocal
 solution - all OK
 0730 Calibrate ppb Rae s/n: 594905015
 10 ppm Isobutylene lot # 0127FA14
 exp 1/27/18; zero cal - OK; span cal - OK
 0745 Calibrate Lantec 2000t s/n 45853
 CO 50ppm, H₂S 25ppm CH₄ 2.5%
 Lot # CAP-412-4 exp 7/15/16
 CO₂ - 35%, CH₄ 50% No balance
 Lot # JAO-399-2 exp 9/26/2018
 0750 Check Air packs
 s/n 12083223 - 3000 OK
 s/n 12050018 - 3000 OK
 Calibrate 4-gas meter, MO2A003772
 H₂S 25ppm, CO 50ppm, Methane 50%, O₂ 19%
 0800 Trip blank ERH134 collected
 0810 DPH and Navy arrive. Contact
 to access Red Hill shaft has
 not showed up. Pete LaPlaca (Navy)
 (Navy) call S.NAVFAC. Someone

Rite in the Rain

Dec GW Sampling - Tunnel 12/12/16

else is being sent out since person is sick

Give tailgate Safety briefing (to Tunnel team begins mob to RHMW2254-01. Outside team proceeds to first well.

0915 Navfac shows up to provide pump room access.

0930 Arrive at pump room well. Barometric press: 29.84

No CH₄ detected. See sample log.

1020 Collect sample ERH 135 (primary + MS/MSD) and ERH 137 (dup)

Note: changed bottles with MW-05 136 due to collection of VOAs marked ERH 137.

Accidentally collected extra samples for MNA parameters (MS/MSD/Dup)

1240 Sampling at RHMW2254-01 complete. Total sample time 2hr 20min

1305 Begin mob to RHMW05. Portable 1" bladder pump decon'd in warehouse prior to sample event. in accordance w/SOP I-F. Initial problem with pump. Pump

Dec GW Sampling - Tunnel 12/12/16

pulled and new bladder installed.

1405 Pump installed. Barometric pressure = 29.73. No CH₄ detected. Ambient PID greater than headspace. See sample log.

1520 1445. Collect sample ERH 136, primary at RHMW05

1520 Sampling complete. Total time 35min.

1540 Begin mobilizing equipment to RHMW01 for next day; not enough time to complete another sample

1635 Exit tunnel, demob equipment.

1655 Prop off IDW w/JK and proceed to warehouse.

1730 Demob equipment and samples.

1800 Receive call from Navy (PL) requesting assessment of warehouse by DOTT

1803 Call JK re: DOTT warehouse visit. Agree to receive DOTT at warehouse.

1825 DOTT arrives.

1900 All leave warehouse

 12/12/16

Dec GW Sampling - Tunnel 12/13/16

0600 Meet at warehouse

0615 Leave warehouse and meet onsite.

0650 Begin calibrations: (see 12/12 details)

0700 Horiba Antocal: OK

0705 ppb Rae: zero cal. OK; Span - OK

0712 Lamtec: zero cal + O₂ - OK; each parameter - OK

0721 Calibrate 4 gas meter: zero cal. OK; all parameters OK

0740 Check airpaks #223 & #018 - OK

0800 Receive call from Navy (PL) indicating an arrival time of 0800.

0800 TR gives safety brief for tunnel team: KE and RG (AECOM); PL (Navy); and Richard Takaba and Shawn (?) Fu (DOH)

Note: DOH does not have airpaks, lights and proper PPE

Weather - partly cloudy

Team begins mob to RHMW01.

0920 Arrive at RHMW01. Contractor in process of chipping/drilling wall and ceiling in vicinity of well. They indicate that it will be 10-15 minutes until

12/13/16

Dec GW Sampling 12/13/16

(cont) They are done at that location. DOH expresses concern about the dust. No CH₄.

0930 Begin prep around well

1000 Contractor completes work and is asked to delay additional drilling until sampling is complete. Barometric Press: 29.87

1040 Collect Sample ERH143 from RHMW01 (primary)

1220 Complete sample. Total time: 1hr. 40min

Begin mob to RHMW02.

1310 Arrive at RHMW02. CH₄ = not detected

Headspace = 0.0ppb ambient = 0.155ppb

Water has slight yellow tint

1435 Collect sample ERH144 from RHMW02 (primary)

1518 Complete sample. Total time: 43 min.

1530 Mobilize equipment to RHMW03 for tomorrow's sampling. Welding in area appears to be complete. Proceed to exit through Adit 3.

1645. Exit tunnel and demob from site.

1738 Arrive at warehouse.

1822 Leave warehouse.

12/13/16

Kit in the Rain

Dec GW Sampling Tunnel. 12/14/16

- 0600 Meet at warehouse.
- 0615 Leave warehouse for site
- 0645 Arrive at Adit 6 and begin calibrations (KE & TQ).
- 0650 Calibrate Horiba w/Autocal - OK
- 0656 Calibrate ppb RAE: zero-OK, span-OK
- 0704 Calibrate Lantec: zero-OK, span-OK
- 0717 Calibrate 4 gas meter: zero-OK, span-OK
- 0730 Check and confirm airpaks OK (#3223 and 0018)
- 0740 Navy (PL) calls to indicate they are running late, but will meet at Adit 6.
- 0810 Navy (PL) and DOH (Rich Takaba) arrive onsite. TW provides safety brief.
- Weather: Sunny, partly cloudy. ~74°.
- 0820 Proceed into tunnel. Tunnel entrance phone rings and PL answers. Security has concerns w/DOH entrant w/ paper pass and no badge for tracking purposes.

Dec GW Sampling Tunnel 12/14/16

- 0900 Arrive at RHMW03 and begin set up.
- 0920 Headspace = 0.096 ppb, ambient = 0.061 ppb; CH₄ = 0.0%; barometric pressure = 29.80" Hg
- 0940 PL and DOH leave to meet additional Navy and DOH members at Adit 6.
- 0955 Having issue with drawdown and reduce flow rate from 225 to 150 mL/min.
- 1015 Navy RPM (Tracy Sageibo), PL, and other DOH observers arrive. Navfac also comes by to inquire about sampling. They are planning to x-ray the tanks. They request that the samplers leave the area for 10 minutes. This is brought to the attention of the Navy RPM. Navfac is told to wait until after sampling is complete to begin any radiation work.
- 1035 Collect sample ERH 152 from RHMW03.

11/21/16

0800 - at warehouse. Pack up supplies to place pumps in RHMW02, 03, 05 and 09.

0845 - mob to site.

0915 - through Red Hill Gate to Adit 3. OB gives final site safety briefing.

Objective: Place pump in RHMW02, RHMW03, RHMW05, and RHMW09. Remove core boxes from RHMW08 and RHMW09.

Personnel: T. Vernon, R. Grannigan, Ci Beigel.

Weather: ^{Light} showers, breezy, High 70's.

1015 - mob into Adit 3.

1040 - place RHMW05 pump. Needed to repair tubing connection to pump.

1100 - place RHMW02 pump. Need to replace one of the screen bolts on the base of the pump - does not impact pump function.

1120 - place RHMW03 pump then mob out of tunnel.

1145 - out of tunnel. Cleanup then mob to RHMW09.

1210 - at RHMW09. Need to repair tubing.

1300 - complete placement of RHMW09 pump. Removed approx 18 inches of excess tubing from the well to prevent punching within well which has previously hung up the water level probe during previous events.

- Demobilize core boxes from RHMW08 + RHMW09.

1450 - Last set of core boxes offsite + mobilize to warehouse.

1530 - All core boxes have been offloaded at the warehouse. End of field day.

~~11/21/16~~

Dark, wind 10-15 NE, 70°, 80% humidity

12/12/16 (85)

Police #: (800) 473-0886
471-3393

0500 -

Started loading vehicles

0615 - left warehouse for site.

0645 - Onsite at Red Hill

0740 - Delay due to construction near RHMW-04 and 06

815 - Meet team for safety meeting

845 - Calibrate equipment PID and set up at RHMW-08.

Calibrate HTR-10: Nutritional Solution Lot # CG54130

PH: 3.95, 4.49 nS/cm, 0.00 NTU, 8.80 mg/L DO

0904 - WCD PID 1.3 ppm 15 min, wind sample NE, 78°, 80% humidity
methane 0.0%

0930 - Started pumping up water
see sample sheet

1050 - Started collecting samples

1130 - Finished sampling at RHMW-08

1140 - Demobilized from RHMW-08

1200 - Mobilize at MW-06
PID: 0.0 ppm methane: 0%

See sample log for details
1530 sample ERM 139

1409 finish sampling, demobe

1445 Set up @ MW-9, sunny, wind sample NE, 85°, 80% humidity
see sample sheet for details
note: Antic 1/2 water discharge line

1655 sample ERM 146

1745 End sampling, demobe

1810 leave site

1830 @ user house

1900 leave warehouse, end of day

N
12-12-16

86 12.13.16 Dark, wind W-15 NE, 70°, 80% humidity

- 0545 AM meet KE, TV, TAE warehouse
- 0730 @ site, cal
- 0800 meet regulators @ site, tail gate
- 0820 @ HDMW 2293-03, sunny, no wind, 85°, 80% humidity
- 1050 sample ERM 149
- 1135 finish samples, demobe, to ADIT 3 to drop off eq.
- 1225 meet more regulators, to ADIT 3
- 1250 to MW-4
- 1300 @ MW-4
- 1430 sample ERM 138
- 1510 end sampling, demobe
- 1545 @ MW-7, sunny, wind S-NW, 85°, 80% humidity
- 1700 sample ERM 140
- 1805 end sampling, demobe
- 1820 leave site
- 1840 @ warehouse
- 1900 end of day

12.13.16

87 12.14.16 Vack, wind W-15 NE, 100°, 80% humidity

- 0550 AM @ warehouse
- 0620 leave warehouse
- 0655 on site @ DWDF, make, sunny, wind 10-15 NE, 85°, 80% humidity
- 0730 meet TV on site
- 0805 meet regulators on site
- 0915 more regulators on site
- 0930 start samples ERM 147 & 148
- 1105 end sampling, demobe
- 1150 sample EB, ERM 149
- 1200 sample FB, ERM 150
- 1230 to drop off IDW
- 1245 leave site
- 1315 @ warehouse, pack samples
- 1345 mt/kg leave for FedEx
- demobe
- 1400 end of day

12.14.16

Dec GW Sampling - Tunnel 12/14/16

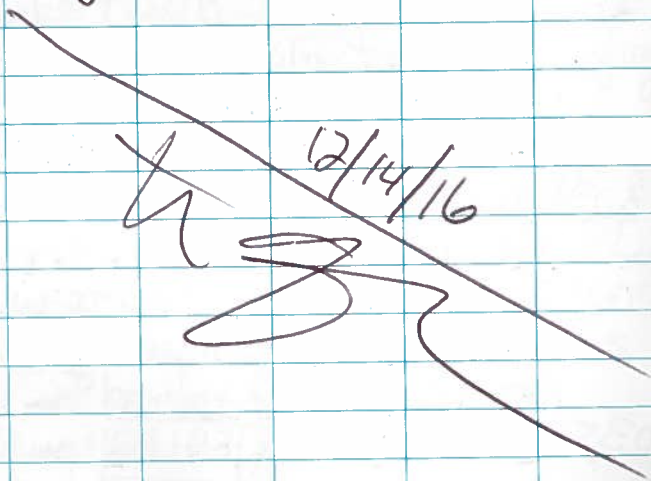
1125 Sample complete. Decon water level w/ Alconox, alcohol and DI water. Begin to demob equipment.

1150 Exit tunnel via Adit 6. Call Team 2 to check status.

1200 Drop IDW off with Team and proceed to warehouse.

1240 Arrive at warehouse with samples. Help team prepare samples for shipping. Demob equipment and supplies.

1600 Leave warehouse, end of day.

~~12/14/16~~


Jan GW Sampling - Tunnel 1/9/17

0525 Calibrate YSI - pass (see calib. log)

0606 Calibrate miniRAE PID - pass

0630 Calibrate multi-RAE 4-gas - pass

0640 Calibrate GEM 2005 - pass

0730 Calibrate Data RAM -

0720 TR talks to Hensel Phelps (HP) regarding GW Sampling

Schedule. HP indicates they will be drilling and doing load testing around MWO1 today and tomorrow. TR told them we need to sample there on Wednesday. He relayed this information to staff working in the tunnel.

0745 Check air breathe-packs:

#12083223 - 3000 OK

16100358 - 3000 OK

12071665 - 3000 OK

JK-minis
@ 0900

0805 Tony from Naufac arrives to let us into the shaft. He noted that the shaft manhole cover was not completely closed.

338-6023 cell for 474-4229 call when work done.

- Jan GW Sampling - Tunnel 1/9/17
- 0815 PL (Navy) calls. They have badges and are on their way.
- 8040 ^{and MH} DOTH and Navy arrive. Conduct targets H₂S meeting. Present are:
 Pete de Blee - NAVFAC
 Randy Hen - HDOIT
 Diamond Tachera - UH
- 0920 Discussion in field blanks w/ Randy Hen (RH) and when and where one should be collected. RH thinks it would be a good idea to collect one while sampling in RH Shaft 2254-01. Pete de Blee to discuss w/ Tracy S. Teresa states that PID readings are collected periodically during sampling. Also, on split sampling, RH wants to have bottles numbered.
- 0925 Discuss w/ Teresa collection of Nitrate and Ferric Iron. No ship today (?). Issue is not in order according to SOP

- Jan GW Sampling - Tunnel 1/9/17
- 1000 Collected Trip blank ERH196
- 1030 Parameters stable. Begin collecting Sample ERH 161 (primary, MS/MSD, ~~and duplicate~~ + full split) and ERH 162 (duplicate + split)
- 1035 First VOAs collected through flow cell. Samples discarded and re-collected.
- 1130 Finished collecting VOAs with available vials and waiting for more vials before proceeding. Paused pump while waiting. Note: for split samples alternating samples collected are being put into each cooler.
- 1200 Send KE to tunnel entrance to determine status of vials.
- 1210 Pumps turn on in pump house
- 1220 Resume VOA sampling
- 1230 Change flow rate from 100 mL back to 290 mL/min for remaining samples.
- 1415 Pumps turn off.

Jan 46

GW Sampling Tunnel 1/09/17

1540 Complete sampling at RHMW2254-02. Diamond (ult) Collects samples for ult.

1545 Collect sample ERT197 - ambient field blank using DI water (lab grade) from J unpreserved trip blanks and transferred to VOA vials preserved with HCl

1620 TR and JJJ demob from tunnel. KE & JK mob equipment to RHMW05.

1730 KE and JK exit tunnel and demob.

1800 Arrive at warehouse and drop off samples

1830 leave warehouse - end of day.

~~1/9/17~~

~~KE JK~~

47

Jan GW Sampling - Tunnel 1/10/17

0455 Calibrate Landtec Gem 2000 s/n 6M08010/05 using CO₂ - 35%, CH₄, 50% N₂ balance lot # EAP-399-4 exp 4/15/19 No H₂, CO, and H₂S sensors.

O₂ span changed from 0.1 to 20.9 Zero - OK, Span OK

0510 Calibrate MultiRAE PGM6228 s/n 32pb

Zero Air w/ charcoal filter

H₂S - 25ppm, CO - 50ppm, CH₄ - 50%, O₂ 19% lot # 984551 Exp Oct 2017

Span Cal - OK

100% Isobutylene - 100ppm lot # 987369 EX Jan 2019

0525 Calibrate MultiRAE Plus R11463 s/n 527439

Zero Air w/ charcoal filter

CO - 50ppm, H₂S 25ppm CH₄ 25 lot # FAQ-412-4 exp 10/25/2018

Span Cal - OK

100ppm Isobutylene lot # EAQ245 1002 VOC cal - OK

0515 Arrive at warehouse

- Jan GW Sampling 1/10/17
- 0530 Calibrate YSI #
See calibration log.
- 0630 Calibrate PID #
See Calibration log
- 0700 Leave warehouse for site
- 0705 TR arrives onsite
- 0725 TR Calibrates Data Ram #5804
Zero OK
- 0730 KE and MT arrive onsite
Weather: Partly cloudy ~ 69°F.
No breeze.
- 0830 Navy Reelyn and DoH (Richard Takaba) arrive onsite. TR gives safety briefing.
- 0850 Team Tunnel mobilizes to MW05
- 0930 Arrive at MW05 and set up.
- 0940 PID has low flow issue. Also use PID on 4 gas meters.
- 0945 Start pumping
- 0955 train comes by.
- 1000 Sample ERH163 collected for trip blank at MW05 in tunnel
- 1030 ~~Stew w/ HP advised in pipe~~
Stew w/ HP advised in pipe
Stew w/ HP advised in pipe
- 1045 Pauli Electrician invests more pipe with some back etc

- Jan GW Sampling 1/10/17
- 1030 Sample ERH164 collected from RHM05.
- 1155 Sampling complete. Begin demob.
- 1230 JK and KE take samples out.
- 1235 Prometheus - Drilling Contractor Govi Tilly 927-8521 Spawbos
Indicated drilling would occur on Wednesday upwind of MW01 TR told them sampling would occur ~0900-1500 and drilling cannot take place during sampling
- 1305 Arrive at RHMW02 and begin set up
- 1315 Begin purging
Note: PID readings range from 2.1 to 4.3 due to adjacent contractors working downwind ~25 feet away
- 1415 Adjusted flow from 250 mL/min to 100 mL/min for VOC sample collect sample ERH174 from RHMW02
- 1440 Adjusted flow back to 250 mL/min

- Jan GW Sampling - Tunnel 1/10/17
- 1540 End sample time and begin demob.
 - 1605 Leave MW02 for exit through Adit 3
 - 1645 Meet JK at Adit 3 and demob equipment
 - 1700 TR leaves site, KE leaves for warehouse
 - 1730 KE arrives at warehouse. Leave warehouse. End of day.

~~1/10/17~~

- Jan GW Sampling 1/11/17
- 0440 Begin gas calibrations. See 1/10/17 for calibration gas details
 - 0455 Begin cal for MultiPac #32pb Zero w/ charcoal-dk, Span-dk, VOC-ok
 - 0505 Begin cal for Lantec GM08090 Zero-ok, Span ok
 - 0515 Calibrate Data Ran #5804. Cal ok
 - 0640 Leave for warehouse.
 - 0710 Arrive at warehouse and pick up equipment.
 - 0720 Leave warehouse for site
 - 0740 Arrive at Adit 3. Meet Adam and Gawn to offload
 - 0800 TR gives safety brief to AM and JK
 - 0830 AM and JK got to Adit 6 to mob equipment from MW03 to MW02.
 - DOH and Navy arrive on site.
 - 0845 TR gives safety brief to PL (Navy) and Richard Takata (DOH)
 - 0855 TR, DOH, and Navy enter tunnel and mob to MW02.
- Weather: Partly cloudy ~71° F.

- 1/11/17 Jan GW Sampling Tunnel
- 0930 Arrive at MW01. Prometheus is drilling ~ 25 ft toward Adit 6 from MW01. Wet drilling methods are being used, dust's being monitored with DataRam.
- 0940 Peak dust = 0.401 mg/m^3
TWA = 0.111 mg/m^3
- 0945 Rustoleum Professional inverted marking paint (yellow) being sprayed up wind of sample location. Label notes contain xylene and toluene.
- 0950 Move upwind temporarily during drilling due to mist spray upwind.
- 0955 TO goes to MW02 to retrieve equipment.
- 1000 JK and AM meet. TO and AM bring equipment to MW01
- 1020 Begin set up at MW01.
Note: Water used for mist has hand soap added to it.
- 1032 Open well and get water level.

- Jan GW Sampling Tunnel 1/11/17
- 1100 Start pumping. See Sample log
- 1105 Drilling begins
Dust = 0.050 mg/m^3
TWA = 0.082 mg/m^3
- 1115 Thin layer of dust observed in sampling area
- 1121 Dust = 0.280 mg/m^3
TWA = 0.082 mg/m^3
- 1140 Drilling stops
Dust = 0.078 mg/m^3
TWA = 0.084 mg/m^3
- 1200 Trip blank ERH 171 collected for MW01 samples in tunnel
- 1205 Sample ERH 172 collected from MW01
- 1210 Prometheus stops work and leaves site. No work conducted at the adjacent site during sampling.
- 1310 Prometheus sweeps work site
Dust = 1.033 mg/m^3
TWA = 0.083 mg/m^3
1L Amber bottles being sampled.

- Jan GW Sampling Tunnel 1/11/17
- 1320 Swapped N₂ tank.
- 1330 Prometheus starts drilling again.
- 1340 Collect sample [ERH200] for MW01 ambient blank. Wet drilling with mist begins. Ambient blank collected using new 2-gallon bottle of Menchville DI water.
- 1415 Drilling at adjacent site stops. Still sampling amber bottles
- 1440 Hensel Phelps comes by to notify team that Adit 3 door is broken.
- 1520 JK arrives onsite. Adit 3 door still broken. JK and PC mob samples to Adit 6.
- 1535 DUST = 0.078 mg/m³
TWA = 0.100 mg/m³
Demob from MW01 to Adit 6.
- 1605 Exit Adit 5.
- 1635 TR leaves site.
- 1645 AM leaves site to go to MW09
- ~~1715 Arrive at~~
TR 1/11/17

- Jan GW sampling - Tunnel 1/11/17
- 1845 AM leaves MW09 to demob to warehouse
- 1915 AM arrives at warehouse to drop off samples and demob.
- 2015 AM leaves warehouse, end of day.

~~1/11/17~~

- Jan GW Sampling - Tunnel 1/12/16
- 0500 Calibrate Lantec # GM08090
Zero - OK, Span OK
- 0505 Calibrate DataRam 5804
OK
- 0515 Calibrate MultiRae # 32pb
Zero - OK, Span - OK, VOC - OK
- 0525 Calibrate Mini Rae # 592-905971
Zero - OK Note: previous span set to 43. Changed to 100,000 ppb. Span - OK
- 0535 Calibrations complete. Self
- 0545 Arrive at warehouse
- 0550 Calibrate YSI - See log.
- 0700 Depart for site.
- 0725 AM & TR arrive at Adit 5
- 0735 Airpacs checked:
#3223 - 3000, #1665 - 3000 - OK
- 0805 Talked to Hensel Phelps and Naufac Sup Operator regarding access to Adit 3. They anticipate it not getting fixed for 1-2 weeks.
- 0825 PL (Navy) calls to indicate Mel will be substituting

- Jan GW Sampling Tunnel 1/12/17
- for Reelynn and They are delayed due to no one at the gate and then a supervisor was called to confirm badges.
- 0830 Navy - Melvin Muraoka
DOH - Shaobin Li
UH - Danny Powell
- Arrive on site. TR gives safety briefing - see log.
Weather: Partly cloudy ~ 72°F
- 0840 Begin mob into tunnel to MW03.
- 0905 Arrive at MW03 and begin setup.
- 0920 Begin purging.
- 0935 Reduced flow rate to 100 mL/min due to drawdown.
- 0945 Collected sample ERH180 trip blank for tunnel - MW03.
- 1015 Collect sample ERH181 from MW03
- 1115 Collect sample ERH203 ambient blank using 1 gallon of (cont.)

- Jan GW Sampling - Tunnel 1/12/17
- 1115 (cont.) DI water from Merckvren.
JK arrives onsite
- 1240 Sampling complete, JK
mobi lizes samples out
of tunnel.
- 1300 Demob out of tunnel.
- 1330 Exit tunnel.
Dolt follows 12 + samples
(taken by MH in truck)
to warehouse.
- 1400 Arrive at warehouse to
demob
- 1600 Leave warehouse - end of
day.

~~1/12/17~~

~~JK~~

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Appendix C: Cumulative Groundwater Results

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Appendix C: Cumulative Groundwater COPC Results (cont'd)
First Quarter 2017 - Quarterly Groundwater Monitoring Report, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

Well Name	Sample ID	Date Sampled	8015				8260				8260SIM	8011	8270				8270/8270 Mod.										
			TPH-d (µg/l)	TPH-g **** (µg/l)	TPH-o (µg/l)	TPH-g **** (µg/l)	1,2-Dibromoethane (µg/l)	1,2-Dichloroethane (µg/l)	Benzene (µg/l)	Ethylbenzene (µg/l)	Naphthalene (µg/l)	Toluene (µg/l)	Xylenes, Total (p/m-, o-xylene) (µg/l)	1,2-Dichloroethane (µg/l)	1,2-Dibromoethane (µg/l)	1-Methylnaphthalene (µg/l)	2-Methylnaphthalene (µg/l)	Naphthalene (µg/l)	Phenol (µg/l)	2-(2-Methoxyethoxy)-ethanol (µg/l)							
Screening Criteria	—	—	100	100	100	100	0.04	5.0	5.0	30	17	40	20	5.0	0.04	6	10	17	300	800							
SSRBL	—	—	4500	—	—	—	—	—	750	—	—	—	—	—	—	—	—	—	—	—							
RHMW07	ERH140	12/13/2016	< 25	U	—	< 40	U	< 18	U	—	—	< 0.30	U	< 0.50	U	—	—	< 0.10	U	< 0.10	U	< 0.10	U	< 4.00	U	< 80.0	U
(cont'd)	ERH179	1/10/2017	< 25	U	—	< 40	U	< 18	U	—	—	< 0.30	U	< 0.50	U	—	—	< 0.10	U	< 0.10	U	< 0.10	U	< 4.00	U	< 80.0	U
RHMW08	ERH102	10/19/2016	< 25	U	—	< 40	U	< 18	U	—	—	< 0.30	U	< 0.50	U	—	—	< 0.10	U	< 0.10	U	< 0.10	U	< 4.00	U	< 80.0	UJ
	ERH122	11/15/2016	33	J	—	32	J	< 18	U	—	—	< 0.30	U	< 0.50	U	—	—	< 0.10	U	< 0.10	U	< 0.10	U	< 4.00	U	< 80.0	U
	ERH141	12/12/2016	27	J	—	29	J	< 18	U	—	—	< 0.30	U	< 0.50	U	—	—	< 0.10	U	< 0.10	U	< 0.10	U	< 4.00	U	< 80.0	U
	ERH157/158	12/21/2016	63	—	—	< 40	U	< 18	U	—	—	< 0.30	U	< 0.50	U	—	—	< 0.10	U	< 0.10	U	< 0.10	U	< 4.00	U	< 80.0	U
	ERH169/170	1/11/2017	28	J	—	29	J	< 18	U	—	—	< 0.30	U	< 0.50	U	—	—	< 0.10	U	< 0.10	U	< 0.10	U	< 4.00	U	< 80.0	U
RHMW09	ERH103	10/25/2016	< 25	U	—	< 40	U	< 18	U	—	—	< 0.30	U	< 0.50	U	—	—	< 0.10	U	< 0.10	U	< 0.10	U	< 4.00	U	< 80.0	UJ
	ERH129	11/15/2016	< 25	U	—	< 40	U	< 18	U	—	—	< 0.30	U	< 0.50	U	—	—	< 0.10	U	< 0.10	U	< 0.10	U	< 4.00	U	< 80.0	U
	ERH146	12/12/2016	< 25	U	—	< 40	U	< 18	U	—	—	< 0.30	U	< 0.50	U	—	—	< 0.10	U	< 0.10	U	< 0.10	U	< 4.00	U	< 80.0	U
	ERH178	1/11/2017	< 25	U	—	< 40	U	< 18	U	—	—	< 0.30	U	< 0.50	U	—	—	< 0.10	U	< 0.10	U	< 0.10	U	< 4.00	U	< 80.0	U

Notes:

January 2008 to November 2009 depth to water measurements were entered in previous reports a tenth of a foot too high, adjustments were made to correct.
HDOH, Tier 1 Environmental Action Levels, Table D-1b. Groundwater Action Levels (Groundwater IS a current or potential drinking water resource, surface water body IS NOT located within 150 meters of release site)
Background historical data are from February 2005 to July 2012.
Non-detects (from October 2012 and on) are the LOD values.
Results for October 2015 sampling have been adjusted to reflect corrections from hits in the laboratory blank.

¹ - The holding time until analysis was exceeded by one day; the results may be biased low.

* duplicate samples

** - Samples analyzed passed the EPA recommended holding time

*** - Samples ES087 and ES088 possibly switched prior to analysis.

**** - TPH-g analyzed by either 8015 or 8260.

a - MDL values were used for non-detects

b - MRL values were used for non-detects

c - no analytical lab reports found, could not verify results

d - no analytical lab reports available, used summary table from DOH Quarterly GW Reports

e - results from stilling basin, pumps offline

f - results from stilling basin, pumps online

g - analyzed by Method 6010B

h - analyzed by Method 6020

i - the MRL/MDL has been elevated due to a chromatographic interference

k - analyzed by Method 200.8

µg/l - micrograms per liter

Grey highlight - exceeds EALs

Bold - detected values

B - analyte was present in the associated method blank

BU - sample analyzed after holding time expired

D - the reported result is from a dilution

F - indicates that the compound was identified but the concentration was above the MDL and below the RL

ICH - Initial calibrtn. verif. recov. above method CL for this analyte

ICJ - Initial calibrtn. verif. recov. below method CL for this analyte

IH - Calibrtn. verif. recov. below method CL for this analyte

IJ - Calibrtn. verif. recov. above method CL for this analyte

J - indicates an estimated value

U - indicates that the compound was analyzed for but not detected at or above the stated limit. The stated limit is the LOD unless otherwise specified.

HD, Y, L, O, Z, H, ++ - the chromatographic pattern was inconsistent with the profile of the reference fuel standard

S - surrogate recovery was outside quality control limits

V - unusual problems found with the data not defined elsewhere. Description of the problem can be found in the associated quarterly monitoring analytical data validation report.

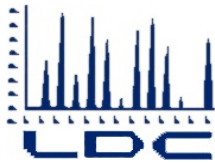
X - possible high bias due to matrix interference

Tb - The analyte was also detected in the associated trip blank at a similar concentration

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2
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**Appendix E:
Data Validation Reports
(on CD-ROM at end of document)**

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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 Thach

January 9, 2017

SUBJECT: Red Hill Bulk Storage Facility, CTO 0053, Data Validation

Dear Ms. Thach,

Enclosed are the final validation report for the fractions listed below. These SDGs were received on December 9, 2016. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #37669:

<u>SDG #</u>	<u>Fraction</u>
81492	Volatiles, Phenol, 2-(2-Methoxyethoxy)-ethanol, Polynuclear Aromatic
81500	Hydrocarbons, Metals, TPH as Gasoline, TPH as Extractables, Methane, Ethylene Dibromide, Wet Chemistry

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:

- Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i, August 2016
- Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i, Revision 01, November 2016
- Project Procedures Manual Naval Facilities Engineering Command, Environmental Restoration Program, NAVFAC Pacific, DON 2015
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

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

Sincerely,

Stella Cuenco
Operations Manager/Senior Chemist

EDD 90/10

LDC #37669 (AECOM-Honolulu, HI / Red Hill Bulk Storage Facility, CTO 0053)

LDC	SDG#	DATE REC'D	(3) DATE DUE	BTEX 1,2-DCA (8260B)		3 PAHs (8270D -SIM)		Phenol (8270D)		2,2-MEE (8270D-M)		(5) Metals (6010C)		TPH-G (8260B)		TPH-E (8015B)		EDB (8011)		Methane (175)		Alk. (2320B)		Br,Cl,F NO ₃ ,SO ₄ (300.0)		Si (4500 -Si)		Diss. Si (4500 -Si)		Fe II (3500-Fe B)		TPH-E (SGCU)					
				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	W	S		
Matrix: Water/Soil				W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S				
A	81492	12/09/16	01/04/17	4	0	3	0	3	0	3	0	2	0	4	0	3	0	-	-	3	0	2	0	2	0	2	0	2	0	2	0	2	0	0	0		
B	81500	12/09/16	01/04/17	4	0	4	0	4	0	4	0	4	0	4	0	4	0	0	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	0	0		
B	81500	12/09/16	01/04/17	1	0	1	0	1	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	1	0
Total				9	0	8	0	8	0	8	0	7	0	9	0	9	0	1	0	8	0	7	0	7	0	7	0	7	0	7	0	7	0	1	103		

Shaded cells indicate Level D validation (all other cells are Level C validation). These sample counts do not include MS/MSD, and DUPs

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Volatiles

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81492

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH114	AZ45865	Water	11/14/16
ERH115	AZ45866	Water	11/14/16
ERH116	AZ45867	Water	11/14/16
ERH120	AZ45868	Water	11/14/16
ERH115MS	AZ45866MS	Water	11/14/16
ERH115MSD	AZ45866MSD	Water	11/14/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 ERH114 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH115 and ERH116 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Laboratory Blank Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Field Blank Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

LDC #: 37669A1
 SDG #: 81492
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 12/21/14
 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	Δ, Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ, Δ	% RSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration /closing CV	Δ	CCV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 1
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	Δ	CCS
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	ERH114	AZ45865	Water	11/14/16
2	ERH115	AZ45866	Water	11/14/16
3	ERH116	AZ45867	Water	11/14/16
4	ERH120	AZ45868	Water	11/14/16
5	ERH115MS	AZ45866MS	Water	11/14/16
6	ERH115MSD	AZ45866MSD	Water	11/14/16
7				
8				
9				

Notes:

16116 BL				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Phenol

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81492

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH115	AZ45866	Water	11/14/16
ERH116	AZ45867	Water	11/14/16
ERH120	AZ45868	Water	11/14/16
ERH115MS	AZ45866MS	Water	11/14/16
ERH115MSD	AZ45866MSD	Water	11/14/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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%.

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% 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH115 and ERH116 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Laboratory Blank Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Field Blank Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

LDC #: 37669A2a
 SDG #: 81492
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C

Date: 12/21/16
 Page: 6 of 1
 Reviewer: EF
 2nd Reviewer: TE

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	% RSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration /closing cv	A	CV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LD
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
 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	ERH115 D	AZ45866	Water	11/14/16
2	ERH116 D	AZ45867	Water	11/14/16
3	ERH120	AZ45868	Water	11/14/16
4	ERH115MS	AZ45866MS	Water	11/14/16
5	ERH115MSD	AZ45866MSD	Water	11/14/16
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8				

Notes:

161117A				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81492

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH115	AZ45866	Water	11/14/16
ERH116	AZ45867	Water	11/14/16
ERH120	AZ45868	Water	11/14/16
ERH115MS	AZ45866MS	Water	11/14/16
ERH115MSD	AZ45866MSD	Water	11/14/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH115 and ERH116 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification
Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -
SDG 81492**

No Sample Data Qualified in this SDG

LDC #: 37669A2b
 SDG #: 81492
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C

Date: 12/21/16
 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 / closing CV	A	CV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	ICS
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	ERH115 D	AZ45866	Water	11/14/16
2	ERH116 D	AZ45867	Water	11/14/16
3	ERH120	AZ45868	Water	11/14/16
4	ERH115MS	AZ45866MS	Water	11/14/16
5	ERH115MSD	AZ45866MSD	Water	11/14/16
6				
7				
8				

Notes:

161118A				

TTT, W, S only

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81492

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH115	AZ45866	Water	11/14/16
ERH116	AZ45867	Water	11/14/16
ERH120	AZ45868	Water	11/14/16
ERH115MS	AZ45866MS	Water	11/14/16
ERH115MSD	AZ45866MSD	Water	11/14/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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%.

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 and MS/MSD percent recoveries were within QC limits. Additionally, all 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH115 and ERH116 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81492**

No Sample Data Qualified in this SDG

LDC #: 37669A2c
 SDG #: 81492
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C

Date: 12/21/16

Page: 1 of 1

Reviewer: FP

2nd Reviewer: PC

Modified

METHOD: GC/MS 2-(2-Methoxyethoxy)-Ethanol (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	DF T P P
III.	Initial calibration/ICV	A, A	r ²
IV.	Continuing calibration / closing CW	Δ	ICV ≤ 20 CCV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	Δ	LC S
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	ERH115	AZ45866	Water	11/14/16
2	ERH116	AZ45867	Water	11/14/16
3	ERH120	AZ45868	Water	11/14/16
4	ERH115MS	AZ45866MS	Water	11/14/16
5	ERH115MSD	AZ45866MSD	Water	11/14/16
6				
7				
8				

Notes:

161118A				

LDC #: 37669 ADC

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, since the LCS and MS/MSD percent recoveries were within QC limits. Additionally, all 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 0053

LDC Report Date: January 3, 2017

Parameters: Metals

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81492

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH115	AZ45866	Water	11/14/16
ERH120	AZ45868	Water	11/14/16
ERH115MS	AZ45866MS	Water	11/14/16
ERH115MSD	AZ45866MSD	Water	11/14/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 analysis was performed on an associated project sample. Percent differences (%D) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Metals - Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Metals - Laboratory Blank Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Metals - Field Blank Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

LDC #: 37669A4b
 SDG #: 81492
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 12/27/16
 Page: 1 of 1
 Reviewer: JD
 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	11/14/16
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	MSID = (3.4)
VII.	Duplicate sample analysis	N	
VIII.	Serial Dilution	A	SER = (1)
IX.	Laboratory control samples	A	LCS
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	ERH115	AZ45866	Water	11/14/16
2	ERH120	AZ45868	Water	11/14/16
3	ERH115MS	AZ45866MS	Water	11/14/16
4	ERH115MSD	AZ45866MSD	Water	11/14/16
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				

Notes: _____

LDC #: 3769A46

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page: 1 of 1
Reviewer: SD
2nd reviewer: A

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1-2	W	Al, Sb, As, Ba, Be, Cd, <u>Ca</u> , Cr, Co, Cu, Fe, Pb, <u>Mg</u> , <u>Mn</u> , Hg, Ni, <u>K</u> , Se, Ag, <u>Na</u> , Ti, V, Zn, Mo, B, Sn, Ti,
		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,
2C-3-4	W	Al, Sb, As, Ba, Be, Cd, <u>Ca</u> , Cr, Co, Cu, Fe, Pb, <u>Mg</u> , <u>Mn</u> , Hg, Ni, <u>K</u> , Se, Ag, <u>Na</u> , Ti, V, Zn, Mo, B, Sn, Ti,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
Analysis Method		
ICP		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,
ICP-MS		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,
GFAA		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,

Comments: Mercury by CVAA if performed

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Wet Chemistry

Validation Level: Level C

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81492

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH115	AZ45866	Water	11/14/16
ERH120	AZ45868	Water	11/14/16
ERH115MS	AZ45866MS	Water	11/14/16
ERH115MSD	AZ45866MSD	Water	11/14/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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, and Sulfate by Environmental Protection Agency (EPA) Method 300.0

Ferrous Iron by Standard Method 3500 Fe B

Silica and Dissolved Silica by Standard Method 4500 Si

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. 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	Associated Samples
PB (prep blank)	Alkalinity	1.6 mg/L	All samples in SDG 81492

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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
ERH115MS/MSD (ERH115)	Chloride Silica	114 (90-110) 133 (80-120)	112 (90-110) -	J (all detects) J (all detects)	A

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) were analyzed as required by the methods. Percent recoveries (%R) 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. No results were rejected in this SDG.

Due to MS/MSD %R, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Data Qualification Summary - SDG 81492**

Sample	Analyte	Flag	A or P	Reason
ERH115	Chloride Silica	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R) (Q)

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Field Blank Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

LDC #: 37669A6
 SDG #: 81492
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 12/21/16
 Page: 1 of 1
 Reviewer: SS
 2nd Reviewer: AK

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Fluoride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B), Silica, Dissolved Silica (SM4500-Si)

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	11/14/16
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	SW	
V.	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	MSD = (3.4)
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
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	ERH115	AZ45866	Water	11/14/16
2	ERH120	AZ45868	Water	11/14/16
3	ERH115MS	AZ45866MS	Water	11/14/16
4	ERH115MSD	AZ45866MSD	Water	11/14/16
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes: _____

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

All circled methods are applicable to each sample.

Sample ID	Parameter
1-2	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄ Br Fe ²⁺ Silica Diss Silica
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
QC13-4	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄ Br Fe ²⁺ Silica Diss Silica
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄

Comments: _____

VALIDATION FINDINGS WORKSHEET
Blanks

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)		No Qualifiers													
Alkalinity	1.6		8														

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".

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

METHOD: Trace metals (EPA SW 846 Method 6010/7000)

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

- N N/A Was a matrix spike analyzed for each matrix in this SDG?
- Y N N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.
- Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for samples?

LEVEL IV ONLY:

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

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
	3/4	W	Cl	114 (90-110)	112 (90-110)		1	Jdet/A (det) (Q)
			Silica W	133 (80-120)				Jdet/A (det) (Q)

Comments: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Total Petroleum Hydrocarbons as Gasoline

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81492

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH114	AZ45865	Water	11/14/16
ERH115	AZ45866	Water	11/14/16
ERH116	AZ45867	Water	11/14/16
ERH120	AZ45868	Water	11/14/16
ERH115MS	AZ45866MS	Water	11/14/16
ERH115MSD	AZ45866MSD	Water	11/14/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 Gasoline 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 ERH114 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH115 and ERH116 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG
81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification
Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification
Summary - SDG 81492**

No Sample Data Qualified in this SDG

LDC #: 37669A7

VALIDATION COMPLETENESS WORKSHEET

SDG #: 81492

Level C

Laboratory: APPL, Inc.

Date: 12/21/16

Page: 1 of 1

Reviewer: FJ

2nd Reviewer: AE

METHOD: GC/MS TPH as Gasoline (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	F7
III.	Initial calibration/ICV	A, Δ	70% r ² CV ≤ 20
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	FB = 1
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	A	UCS
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
 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	ERH114	AZ45865	Water	11/14/16
2	ERH115	AZ45866	Water	11/14/16
3	ERH116	AZ45867	Water	11/14/16
4	ERH120	AZ45868	Water	11/14/16
5	ERH115MS	AZ45866MS	Water	11/14/16
6	ERH115MSD	AZ45866MSD	Water	11/14/16
7				
8				
9				

Notes:

16116 BL				

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

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Total Petroleum Hydrocarbons as Extractables

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81492

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH115	AZ45866	Water	11/14/16
ERH116	AZ45867	Water	11/14/16
ERH120	AZ45868	Water	11/14/16
ERH115MS	AZ45866MS	Water	11/14/16
ERH115MSD	AZ45866MSD	Water	11/14/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH115 and ERH116 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -
SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data
Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification
Summary - SDG 81492**

No Sample Data Qualified in this SDG

LDC #: 37669A8

VALIDATION COMPLETENESS WORKSHEET

Date: 12/21/16

SDG #: 81492

Level C

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: FD

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 / Δ	
II.	Initial calibration/ICV	Δ / Δ	% PSD ≤ 20 ICV ≤ 20
III.	Continuing calibration	Δ	CN ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	N	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	ICS
IX.	Field duplicates	ND	D = 1, 2
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	ERH115 <u>D</u>	AZ45866	Water	11/14/16
2	ERH116 <u>D</u>	AZ45867	Water	11/14/16
3	ERH120	AZ45868	Water	11/14/16
4	ERH115MS	AZ45866MS	Water	11/14/16
5	ERH115MSD	AZ45866MSD	Water	11/14/16
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11				
12				

Notes:

16118A				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Methane

Validation Level: Level C

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81492

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH114	AZ45865	Water	11/14/16
ERH115	AZ45866	Water	11/14/16
ERH120	AZ45868	Water	11/14/16
ERH115MS	AZ45866MS	Water	11/14/16
ERH115MSD	AZ45866MSD	Water	11/14/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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).
- 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 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 ERH114 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
ERH115MS/MSD (ERH115)	Methane	143 (73-125)	150 (73-125)	NA	-

Relative percent differences (RPD) were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Laboratory Blank Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Field Blank Data Qualification Summary - SDG 81492**

No Sample Data Qualified in this SDG

LDC #: 37669A51

VALIDATION COMPLETENESS WORKSHEET

Date: 12/21/16

SDG #: 81492

Level C

Page: 1 of 1

Laboratory: APPL Labs

Reviewer: #2
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	Δ/Δ	
II.	Initial calibration/ICV	Δ/Δ	r^2 $ICV \leq 20$
III.	Continuing calibration	Δ	$CCV \leq 20$
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	TB = 1
VI.	Matrix spike/Matrix spike duplicates	SW	
VII.	Laboratory control samples	Δ	ICS
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	ERH114 TB	AZ45865	Water	11/14/16
2	ERH115	AZ45866	Water	11/14/16
3	ERH120	AZ45868	Water	11/14/16
4	ERH115MS	AZ45866MS	Water	11/14/16
5	ERH115MSD	AZ45866MSD	Water	11/14/16
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13				

Notes:

161119A				

LDC #: 37669AS1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

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

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 matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?
Y/N/N/A Was an MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed?
Y/N/N/A Were the MS/MSD percent recoveries (%R) and relative percent differences (RPD) within QC limits?

Code = Q

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	<u>4+5</u>	<u>Methane</u>	<u>143 (73-125)</u>	<u>150 (73-125)</u>	<u>()</u>	<u>2</u>	<u>Jan/A (ND)</u>
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**Red Hill Bulk Storage Facility, CTO 0053 - SDG 81492
LDC 37669**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 2320B													
ERH115	AZ45866	1	ALKALINITY, AS CaCO3	11/14/2016 11:20:00 AM	11/15/2016 8:28:00 PM	C	67.4	MG_L		2.0	1.70		
ERH115	AZ45866	1	ALKALINITY, BICARBONATE	11/14/2016 11:20:00 AM	11/15/2016 8:28:00 PM	C	67.4	MG_L		2.0	1.70		
ERH115	AZ45866	1	ALKALINITY, CARBONATE	11/14/2016 11:20:00 AM	11/15/2016 8:28:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH120	AZ45868	1	ALKALINITY, AS CaCO3	11/14/2016 10:55:00 AM	11/15/2016 9:05:00 PM	C	108	MG_L		2.0	1.70		
ERH120	AZ45868	1	ALKALINITY, BICARBONATE	11/14/2016 10:55:00 AM	11/15/2016 9:05:00 PM	C	108	MG_L		2.0	1.70		
ERH120	AZ45868	1	ALKALINITY, CARBONATE	11/14/2016 10:55:00 AM	11/15/2016 9:05:00 PM	C	1.70	MG_L	U	2.0	1.70		U
METHOD: 300.0													
ERH115	AZ45866	1	BROMIDE	11/14/2016 11:20:00 AM	11/15/2016 12:19:00 PM	C	0.36	MG_L	J	0.5	0.16		J
ERH115	AZ45866	2	CHLORIDE	11/14/2016 11:20:00 AM	11/15/2016 2:04:00 PM	C	72.3	MG_L	D	2.0	0.40		J q
ERH115	AZ45866	1	FLUORIDE	11/14/2016 11:20:00 AM	11/15/2016 12:19:00 PM	C	0.24	MG_L		0.1	0.09		
ERH115	AZ45866	1	NITRATE	11/14/2016 11:20:00 AM	11/15/2016 12:19:00 PM	C	2.9	MG_L		0.5	0.18		
ERH115	AZ45866	1	SULFATE	11/14/2016 11:20:00 AM	11/15/2016 12:19:00 PM	C	18.5	MG_L		1.0	0.20		
ERH120	AZ45868	2	BROMIDE	11/14/2016 10:55:00 AM	11/15/2016 12:32:00 PM	C	1.3	MG_L		1.0	0.32		
ERH120	AZ45868	10	CHLORIDE	11/14/2016 10:55:00 AM	11/15/2016 2:17:00 PM	C	365	MG_L	D	10.0	2.00		
ERH120	AZ45868	2	FLUORIDE	11/14/2016 10:55:00 AM	11/15/2016 12:32:00 PM	C	0.23	MG_L		0.2	0.18		
ERH120	AZ45868	2	NITRATE	11/14/2016 10:55:00 AM	11/15/2016 12:32:00 PM	C	3.0	MG_L		1.0	0.36		
ERH120	AZ45868	2	SULFATE	11/14/2016 10:55:00 AM	11/15/2016 12:32:00 PM	C	81.8	MG_L		2.0	0.40		
METHOD: 3500_FE_B													
ERH115	AZ45866	1	IRON, FERROUS	11/14/2016 11:20:00 AM	11/15/2016 11:39:00 AM	C	0.32	MG_L	U	1.0	0.32		U
ERH120	AZ45868	1	IRON, FERROUS	11/14/2016 10:55:00 AM	11/15/2016 11:40:00 AM	C	0.32	MG_L	U	1.0	0.32		U
METHOD: 4500_SI_D													
ERH115	AZ45866	5	SILICA	11/14/2016 11:20:00 AM	11/21/2016 12:43:00 PM	C	51.9	MG_L		5.0	4.00		J q
ERH115	AZ45866	5	SILICA	11/14/2016 11:20:00 AM	11/21/2016 3:06:00 PM	C	53.0	MG_L		5.0	4.00		
ERH120	AZ45868	5	SILICA	11/14/2016 10:55:00 AM	11/21/2016 3:09:00 PM	C	71.2	MG_L		5.0	4.00		
ERH120	AZ45868	5	SILICA	11/14/2016 10:55:00 AM	11/21/2016 12:44:00 PM	C	72.1	MG_L		5.0	4.00		
METHOD: 6010C													

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 6010C													
ERH115	AZ45866	1	CALCIUM	11/14/2016 11:20:00 AM	11/22/2016 5:05:00 PM	C	15800	UG_L		1000	75.0		
ERH115	AZ45866	1	MAGNESIUM	11/14/2016 11:20:00 AM	11/22/2016 5:05:00 PM	C	15400	UG_L		500	30.0		
ERH115	AZ45866	1	MANGANESE	11/14/2016 11:20:00 AM	11/22/2016 5:05:00 PM	C	4.00	UG_L	U	10.0	4.00	U	
ERH115	AZ45866	1	POTASSIUM	11/14/2016 11:20:00 AM	11/22/2016 5:05:00 PM	C	2230	UG_L	J	3000	500.0	J	
ERH115	AZ45866	1	SODIUM	11/14/2016 11:20:00 AM	11/22/2016 5:05:00 PM	C	42200	UG_L		5000	500.0		
ERH120	AZ45868	1	CALCIUM	11/14/2016 10:55:00 AM	11/22/2016 5:31:00 PM	C	35100	UG_L		1000	75.0		
ERH120	AZ45868	1	MAGNESIUM	11/14/2016 10:55:00 AM	11/22/2016 5:31:00 PM	C	54900	UG_L		500	30.0		
ERH120	AZ45868	1	MANGANESE	11/14/2016 10:55:00 AM	11/22/2016 5:31:00 PM	C	4.00	UG_L	U	10.0	4.00	U	
ERH120	AZ45868	1	POTASSIUM	11/14/2016 10:55:00 AM	11/22/2016 5:31:00 PM	C	2330	UG_L	J	3000	500.0	J	
ERH120	AZ45868	20	SODIUM	11/14/2016 10:55:00 AM	11/22/2016 4:32:00 PM	C	165000	UG_L	D	100000	10000.0		
METHOD: 8015B_E													
ERH115	AZ45866	1	TPH-DIESEL RANGE	11/14/2016 11:20:00 AM	11/21/2016 5:25:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH115	AZ45866	1	TPH-OIL RANGE	11/14/2016 11:20:00 AM	11/21/2016 5:25:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH116	AZ45867	1	TPH-DIESEL RANGE	11/14/2016 11:20:00 AM	11/21/2016 5:46:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH116	AZ45867	1	TPH-OIL RANGE	11/14/2016 11:20:00 AM	11/21/2016 5:46:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH120	AZ45868	1	TPH-DIESEL RANGE	11/14/2016 10:55:00 AM	11/21/2016 6:06:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH120	AZ45868	1	TPH-OIL RANGE	11/14/2016 10:55:00 AM	11/21/2016 6:06:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
METHOD: 8260B													
ERH114	AZ45865	1	BENZENE	11/14/2016 11:00:00 AM	11/17/2016 10:08:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH114	AZ45865	1	ETHYLBENZENE	11/14/2016 11:00:00 AM	11/17/2016 10:08:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH114	AZ45865	1	TOLUENE	11/14/2016 11:00:00 AM	11/17/2016 10:08:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH114	AZ45865	1	TPH-GASOLINE RANGE C6-C10	11/14/2016 11:00:00 AM	11/17/2016 10:07:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH114	AZ45865	1	XYLENES, TOTAL	11/14/2016 11:00:00 AM	11/17/2016 10:08:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH115	AZ45866	1	BENZENE	11/14/2016 11:20:00 AM	11/17/2016 10:35:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH115	AZ45866	1	ETHYLBENZENE	11/14/2016 11:20:00 AM	11/17/2016 10:35:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH115	AZ45866	1	TOLUENE	11/14/2016 11:20:00 AM	11/17/2016 10:35:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH115	AZ45866	1	TPH-GASOLINE RANGE C6-C10	11/14/2016 11:20:00 AM	11/17/2016 10:36:00 AM	C	18.0	UG_L	U	20	18.0	U	

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8260B													
ERH115	AZ45866	1	XYLENES, TOTAL	11/14/2016 11:20:00 AM	11/17/2016 10:35:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH116	AZ45867	1	BENZENE	11/14/2016 11:20:00 AM	11/17/2016 11:03:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH116	AZ45867	1	ETHYLBENZENE	11/14/2016 11:20:00 AM	11/17/2016 11:03:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH116	AZ45867	1	TOLUENE	11/14/2016 11:20:00 AM	11/17/2016 11:03:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH116	AZ45867	1	TPH-GASOLINE RANGE C6-C10	11/14/2016 11:20:00 AM	11/17/2016 11:04:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH116	AZ45867	1	XYLENES, TOTAL	11/14/2016 11:20:00 AM	11/17/2016 11:03:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH120	AZ45868	1	BENZENE	11/14/2016 10:55:00 AM	11/17/2016 11:33:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH120	AZ45868	1	ETHYLBENZENE	11/14/2016 10:55:00 AM	11/17/2016 11:33:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH120	AZ45868	1	TOLUENE	11/14/2016 10:55:00 AM	11/17/2016 11:33:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH120	AZ45868	1	TPH-GASOLINE RANGE C6-C10	11/14/2016 10:55:00 AM	11/17/2016 11:32:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH120	AZ45868	1	XYLENES, TOTAL	11/14/2016 10:55:00 AM	11/17/2016 11:33:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
METHOD: 8270D													
ERH115	AZ45866	1	2-(2-METHOXYETHOXY)-ETHANOL	11/14/2016 11:20:00 AM	11/23/2016 4:50:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH115	AZ45866	1	PHENOL	11/14/2016 11:20:00 AM	11/28/2016 1:39:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH116	AZ45867	1	2-(2-METHOXYETHOXY)-ETHANOL	11/14/2016 11:20:00 AM	11/23/2016 5:19:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH116	AZ45867	1	PHENOL	11/14/2016 11:20:00 AM	11/28/2016 2:09:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH120	AZ45868	1	2-(2-METHOXYETHOXY)-ETHANOL	11/14/2016 10:55:00 AM	11/23/2016 5:48:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH120	AZ45868	1	PHENOL	11/14/2016 10:55:00 AM	11/28/2016 2:39:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
METHOD: 8270D_SIM													
ERH115	AZ45866	1	1-METHYLNAPHTHALENE	11/14/2016 11:20:00 AM	11/23/2016 7:42:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH115	AZ45866	1	2-METHYLNAPHTHALENE	11/14/2016 11:20:00 AM	11/23/2016 7:42:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH115	AZ45866	1	NAPHTHALENE	11/14/2016 11:20:00 AM	11/23/2016 7:42:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH116	AZ45867	1	1-METHYLNAPHTHALENE	11/14/2016 11:20:00 AM	11/23/2016 8:14:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH116	AZ45867	1	2-METHYLNAPHTHALENE	11/14/2016 11:20:00 AM	11/23/2016 8:14:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH116	AZ45867	1	NAPHTHALENE	11/14/2016 11:20:00 AM	11/23/2016 8:14:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH120	AZ45868	1	1-METHYLNAPHTHALENE	11/14/2016 10:55:00 AM	11/29/2016 5:27:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH120	AZ45868	1	2-METHYLNAPHTHALENE	11/14/2016 10:55:00 AM	11/29/2016 5:27:00 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
METHOD: 8270D_SIM													
ERH120	AZ45868	1	NAPHTHALENE	11/14/2016 10:55:00 AM	11/29/2016 5:27:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
METHOD: RSK-175													
ERH114	AZ45865	1	METHANE	11/14/2016 11:00:00 AM	11/19/2016 12:21:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH115	AZ45866	1	METHANE	11/14/2016 11:20:00 AM	11/19/2016 12:23:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH120	AZ45868	1	METHANE	11/14/2016 10:55:00 AM	11/19/2016 12:30:00 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 0053

LDC Report Date: January 3, 2017

Parameters: Volatiles

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81500

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH117	AZ45907	Water	11/14/16
ERH121	AZ45908	Water	11/14/16
ERH122**	AZ45909**	Water	11/15/16
ERH126	AZ45910	Water	11/15/16
ERH128	AZ45911	Water	11/14/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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. 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

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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Laboratory Blank Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Field Blank Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

LDC #: 37669B1
 SDG #: 81500
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 12/21/16
 Page: 1 of 1
 Reviewer: F7
 2nd Reviewer: A

METHOD: GC/MS Volatiles (BTEX) (EPA SW 846 Method 8260B)
 + 1, 2 - DCA

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	% RSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration /closing CV	Δ	CV ≤ 20
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	LC9
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	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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH117	AZ45907	Water	11/14/16
2	ERH121	AZ45908	Water	11/14/16
3	ERH122** + 1, 2 - DCA	AZ45909**	Water	11/15/16
4	ERH126	AZ45910	Water	11/15/16
5	ERH128	AZ45911	Water	11/14/16
6				
7				
8				
9				

Notes:

16116AL				

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	/			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of > 0.990?			/	
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) > 0.05?	/			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	/			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?		/		
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	/			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			/	

VALIDATION FINDINGS CHECKLIST

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
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. 1,1,1,2-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
Initial Calibration Calculation Verification

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 5 std)	Recalculated (RRF 5 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	11/13/2016	V (IS 1)	2.055	2.055	1.9710	1.9710	3.8	3.8
	Loki		EE (IS 2)	2.462	2.462	2.3520	2.3520	2.8	2.8

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	eev 1116416	11/16/16	✓ (IS1)	1.9710	2.024	2.024	2.7	2.7
			EE (IS2)	2.3520	2.358	2.358	0.27	0.27
			(IS3)					
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3								
4								

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: #3

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane	25.0	23.69936	94.8	94.8	0
1,2-Dichloroethane-d4	↓	25.85782	103	103	↓
Toluene-d8	↓	25.57125	102	102	↓
Bromofluorobenzene	↓	24.90298	99.6	99.6	↓

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 #: 37669B1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

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

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: 16116AL LCS

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	NA	10.3	NA	103	103				
Toluene	10.0	↓	10.0	↓	100	100	NA			
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.

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

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?

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

- A_x = Area of the characteristic ion (EICP) for the compound to be measured
- A_s = 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. 105, ✓:

$$\text{Conc.} = \frac{592552 (25.0)}{731776 (1.9710)}$$

=
 10.3 ug/L

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Phenol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81500

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH117	AZ45907	Water	11/14/16
ERH121	AZ45908	Water	11/14/16
ERH122**	AZ45909**	Water	11/15/16
ERH126	AZ45910	Water	11/15/16
ERH128	AZ45911	Water	11/14/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Laboratory Blank Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Field Blank Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

LDC #: 37669B2a
 SDG #: 81500
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 12/21/16
 Page: 1 of 1
 Reviewer: FJ
 2nd Reviewer: JL

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 1A	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	A 1A	% PSD ≤ 15 1CV ≤ 20.
IV.	Continuing calibration / closing CV	A	CV ≤ 20
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	LCS
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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH117	AZ45907	Water	11/14/16
2	ERH121	AZ45908	Water	11/14/16
3	ERH122**	AZ45909**	Water	11/15/16
4	ERH126	AZ45910	Water	11/15/16
5	ERH128	AZ45911	Water	11/14/16
6				
7				
8				

Notes:

16117A				

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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) 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?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) < 20%?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed 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 completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?		/		
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
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?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37669B2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: [Signature]

METHOD: GCMS 8270A ^P

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 40 std)	Recalculated (RRF40 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	11/17/2016	A	2.010	2.010	1.996	1.996	1.40	1.40
	Yoda								

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, A_{is} = Area of associated internal standard
 C_x = Concentration of compound, 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	1117Y116	11/28/16	A (1st IS)	1.996	2.082	2.082	4.3	4.3
			(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	93.458	55.7207	59.6	59.6	0
2-Fluorobiphenyl	↓	56.70435	60.7	60.7	
Terphenyl-d14	↓	59.32207	63.5	63.5	
Phenol-d5	186.916	39.86381	21.3	21.3	
2-Fluorophenol	↓	68.6528	36.7	36.7	
2,4,6-Tribromophenol	↓	121.88369	65.2	65.2	↓
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					

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

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: 16117A

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	50.0	NA	17.7	NA	35.4	35.4	NA	→		
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.

LDC #: 37669B2a

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Sample Calculation Verification

Reviewer: FT

2nd reviewer: AE

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

Y N/A
Y 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?

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

Example:

Sample I.D. 16117A, LC5

$$\text{Conc.} = \frac{141622 (40.0) (1) (1000)}{160801 (1.996) (1000)} = 17.7 \text{ ug/L}$$

- 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)
- V_s = Volume or weight of sample extract in milliliters (ml) or grams (g).
- V_i = Volume of extract injected in microliters (ul)
- V_t = 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

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81500

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH117	AZ45907	Water	11/14/16
ERH121	AZ45908	Water	11/14/16
ERH122**	AZ45909**	Water	11/15/16
ERH126	AZ45910	Water	11/15/16
ERH128	AZ45911	Water	11/14/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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

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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification
Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -
SDG 81500**

No Sample Data Qualified in this SDG

LDC #: 37669B2b
 SDG #: 81500
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 12/21/16
 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	Δ	
III.	Initial calibration/ICV	A Δ	$\%RSD \leq 15$ $ICV \leq 20$
IV.	Continuing calibration / closing COV	A	$COV \leq 20$
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	LCs
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	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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH117	AZ45907	Water	11/14/16
2	ERH121	AZ45908	Water	11/14/16
3	ERH122**	AZ45909**	Water	11/15/16
4	ERH126	AZ45910	Water	11/15/16
5	ERH128	AZ45911	Water	11/14/16
6				
7				
8				

Notes:

16118A					

TTT, W, S only

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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) 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?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) ≤ 20%?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed 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 completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?		/		
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
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 ?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII: Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX: Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X: Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
XI: Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII: Compound quantitation				
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?	/			
XIII: Target compound identification				
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?	/			
XIV: System performance				
System performance was found to be acceptable.	/			
XV: Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37669B26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GCMS 8270 ^D

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 (RRF5 std)	Recalculated (RRF 5 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL Linus	10/26/2016	S (IS1)	1.079	1.079	1.020	1.020	5.80	5.80

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	10262316	11/23/16	S	1.020	1.054	1.054	3.3	3.3
			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th 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 #: 37669B26

VALIDATION FINDINGS WORKSHEET

Surrogate Results Verification

Page: 1 of 1Reviewer: FT2nd reviewer: π**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 SpikedSample ID: #3

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	4.673	3.25984	69.8	69.8	0
2-Fluorobiphenyl	↓	2.42922	53.3	53.3	↓
Terphenyl-d14	↓	3.31401	70.9	70.9	↓
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					

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

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: 16118A LCS

Compound	Spike Added (<u>4g/L</u>)		Spike Concentration (<u>4g/L</u>)		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>S</u>	<u>5.0</u>	<u>NA</u>	<u>3.24</u>	<u>NA</u>	<u>64.8</u>	<u>64.8</u>	<u>NA</u>	<u>---</u>	<u>---</u>	<u>---</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.

LDC #: 37669B26

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

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?

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

- 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)
- V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).
- V_i = Volume of extract injected in microliters (ul)
- V_t = 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. 16118A LCS S

$$\text{Conc.} = \frac{3055 (2.5) (1) (1000)}{2312 (1.020) (1000)}$$

=
3.24 ug/L

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81500

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH117	AZ45907	Water	11/14/16
ERH121	AZ45908	Water	11/14/16
ERH122**	AZ45909**	Water	11/15/16
ERH126	AZ45910	Water	11/15/16
ERH128	AZ45911	Water	11/14/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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%.

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 percent recoveries were within QC limits. Additionally, all 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) were analyzed as required by the method. Percent recoveries (%R) 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 with the exception noted in Section VII. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81500**

No Sample Data Qualified in this SDG

LDC #: 37669B2c
 SDG #: 81500
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 12/21/16

Page: 1 of 1

Reviewer: FZ
 2nd Reviewer: K

Modified

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

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	1, 2 ICV ≤ 20
IV.	Continuing calibration / closing CCV	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH117	AZ45907	Water	11/14/16
2	ERH121	AZ45908	Water	11/14/16
3	ERH122**	AZ45909**	Water	11/15/16
4	ERH126	AZ45910	Water	11/15/16
5	ERH128	AZ45911	Water	11/14/16
6				
7				
8				

Notes:

161118A				

LDC #: 37669B2c

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: FJ
2nd Reviewer: R**Method:** Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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 ?	/			
IIIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) $< 20\%$?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) $\leq 20\%$ and relative response factors (RRF) within method criteria?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed 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 completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?		/		
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
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?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37669B2C

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

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

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
		Surrogates were not added to all samples as required by the method. Using professional judgment, no data were qualified, since the LCS percent recoveries were within QC limits. Additionally, all surrogate percent recoveries were within QC limits in the phenol analysis.		
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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

LDC#: 37669B2c
 SDG#: see cover

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

Method: GCMS 8270D Modified

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
10/23/2016	Yoda	2-(2-Methoxyethoxy)ethanol	1	0.16913682	2.5
			2	0.508719353	5
			3	1.985671266	10
			4	2.585315275	12.5
			5	3.229177548	15
			6	4.416010128	20
			7	5.520756674	25

Regression Output

Reported

Constant	-0.518212	-0.518212
Std Err of Y Est		
R Squared	0.997237	0.999000
Degrees of Freedom		
X Coefficient(s)	0.244914	0.244914
Std Err of Coef.		
Correlation Coefficient	0.998617	
Coefficient of Determination (r ²)	0.997237	0.999000

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, A_{is} = Area of associated internal standard
 C_x = Concentration of compound, 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	11234012	11/23/16	2- (2-MEE) (1st IS)	500.0	545.837	545.837	9.2	9.2
			(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.

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

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: 16118 A

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>SDO</u>	<u>NA</u>	<u>407</u>	<u>NA</u>	<u>81.4</u>	<u>81.4</u>	<u>NA</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.

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

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_x = Area of the characteristic ion (EICP) for the compound to be measured
- A_s = Area of the characteristic ion (EICP) for the specific internal standard
- I_s = Amount of internal standard added in nanograms (ng)
- V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).
- V_i = Volume of extract injected in microliters (ul)
- V_t = 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. 161118A LoS : 2-(2-MEE)

Conc. =
$$\frac{\left(\frac{372254}{188487} + 0.518 \right) (40)}{0.245}$$

= 407 ug / L

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Metals

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81500

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH117	AZ45907	Water	11/14/16
ERH121	AZ45908	Water	11/14/16
ERH122**	AZ45909**	Water	11/15/16
ERH126	AZ45910	Water	11/15/16
ERH128	AZ45911	Water	11/14/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Metals - Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Metals - Laboratory Blank Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Metals - Field Blank Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

LDC #: 37669B4b
 SDG #: 81500
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 12/21/16
 Page: of 1
 Reviewer: SD
 2nd Reviewer: A

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	11/14-15/16
II.	Instrument Calibration	A	
III.	ICP Interference Check Sample (ICS) Analysis	A	
IV.	Laboratory Blanks	A	
V.	Field Blanks	2	
VI.	Matrix Spike/Matrix Spike Duplicates	2	CS
VII.	Duplicate sample analysis	2	
VIII.	Serial Dilution	2	Not Performed
IX.	Laboratory control samples	A	ICS
X.	Field Duplicates	2	
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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH117	AZ45907	Water	11/14/16
2	ERH121	AZ45908	Water	11/14/16
3	ERH122**	AZ45909**	Water	11/15/16
4	ERH126	AZ45910	Water	11/15/16
5	ERH128	AZ45911	Water	11/14/16
6				
7				
8				
9				
10				
11				
12				
13				
14				

Notes: _____

Method: Metals (EPA SW 846 Method 6010B/7000/6020)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	/			
Cooler temperature criteria was met.	/			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?			/	
Were %RSD of isotopes in the tuning solution $\leq 5\%$?			/	
III. Calibration				
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 all initial calibration correlation coefficients > 0.995 ?	/			
IV. Blanks				
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.		/		
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	/			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	/			
VI. Matrix spike/Matrix spike duplicates				
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 $\pm RL$ ($\pm 2X RL$ 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.			/	
VII. Laboratory control samples				
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?	/			

VALIDATION FINDINGS CHECKLIST

Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
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?			/	
IX. ICP Serial Dilution				
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.			/	
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.		/		
Target analytes were detected in the field duplicates.			/	
XIII. Field blanks				
Field blanks were identified in this SDG.		/		
Target analytes were detected in the field blanks.			/	

LDC #: 3769B44

VALIDATION FINDINGS WORKSHEET Sample Specific Element Reference

Page: 1 of 1
Reviewer: SS
2nd reviewer: A

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1-5		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, <u>Mg</u> , <u>Mn</u> , Hg, Ni, K, Se, Ag, Na, <u>B</u> , Ti, V, Zn, Mo, B, Sn, Ti,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
		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,
Analysis Method		
ICP		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,
ICP-MS		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,
GFAA		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,

Comments: Mercury by CVAA if performed

LDC #: 3769 Bbb

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

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

METHOD: Trace Metals (See cover)

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	
<u>ICV</u> <u>13-03</u>	ICP (Initial calibration)	<u>Ca</u>	<u>12810 ug/L</u>	<u>12500 ug/L</u>	<u>102%R</u>	<u>102%R</u>	<u>Y</u>
	ICP/MS (Initial calibration)						
	CVAA (Initial calibration)						
<u>CCV</u> <u>10-88</u>	ICP (Continuing calibration)	<u>Mg</u>	<u>19470 ug/L</u>	<u>18750 ug/L</u>	<u>104%R</u>	<u>104%R</u>	<u>Y</u>
	ICP/MS (Continuing calibration)						
	CVAA (Contining calibration)						
	GFAA (Initial calibration)						
	GFAA (Continuing calibration)						

Comments: _____

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

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	
<u>IC5AB</u> <u>13:19</u>	ICP interference check	<u>Mn</u>	<u>234 µg/L</u>	<u>250 µg/L</u>	<u>93.6%R</u>	<u>93.6%R</u>	<u>Y</u>
<u>LCS</u> <u>15:28</u>	Laboratory control sample	<u>Na</u>	<u>2690 µg/L</u>	<u>28000 µg/L</u>	<u>105%R</u>	<u>105%R</u>	<u>Y</u>
<u>2</u>	Matrix spike		(SSR-SR)				
<u>2</u>	Duplicate						
<u>2</u>	ICP serial dilution						

Comments: _____

VALIDATION FINDINGS WORKSHEET

Sample Calculation Verification

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

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 and within the linear range of the ICP?
Y/N N/A Are all detection limits below the CRDL?

Detected analyte results for (3) Ca were recalculated and verified using the following equation:

$$\text{Concentration} = \frac{(\text{RD})(\text{FV})(\text{Dil})}{(\text{In. Vol.})}$$

Recalculation:

- RD = Raw data concentration
 FV = Final volume (ml)
 In. Vol. = Initial volume (ml) or weight (G)
 Dil = Dilution factor

RD = 32700 ug/L

#	Sample ID	Analyte	Reported Concentration (ug/L)	Calculated Concentration (ug/L)	Acceptable (Y/N)
	<u>3</u>	<u>Ca</u>	<u>32700</u>	<u>32700</u>	<u>Y</u>
		<u>Mg</u>	<u>12000</u>	<u>12000</u>	↓
		<u>K</u>	<u>5680</u>	<u>5680</u>	
		<u>Na</u>	<u>109000</u>	<u>109000</u>	

Note: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Wet Chemistry

Validation Level: Level C & D

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81500

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH117	AZ45907	Water	11/14/16
ERH121	AZ45908	Water	11/14/16
ERH122**	AZ45909**	Water	11/15/16
ERH126	AZ45910	Water	11/15/16
ERH128	AZ45911	Water	11/14/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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, and Sulfate by Environmental Protection Agency (EPA) Method 300.0

Ferrous Iron by Standard Method 3500 Fe B

Silica and Dissolved Silica by Standard Method 4500 Si

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. 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.

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) were analyzed as required by the methods. Percent recoveries (%R) 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.

XI. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Field Blank Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

LDC #: 37669B6
 SDG #: 81500
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 12/27/16
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Fluoride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B), Silica, Dissolved Silica (SM4500-Si)

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	11/4-15/16
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH117	AZ45907	Water	11/14/16
2	ERH121	AZ45908	Water	11/14/16
3	ERH122**	AZ45909**	Water	11/15/16
4	ERH126	AZ45910	Water	11/15/16
5	ERH128	AZ45911	Water	11/14/16
6				
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12				
13				
14				
15				

Notes: _____

VALIDATION FINDINGS CHECKLIST

Method: Inorganics (EPA Method See Cont())

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	/			
Cooler temperature criteria was met.	/			
II. Calibration				
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)			/	
III. Blanks				
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.		/		
IV. Matrix spike/Matrix spike duplicates and Duplicates				
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 CRDL ($\leq 2X$ CRDL for soil) was used for samples that were $\leq 5X$ the CRDL, including when only one of the duplicate sample values were $\leq 5X$ the CRDL.			/	
V. Laboratory control samples				
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?	/			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?			/	
Were the performance evaluation (PE) samples within the acceptance limits?			/	

VALIDATION FINDINGS CHECKLIST

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

LDC #: 31086

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Page: 1 of 1

Reviewer: JD

2nd reviewer: [Signature]

All circled methods are applicable to each sample.

Sample ID	Parameter
1-5	pH TDS (Cl) (F) (NO ₃) NO ₂ (SO ₄) O-PO ₄ (Alk) CN NH ₃ TKN TOC Cr6+ ClO ₄ (Br) (Fe+2) (Silica) (Diss Silica)
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄

Comments: _____

LDC #: 376986

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 Fe²⁺ was recalculated. Calibration date: 5/20/10

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 ²	r or r ²	
Initial calibration	Fe ²⁺	s1	0.0	0	0.99983	0.99983	Y
		s2	1	0.101			
		s3	2	0.201			
		s4	4	0.403			
		s5	5	0.512			
		s6	10	0.999			
ICV (2:41) Calibration verification	Fe ²⁺	<u>Found</u> 3.01mg/L	<u>True</u> 3mg/L		100.3%R	100.5%R	Y*
ICV 11:09 Calibration verification	Silica	4.11mg/L	4 mg/L		103%R	103%R	Y
ICV (2:37) Calibration verification	Cl	18.18mg/L	20mg/L		90.9%R	91.1%R	Y*

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

Bonding

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

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	
<u>LCS</u>	Laboratory control sample	<u>Alkalinity</u>	<u>242mg/L</u>	<u>250mg/L</u>	<u>96.8%R</u>	<u>96.8%R</u>	
	Matrix spike sample		(SSR-SR)				
	Duplicate sample						

Comments: _____

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

METHOD: Inorganics, Method See Cover

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

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

Compound (analyte) results for (3) Br reported with a positive detect were recalculated and verified using the following equation:

Concentration =
$$\frac{A - (-0.008)}{0.063}$$

Recalculation:
$$\frac{0.032 - (-0.008)}{0.063} = 0.63 \text{ mg/L}$$

A = 0.032

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
	<u>3</u>	<u>Br</u>	<u>0.63</u>	<u>0.63</u>	<u>Y</u>
		<u>Alkalinity</u>	<u>50.8</u>	<u>50.8</u>	<u>Y</u>
		<u>Dissolved Silica</u>	<u>39.0</u>	<u>39.0</u>	<u>Y</u>

Note: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Total Petroleum Hydrocarbons as Gasoline

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81500

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH117	AZ45907	Water	11/14/16
ERH121	AZ45908	Water	11/14/16
ERH122**	AZ45909**	Water	11/15/16
ERH126	AZ45910	Water	11/15/16
ERH128	AZ45911	Water	11/14/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 Gasoline 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

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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG
81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification
Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification
Summary - SDG 81500**

No Sample Data Qualified in this SDG

LDC #: 37669B7

VALIDATION COMPLETENESS WORKSHEET

SDG #: 81500

Level C/D

Laboratory: APPL, Inc.

Date: 12/21/16

Page: 1 of 1

Reviewer: FJ

2nd Reviewer: TE

METHOD: GC/MS TPH as Gasoline (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	Δ, A	10 1 ² ICV ≤ 20
IV.	Continuing calibration	Δ	CCV ≤ 20
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	LCs
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	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:

** Indicates sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH117	AZ45907	Water	11/14/16
2	ERH121	AZ45908	Water	11/14/16
3	ERH122**	AZ45909**	Water	11/15/16
4	ERH126	AZ45910	Water	11/15/16
5	ERH128	AZ45911	Water	11/14/16
6				
7				
8				
9				

Notes:

16/116AL				

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I: Technical holding times				
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"/>	
II: GC/MS Instrument performance check				
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"/>	
IIIa: Initial calibration				
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 > 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) ≥ 0.05 ?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
IIIb: Initial Calibration Verification				
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) $\leq 20\%$ or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV: Continuing calibration				
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) ≥ 0.05 ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
V: Laboratory Blanks				
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 completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VI: Field blanks				
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"/>	
VII: Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	

Validation Area	Yes	No	NA	Findings/Comments
VIII: Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX: Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X: Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
XI: Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII: Compound quantitation				
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?	/			
XIII: Target compound identification				
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?	/			
XIV: System performance				
System performance was found to be acceptable.	/			
XV: Overall assessment of data				
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#: 37669B7
 SDG#: See cover

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
 Reviewer: FZ
 2nd Reviewer: R

Method: GRO (8260B)

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
7/18/2016	GCMS Loki	Gasoline Range Organics	1	10.66716622	0.8
			2	11.62553247	2
			3	13.7084338	4
			4	21.31832367	12
			5	33.10763147	24
			6	40.2471884	32
			7	48.33253021	40

Regression Output

Reported

Constant	9.829751	9.830000
Std Err of Y Est		
R Squared	0.999867	1.000000
Degrees of Freedom		
X Coefficient(s)	0.959918	0.960000
Std Err of Coef.		
Correlation Coefficient	0.999934	
Coefficient of Determination (r ²)	0.999867	1.000000

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	1116412	11/16/16	Gasoline C ₆ -C ₁₀ (IS1)	300	268.5	268.5	10	10.5
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3								
4								

LDC #: 37669B7

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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: # 3

	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>24.90</u>	<u>99.6</u>	<u>99.6</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 #: 3766987

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

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

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: 16116AL LCS

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
gasoline Range										
1,1-Dichloroethene	300	NA	269	NA	89.7	89.7	NA			
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 0053

LDC Report Date: January 9, 2017

Parameters: Total Petroleum Hydrocarbons as Extractables

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81500

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH117	AZ45907	Water	11/14/16
ERH121	AZ45908	Water	11/14/16
ERH122**	AZ45909**	Water	11/15/16
ERH122RE**	AZ45909RE**	Water	11/15/16
ERH126	AZ45910	Water	11/15/16
ERH128	AZ45911	Water	11/14/16
ERH122SGCU**	AZ45909SGCU**	Water	11/15/16

Samples ending in "SGCU" underwent Silica Gel cleanup
 **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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds

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) were analyzed as required by the method. Percent recoveries (%R) 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.

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	Flag	A or P
ERH122RE**	All compounds	R	A

The quality control criteria reviewed, as discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Based upon the data validation, all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -
SDG 81500**

Sample	Compound	Flag	A or P	Reason
ERH122RE**	All compounds	R	A	Overall assessment of data (D)

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data
Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification
Summary - SDG 81500**

No Sample Data Qualified in this SDG

LDC #: 37669B8
 SDG #: 81500
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 12/21/16
 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 / 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	N	CS
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
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	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 was underwent Level D review

SGC = silica gel clean

	Client ID	Lab ID	Matrix	Date
+ 1	ERH117	AZ45907	Water	11/14/16
- 2	ERH121	AZ45908	Water	11/14/16
+ 3	ERH122**	AZ45909**	Water	11/15/16
+ 4	ERH122RE**	AZ45909RE**	Water	11/15/16
- 5	ERH126	AZ45910	Water	11/15/16
- 6	ERH128	AZ45911	Water	11/14/16
- 7	ERH122 w/ SGC **	AZ45909 w/ SGC water	Water	11/15/16
8				
9				
10				
11				
12				

Notes:

1	16118A			
2	16118A1			
3	16118A2 w/ SGC			

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical Holding Times				
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"/>	
II. Initial Calibration				
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"/>	
III. Initial Calibration Verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing Calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
V. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
VI. Field Blanks				
Were field blanks 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"/>	
VII. Surrogate Spikes				
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"/>	
VIII. Matrix Spike/Matrix Spike Duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

LDC #: 37669B8

VALIDATION FINDINGS CHECKLIST

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

Validation Area	Yes	No	NA	Findings/Comments
XIII. Laboratory control samples				
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 QC limits?	/			
XIV. Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
XV. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XVI. Target compound identification				
Were the retention times of reported detects within the RT windows?	/			
XVII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

LDC #: 37669BJ

VALIDATION FINDINGS WORKSHEET Overall Assessment of Data

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

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.

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

Code = D

#	Associated samples	Compounds	Findings	Qualifications
	<u>4</u>	<u>All</u>	<u>original analysis has a higher results</u>	<u>R/A</u>

Comments: _____

LDC #: 37669B8

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=400)	Recalculated (CF4 std=400)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	11/3/2016	Diesel C10-C24)	1625582	Diesel C10-C24)	1727130	1727130	9.6	9.6
	Apollo								

LDC #: 37669B8

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:

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

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	1121002 CCV	11/21/16	Diesel C10-C24	1727130	1694440	1694440	1.9	1.9
2	1130070 CCV	12/1/16	↓	↓	1767250	1767250	2.3	2.3
3	1205002 CCV	12/5/16	↓	↓	1631080	1631080	5.6	5.6
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 #: 3766988

VALIDATION FINDINGS WORKSHEET

Surrogate Results Verification

Page: 1 of 1Reviewer: FT2nd reviewer: STMETHOD: 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 SpikedSample ID: #3

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
octacosane	/	40.0	36.249	90.6	90.6	0
o-terphenyl		40.0	29.182	73.0	73.0	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 #: 37669B8

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT

2nd Reviewer: PK

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: 16118A-LCS

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>90-cw</u> (8015)	<u>1330</u>	<u>NA</u>	<u>988</u>	<u>NA</u>	<u>74.1</u>	<u>74.1</u>	<u>NA</u>	<u>NA</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.

LDC #: 37669 BS

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

$$\text{Concentration} = \frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$$

Example:

Sample ID: # 3 Compound Name Diesel C₁₀-C₂₄

- A= Area or height of the compound to be measured
- Fv= Final Volume of extract
- Df= Dilution Factor
- RF= Average response factor of the compound
In the initial calibration
- Vs= Initial volume of the sample
- Ws= Initial weight of the sample
- %S= Percent Solid

$$\text{Concentration} = \frac{(84673145)(2)(1000)}{(1727130)(2)(1500)} = 33 \text{ ug/L}$$

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Ethylene Dibromide

Validation Level: Level D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81500

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH122	AZ45909	Water	11/15/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 D data validation, which is comprised of the quality control (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.

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.

Retention time windows were established as required by the method.

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

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
11/22/16	ICV	DB-35MS	Ethylene dibromide	22	All samples in SDG 81500	UJ (all non-detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

Retention times of all compounds in the calibration standards were within the established retention time windows.

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

All compound quantitations met validation criteria.

XI. Target Compound Identification

All target compound identifications met validation criteria.

XII. Overall Assessment of Data

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

Due to ICV %D, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Data Qualification Summary - SDG 81500**

Sample	Compound	Flag	A or P	Reason
ERH122	Ethylene dibromide	UJ (all non-detects)	A	Initial calibration verification (%D) (C)

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Laboratory Blank Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Field Blank Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

LDC #: 37669B10

VALIDATION COMPLETENESS WORKSHEET

SDG #: 81500

Level D

Laboratory: APPL, Inc.

Date: 12/21/16

Page: 1 of 1

Reviewer: E7

2nd Reviewer: E7

METHOD: GC Ethylene Dibromide (EPA SW 846 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	Δ / A	
II.	Initial calibration/ICV	A-SW	% PSD ≤ 20, r ² 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	N	CS
VIII.	Laboratory control samples	Δ	LCS
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	Δ	
XI.	Target compound identification	Δ	
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	ERH122	AZ45909	Water	11/15/16
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Notes:

161/22A				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. Initial calibration				
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 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"/>	
III. Initial calibration verification				
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% or percent recoveries (%R) 80-120%?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
V. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
VI. Field Blanks				
Were field blanks 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"/>	
VII. Surrogate spikes				
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"/>	
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

LDC #: 37669B1D

VALIDATION FINDINGS CHECKLIST

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

Validation Area	Yes	No	NA	Findings/Comments
VII. Laboratory control samples				
Was an LCS analyzed for this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was an LCS analyzed per 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"/>	
VIII. Field duplicates				
Were field duplicate pairs identified in this SDG?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Were target compounds detected in the field duplicates?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
IX. Compound quantitation				
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"/>	
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

LDC #: 37669B10

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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".

What type of initial calibration verification calculation was performed? ___%D or ___%R

N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y N N/A Did the initial calibration verification standards meet the %D / %R validation criteria of <20.0% / 80-120%?

code = C

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	11/22/16	1CV	DB-35MS	Ethylbromide	22	All	J/UJ/A ND

LDC#: 37669B10
 SDG#: see cover

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

Method: 8011 Ethylene Dibromide

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
11/22/2016	Herbie	EDB DB-35MS	1	36220	0.04
			2	133557	0.2
			3	330365	0.5
			4	548370	1
			5	826365	1.5
			6	1169605	2

Regression Output

Reported

Constant	18041.906655	NR
Std Err of Y Est		
R Squared	0.995771	NR
Degrees of Freedom		
X Coefficient(s)	560349.343525	NR
Std Err of Coef.		
Correlation Coefficient	0.997883	
Coefficient of Determination (r ²)	0.995771	NR

Linear fit + constant

LDC #: 37669 B1U

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

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	11/22/2016	EDB (DB-35MS)	see curve					
	Herbie		EDB (DB-XLB)	1820586	1820586	1691361	1691361	5.5	5.5

LDC #: 37669 B10

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	1101169	11/22/16	EPB DB-3SMS	0.097276	0.119	0.119	22	2
			DB-XLB	↓	0.110	0.110	13	13
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 #: 37669 B10

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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	
<u>1,3-Dibromopropane</u>	<u>DB-35MS</u>	<u>0.343</u>	<u>0.352</u>	<u>103</u>	<u>103</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 #: 3769B10

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: 161122A - LCS

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)										
EDB	0.250	NA	0.241	NA	96.4	96.4	NA	NA	NA	NA

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.

LDC #: 37669B10

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1

Reviewer: [Signature]
2nd reviewer: [Signature]

METHOD: GC

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?

$$\text{Concentration} = \frac{(A_x)(I_s)(V_i)(DF)(2.0)}{(A_s)(RRF)(V_o)(V_1)(\%S)}$$

- A_x = Area of the characteristic ion (EICP) for the compound to be measured
- A_s = Area of the characteristic ion (EICP) for the specific internal standard
- I_s = Amount of internal standard added in nanograms (ng)
- V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).
- V_i = Volume of extract injected in microliters (ul)
- V₁ = 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. LCS, EDB

$$\text{Conc.} = \frac{0.9 \cdot 0.493 (0.98)}{2} = 0.241 \text{ ug/L}$$

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification
	LCS - EDB				
	294717 =	566349.343 (X) + 18041.90665			
		X = 0.493			

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 3, 2017

Parameters: Methane

Validation Level: Level C & D

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81500

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH117	AZ45907	Water	11/14/16
ERH121	AZ45908	Water	11/14/16
ERH122**	AZ45909**	Water	11/15/16
ERH126	AZ45910	Water	11/15/16
ERH128	AZ45911	Water	11/14/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 of all compounds in the calibration standards were within the established retention time windows. 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

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. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Laboratory Blank Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Field Blank Data Qualification Summary - SDG 81500**

No Sample Data Qualified in this SDG

LDC #: 37669B51
 SDG #: 81500
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 12/21/16
 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	1 ² ICV ≤ 20
III.	Continuing calibration	Δ	CCV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Matrix spike/Matrix spike duplicates	N	CS
VII.	Laboratory control samples	A	CS
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	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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH117	AZ45907	Water	11/14/16
2	ERH121	AZ45908	Water	11/14/16
3	ERH122**	AZ45909**	Water	11/15/16
4	ERH126	AZ45910	Water	11/15/16
5	ERH128	AZ45911	Water	11/14/16
6				
7				
8				
9				
10				
11				
12				
13				

Notes:

16119 A				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. Initial calibration				
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"/>	
III. Initial calibration verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
V. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
VI. Field Blanks				
Were field blanks 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"/>	
VII. Surrogate spikes				
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"/>	
VIII. Matrix spike/matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

LDC #: 37669B51

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: F7
 2nd Reviewer: R

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was an LCS analyzed per 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"/>	
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Were target compounds detected in the field duplicates?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
X. Compound quantitation				
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"/>	
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
XII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

LDC#: 37669B51
 SDG#: su cover

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

Method: RSK 175

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
9/1/2016	Ints 7890	Methane	1	6703	0.9
			2	10209	1.8
			3	15515	5.1
			4	45792	13.33
			5	28664	26.7
			6	67137	66.75
			7	126422	106.8
			8	421052	320.4
			9	723824	667.5
			10	1454283	1335

Regression Output

Reported

Constant	14373.549641	14400.00
Std Err of Y Est		
R Squared	0.997596	0.998000
Degrees of Freedom		
X Coefficient(s)	1083.161249	1083.00
Std Err of Coef.		
Correlation Coefficient	0.998797	
Coefficient of Determination (r ²)	0.997596	0.998000

LDC #: 37669851

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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

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	1119000 ccv	11/19/16	Methane	320.4	305.689	305.689	4.6	4.6
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 #: 37669B51

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT

METHOD: GC HPLC

2nd Reviewer: [Signature]

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: 16119A - LCS

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)	320	NA	306	NA	95.5	95.5	NA			
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.

LDC #: 37669BS/

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

Concentration = $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

Example:

Sample ID: 161119A-LCS Compound Name Methane

Concentration = $\frac{(345484 - 14400)}{(1083)}$
= 306 ug/L

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound
In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

**Red Hill Bulk Storage Facility, CTO 0053 - SDG 81500
LDC 37669**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 2320B													
ERH117	AZ45907	1	ALKALINITY, AS CaCO3	11/14/2016 4:00:00 PM	11/21/2016 7:47:00 PM	C	94.4	MG_L		2.0	1.70		
ERH117	AZ45907	1	ALKALINITY, BICARBONATE	11/14/2016 4:00:00 PM	11/21/2016 7:47:00 PM	C	94.4	MG_L		2.0	1.70		
ERH117	AZ45907	1	ALKALINITY, CARBONATE	11/14/2016 4:00:00 PM	11/21/2016 7:47:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH121	AZ45908	1	ALKALINITY, AS CaCO3	11/14/2016 1:50:00 PM	11/21/2016 7:53:00 PM	C	119	MG_L		2.0	1.70		
ERH121	AZ45908	1	ALKALINITY, BICARBONATE	11/14/2016 1:50:00 PM	11/21/2016 7:53:00 PM	C	119	MG_L		2.0	1.70		
ERH121	AZ45908	1	ALKALINITY, CARBONATE	11/14/2016 1:50:00 PM	11/21/2016 7:53:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH122	AZ45909	1	ALKALINITY, AS CaCO3	11/15/2016 9:40:00 AM	11/21/2016 8:00:00 PM	D	50.8	MG_L		2.0	1.70		
ERH122	AZ45909	1	ALKALINITY, BICARBONATE	11/15/2016 9:40:00 AM	11/21/2016 8:00:00 PM	D	50.8	MG_L		2.0	1.70		
ERH122	AZ45909	1	ALKALINITY, CARBONATE	11/15/2016 9:40:00 AM	11/21/2016 8:00:00 PM	D	1.70	MG_L	U	2.0	1.70		U
ERH126	AZ45910	1	ALKALINITY, AS CaCO3	11/15/2016 9:40:00 AM	11/21/2016 8:04:00 PM	C	98.1	MG_L		2.0	1.70		
ERH126	AZ45910	1	ALKALINITY, BICARBONATE	11/15/2016 9:40:00 AM	11/21/2016 8:04:00 PM	C	98.1	MG_L		2.0	1.70		
ERH126	AZ45910	1	ALKALINITY, CARBONATE	11/15/2016 9:40:00 AM	11/21/2016 8:04:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH128	AZ45911	1	ALKALINITY, AS CaCO3	11/14/2016 5:30:00 PM	11/21/2016 8:10:00 PM	C	75.2	MG_L		2.0	1.70		
ERH128	AZ45911	1	ALKALINITY, BICARBONATE	11/14/2016 5:30:00 PM	11/21/2016 8:10:00 PM	C	75.2	MG_L		2.0	1.70		
ERH128	AZ45911	1	ALKALINITY, CARBONATE	11/14/2016 5:30:00 PM	11/21/2016 8:10:00 PM	C	1.70	MG_L	U	2.0	1.70		U
METHOD: 300.0													
ERH117	AZ45907	1	BROMIDE	11/14/2016 4:00:00 PM	11/16/2016 1:48:00 PM	C	0.26	MG_L	J	0.5	0.16		J
ERH117	AZ45907	1	CHLORIDE	11/14/2016 4:00:00 PM	11/16/2016 1:48:00 PM	C	39.4	MG_L		1.0	0.20		
ERH117	AZ45907	1	FLUORIDE	11/14/2016 4:00:00 PM	11/16/2016 1:48:00 PM	C	0.28	MG_L		0.1	0.09		
ERH117	AZ45907	1	NITRATE	11/14/2016 4:00:00 PM	11/16/2016 1:48:00 PM	C	0.94	MG_L		0.5	0.18		
ERH117	AZ45907	1	SULFATE	11/14/2016 4:00:00 PM	11/16/2016 1:48:00 PM	C	4.5	MG_L		1.0	0.20		
ERH121	AZ45908	2	BROMIDE	11/14/2016 1:50:00 PM	11/16/2016 1:35:00 PM	C	1.3	MG_L		1.0	0.32		
ERH121	AZ45908	10	CHLORIDE	11/14/2016 1:50:00 PM	11/16/2016 4:24:00 PM	C	411	MG_L	D	10.0	2.00		
ERH121	AZ45908	2	FLUORIDE	11/14/2016 1:50:00 PM	11/16/2016 1:35:00 PM	C	0.19	MG_L	J	0.2	0.18		J
ERH121	AZ45908	2	NITRATE	11/14/2016 1:50:00 PM	11/16/2016 1:35:00 PM	C	4.1	MG_L		1.0	0.36		

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 300.0													
ERH121	AZ45908	2	SULFATE	11/14/2016 1:50:00 PM	11/16/2016 1:35:00 PM	C	67.9	MG_L		2.0	0.40		
ERH122	AZ45909	1	BROMIDE	11/15/2016 9:40:00 AM	11/16/2016 1:08:00 PM	D	0.63	MG_L		0.5	0.16		
ERH122	AZ45909	5	CHLORIDE	11/15/2016 9:40:00 AM	11/16/2016 3:45:00 PM	D	169	MG_L	D	5.0	1.00		
ERH122	AZ45909	1	FLUORIDE	11/15/2016 9:40:00 AM	11/16/2016 1:08:00 PM	D	0.35	MG_L		0.1	0.09		
ERH122	AZ45909	1	NITRATE	11/15/2016 9:40:00 AM	11/16/2016 1:08:00 PM	D	2.1	MG_L		0.5	0.18		
ERH122	AZ45909	5	SULFATE	11/15/2016 9:40:00 AM	11/16/2016 3:45:00 PM	D	58.2	MG_L	D	5.0	1.00		
ERH126	AZ45910	1	BROMIDE	11/15/2016 9:40:00 AM	11/16/2016 3:58:00 PM	C	0.62	MG_L		0.5	0.16		
ERH126	AZ45910	5	CHLORIDE	11/15/2016 9:40:00 AM	11/16/2016 4:11:00 PM	C	157	MG_L	D	5.0	1.00		
ERH126	AZ45910	1	FLUORIDE	11/15/2016 9:40:00 AM	11/16/2016 3:58:00 PM	C	0.39	MG_L		0.1	0.09		
ERH126	AZ45910	1	NITRATE	11/15/2016 9:40:00 AM	11/16/2016 3:58:00 PM	C	4.4	MG_L		0.5	0.18		
ERH126	AZ45910	5	SULFATE	11/15/2016 9:40:00 AM	11/16/2016 4:11:00 PM	C	46.5	MG_L	D	5.0	1.00		
ERH128	AZ45911	1	BROMIDE	11/14/2016 5:30:00 PM	11/16/2016 2:01:00 PM	C	0.35	MG_L	J	0.5	0.16	J	
ERH128	AZ45911	2	CHLORIDE	11/14/2016 5:30:00 PM	11/16/2016 2:14:00 PM	C	72.8	MG_L	D	2.0	0.40		
ERH128	AZ45911	1	FLUORIDE	11/14/2016 5:30:00 PM	11/16/2016 2:01:00 PM	C	0.16	MG_L		0.1	0.09		
ERH128	AZ45911	1	NITRATE	11/14/2016 5:30:00 PM	11/16/2016 2:01:00 PM	C	2.4	MG_L		0.5	0.18		
ERH128	AZ45911	1	SULFATE	11/14/2016 5:30:00 PM	11/16/2016 2:01:00 PM	C	9.8	MG_L		1.0	0.20		
METHOD: 3500_FE_B													
ERH117	AZ45907	1	IRON, FERROUS	11/14/2016 4:00:00 PM	11/16/2016 2:38:00 PM	C	0.53	MG_L	J	1.0	0.32	J	
ERH121	AZ45908	1	IRON, FERROUS	11/14/2016 1:50:00 PM	11/16/2016 2:39:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
ERH122	AZ45909	1	IRON, FERROUS	11/15/2016 9:40:00 AM	11/16/2016 2:40:00 PM	D	0.32	MG_L	U	1.0	0.32	U	
ERH126	AZ45910	1	IRON, FERROUS	11/15/2016 9:40:00 AM	11/16/2016 2:41:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
ERH128	AZ45911	1	IRON, FERROUS	11/14/2016 5:30:00 PM	11/16/2016 2:42:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
METHOD: 4500_SI_D													
ERH117	AZ45907	5	SILICA	11/14/2016 4:00:00 PM	11/21/2016 3:10:00 PM	C	68.1	MG_L		5.0	4.00		
ERH117	AZ45907	5	SILICA	11/14/2016 4:00:00 PM	11/21/2016 12:45:00 PM	C	65.9	MG_L		5.0	4.00		
ERH121	AZ45908	5	SILICA	11/14/2016 1:50:00 PM	11/21/2016 3:11:00 PM	C	76.7	MG_L		5.0	4.00		
ERH121	AZ45908	5	SILICA	11/14/2016 1:50:00 PM	11/21/2016 12:46:00 PM	C	78.0	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
METHOD: 4500 SI_D													
ERH122	AZ45909	5	SILICA	11/15/2016 9:40:00 AM	11/21/2016 3:12:00 PM	D	39.0	MG_L		5.0	4.00		
ERH122	AZ45909	5	SILICA	11/15/2016 9:40:00 AM	11/21/2016 12:47:00 PM	D	36.3	MG_L		5.0	4.00		
ERH126	AZ45910	5	SILICA	11/15/2016 9:40:00 AM	11/21/2016 3:13:00 PM	C	85.4	MG_L		5.0	4.00		
ERH126	AZ45910	5	SILICA	11/15/2016 9:40:00 AM	11/21/2016 12:48:00 PM	C	82.6	MG_L		5.0	4.00		
ERH128	AZ45911	5	SILICA	11/14/2016 5:30:00 PM	11/21/2016 12:49:00 PM	C	57.2	MG_L		5.0	4.00		
ERH128	AZ45911	5	SILICA	11/14/2016 5:30:00 PM	11/21/2016 3:14:00 PM	C	62.4	MG_L		5.0	4.00		
METHOD: 6010C													
ERH117	AZ45907	1	CALCIUM	11/14/2016 4:00:00 PM	11/22/2016 5:37:00 PM	C	11500	UG_L		1000	75.0		
ERH117	AZ45907	1	MAGNESIUM	11/14/2016 4:00:00 PM	11/22/2016 5:37:00 PM	C	9880	UG_L		500	30.0		
ERH117	AZ45907	1	MANGANESE	11/14/2016 4:00:00 PM	11/22/2016 5:37:00 PM	C	743	UG_L		10.0	4.00		
ERH117	AZ45907	1	POTASSIUM	11/14/2016 4:00:00 PM	11/22/2016 5:37:00 PM	C	1900	UG_L	J	3000	500.0	J	
ERH117	AZ45907	1	SODIUM	11/14/2016 4:00:00 PM	11/22/2016 5:37:00 PM	C	35200	UG_L		5000	500.0		
ERH121	AZ45908	1	CALCIUM	11/14/2016 1:50:00 PM	11/22/2016 5:42:00 PM	C	55500	UG_L		1000	75.0		
ERH121	AZ45908	1	MAGNESIUM	11/14/2016 1:50:00 PM	11/22/2016 5:42:00 PM	C	71900	UG_L		500	30.0		
ERH121	AZ45908	1	MANGANESE	11/14/2016 1:50:00 PM	11/22/2016 5:42:00 PM	C	4.00	UG_L	U	10.0	4.00	U	
ERH121	AZ45908	1	POTASSIUM	11/14/2016 1:50:00 PM	11/22/2016 5:42:00 PM	C	3040	UG_L		3000	500.0		
ERH121	AZ45908	20	SODIUM	11/14/2016 1:50:00 PM	11/22/2016 4:40:00 PM	C	150000	UG_L	D	100000	10000.0		
ERH122	AZ45909	1	CALCIUM	11/15/2016 9:40:00 AM	11/22/2016 5:48:00 PM	D	32700	UG_L		1000	75.0		
ERH122	AZ45909	1	MAGNESIUM	11/15/2016 9:40:00 AM	11/22/2016 5:48:00 PM	D	12000	UG_L		500	30.0		
ERH122	AZ45909	1	MANGANESE	11/15/2016 9:40:00 AM	11/22/2016 5:48:00 PM	D	4.00	UG_L	U	10.0	4.00	U	
ERH122	AZ45909	1	POTASSIUM	11/15/2016 9:40:00 AM	11/22/2016 5:48:00 PM	D	5680	UG_L		3000	500.0		
ERH122	AZ45909	20	SODIUM	11/15/2016 9:40:00 AM	11/22/2016 4:45:00 PM	D	109000	UG_L	D	100000	10000.0		
ERH126	AZ45910	1	CALCIUM	11/15/2016 9:40:00 AM	11/22/2016 5:53:00 PM	C	7850	UG_L		1000	75.0		
ERH126	AZ45910	1	MAGNESIUM	11/15/2016 9:40:00 AM	11/22/2016 5:53:00 PM	C	13200	UG_L		500	30.0		
ERH126	AZ45910	1	MANGANESE	11/15/2016 9:40:00 AM	11/22/2016 5:53:00 PM	C	4.00	UG_L	U	10.0	4.00	U	
ERH126	AZ45910	1	POTASSIUM	11/15/2016 9:40:00 AM	11/22/2016 5:53:00 PM	C	4930	UG_L		3000	500.0		
ERH126	AZ45910	20	SODIUM	11/15/2016 9:40:00 AM	11/22/2016 4:49:00 PM	C	136000	UG_L	D	100000	10000.0		

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 6010C													
ERH128	AZ45911	1	CALCIUM	11/14/2016 5:30:00 PM	11/22/2016 5:59:00 PM	C	16900	UG_L		1000	75.0		
ERH128	AZ45911	1	MAGNESIUM	11/14/2016 5:30:00 PM	11/22/2016 5:59:00 PM	C	18600	UG_L		500	30.0		
ERH128	AZ45911	1	MANGANESE	11/14/2016 5:30:00 PM	11/22/2016 5:59:00 PM	C	4.00	UG_L	U	10.0	4.00	U	
ERH128	AZ45911	1	POTASSIUM	11/14/2016 5:30:00 PM	11/22/2016 5:59:00 PM	C	1960	UG_L	J	3000	500.0	J	
ERH128	AZ45911	1	SODIUM	11/14/2016 5:30:00 PM	11/22/2016 5:59:00 PM	C	34700	UG_L		5000	500.0		
METHOD: 8011													
ERH122	AZ45909	1	1,2-DIBROMOETHANE	11/15/2016 9:40:00 AM	11/22/2016 9:40:00 PM	D	0.020	UG_L	U	0.02	0.020	UJ	c
METHOD: 8015B_E													
ERH117	AZ45907	1	TPH-DIESEL RANGE	11/14/2016 4:00:00 PM	11/21/2016 6:27:00 PM	C	94	UG_L	T6	40.0	25.00		
ERH117	AZ45907	1	TPH-OIL RANGE	11/14/2016 4:00:00 PM	11/21/2016 6:27:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH121	AZ45908	1	TPH-DIESEL RANGE	11/14/2016 1:50:00 PM	11/21/2016 6:48:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH121	AZ45908	1	TPH-OIL RANGE	11/14/2016 1:50:00 PM	11/21/2016 6:48:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH122	AZ45909	1	TPH-DIESEL RANGE	11/15/2016 9:40:00 AM	11/21/2016 7:08:00 PM	D	33	UG_L	JT3M	40.0	25.00		
ERH122	AZ45909	1	TPH-DIESEL RANGE	11/15/2016 9:40:00 AM	12/1/2016 11:42:00 AM	D	27	UG_L	JT3M	40.0	25.00	R	d
ERH122	AZ45909	1	TPH-DIESEL RANGE	11/15/2016 9:40:00 AM	12/5/2016 6:04:00 PM	D	25.00	UG_L	U	40.0	25.00	U	
ERH122	AZ45909	1	TPH-OIL RANGE	11/15/2016 9:40:00 AM	12/5/2016 6:04:00 PM	D	40.00	UG_L	U	40.0	40.00	U	
ERH122	AZ45909	1	TPH-OIL RANGE	11/15/2016 9:40:00 AM	11/21/2016 7:08:00 PM	D	32	UG_L	J	40.0	40.00	J	
ERH122	AZ45909	1	TPH-OIL RANGE	11/15/2016 9:40:00 AM	12/1/2016 11:42:00 AM	D	23	UG_L	J	40.0	40.00	R	d
ERH126	AZ45910	1	TPH-DIESEL RANGE	11/15/2016 9:40:00 AM	11/21/2016 7:29:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH126	AZ45910	1	TPH-OIL RANGE	11/15/2016 9:40:00 AM	11/21/2016 7:29:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH128	AZ45911	1	TPH-DIESEL RANGE	11/14/2016 5:30:00 PM	11/21/2016 7:50:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH128	AZ45911	1	TPH-OIL RANGE	11/14/2016 5:30:00 PM	11/21/2016 7:50:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
METHOD: 8260B													
ERH117	AZ45907	1	BENZENE	11/14/2016 4:00:00 PM	11/16/2016 9:33:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH117	AZ45907	1	ETHYLBENZENE	11/14/2016 4:00:00 PM	11/16/2016 9:33:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH117	AZ45907	1	TOLUENE	11/14/2016 4:00:00 PM	11/16/2016 9:33:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH117	AZ45907	1	TPH-GASOLINE RANGE C6-C10	11/14/2016 4:00:00 PM	11/16/2016 9:32:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH117	AZ45907	1	XYLENES, TOTAL	11/14/2016 4:00:00 PM	11/16/2016 9:33:00 PM	C	0.30	UG_L	U	2.0	0.30	U	

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8260B													
ERH121	AZ45908	1	BENZENE	11/14/2016 1:50:00 PM	11/16/2016 10:00:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH121	AZ45908	1	ETHYLBENZENE	11/14/2016 1:50:00 PM	11/16/2016 10:00:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH121	AZ45908	1	TOLUENE	11/14/2016 1:50:00 PM	11/16/2016 10:00:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH121	AZ45908	1	TPH-GASOLINE RANGE C6-C10	11/14/2016 1:50:00 PM	11/16/2016 10:01:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH121	AZ45908	1	XYLENES, TOTAL	11/14/2016 1:50:00 PM	11/16/2016 10:00:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH122	AZ45909	1	1,2-DICHLOROETHANE	11/15/2016 9:40:00 AM	11/16/2016 10:28:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH122	AZ45909	1	BENZENE	11/15/2016 9:40:00 AM	11/16/2016 10:28:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH122	AZ45909	1	ETHYLBENZENE	11/15/2016 9:40:00 AM	11/16/2016 10:28:00 PM	D	0.50	UG_L	U	1.0	0.50	U	
ERH122	AZ45909	1	TOLUENE	11/15/2016 9:40:00 AM	11/16/2016 10:28:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH122	AZ45909	1	TPH-GASOLINE RANGE C6-C10	11/15/2016 9:40:00 AM	11/16/2016 10:29:00 PM	D	18.0	UG_L	U	20	18.0	U	
ERH122	AZ45909	1	XYLENES, TOTAL	11/15/2016 9:40:00 AM	11/16/2016 10:28:00 PM	D	0.30	UG_L	U	2.0	0.30	U	
ERH126	AZ45910	1	BENZENE	11/15/2016 9:40:00 AM	11/16/2016 10:56:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH126	AZ45910	1	ETHYLBENZENE	11/15/2016 9:40:00 AM	11/16/2016 10:56:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH126	AZ45910	1	TOLUENE	11/15/2016 9:40:00 AM	11/16/2016 10:56:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH126	AZ45910	1	TPH-GASOLINE RANGE C6-C10	11/15/2016 9:40:00 AM	11/16/2016 10:57:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH126	AZ45910	1	XYLENES, TOTAL	11/15/2016 9:40:00 AM	11/16/2016 10:56:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH128	AZ45911	1	BENZENE	11/14/2016 5:30:00 PM	11/16/2016 11:25:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH128	AZ45911	1	ETHYLBENZENE	11/14/2016 5:30:00 PM	11/16/2016 11:25:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH128	AZ45911	1	TOLUENE	11/14/2016 5:30:00 PM	11/16/2016 11:25:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH128	AZ45911	1	TPH-GASOLINE RANGE C6-C10	11/14/2016 5:30:00 PM	11/16/2016 11:24:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH128	AZ45911	1	XYLENES, TOTAL	11/14/2016 5:30:00 PM	11/16/2016 11:25:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
METHOD: 8270D													
ERH117	AZ45907	1	2-(2-METHOXYETHOXY)-ETHANOL	11/14/2016 4:00:00 PM	11/23/2016 6:18:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH117	AZ45907	1	PHENOL	11/14/2016 4:00:00 PM	11/28/2016 3:08:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH121	AZ45908	1	2-(2-METHOXYETHOXY)-ETHANOL	11/14/2016 1:50:00 PM	11/23/2016 6:47:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH121	AZ45908	1	PHENOL	11/14/2016 1:50:00 PM	11/28/2016 3:37:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH122	AZ45909	1	2-(2-METHOXYETHOXY)-ETHANOL	11/15/2016 9:40:00 AM	11/23/2016 7:17:00 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
METHOD: 8270D													
ERH122	AZ45909	1	PHENOL	11/15/2016 9:40:00 AM	11/28/2016 4:07:00 PM	D	4.00	UG_L	U	5.0	4.00	U	
ERH126	AZ45910	1	2-(2-METHOXYETHOXY)-ETHANOL	11/15/2016 9:40:00 AM	11/23/2016 7:46:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH126	AZ45910	1	PHENOL	11/15/2016 9:40:00 AM	11/28/2016 4:36:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH128	AZ45911	1	2-(2-METHOXYETHOXY)-ETHANOL	11/14/2016 5:30:00 PM	11/23/2016 8:15:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH128	AZ45911	1	PHENOL	11/14/2016 5:30:00 PM	11/28/2016 5:06:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
METHOD: 8270D_SIM													
ERH117	AZ45907	1	1-METHYLNAPHTHALENE	11/14/2016 4:00:00 PM	11/29/2016 5:58:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH117	AZ45907	1	2-METHYLNAPHTHALENE	11/14/2016 4:00:00 PM	11/29/2016 5:58:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH117	AZ45907	1	NAPHTHALENE	11/14/2016 4:00:00 PM	11/29/2016 5:58:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH121	AZ45908	1	1-METHYLNAPHTHALENE	11/14/2016 1:50:00 PM	11/23/2016 9:51:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH121	AZ45908	1	2-METHYLNAPHTHALENE	11/14/2016 1:50:00 PM	11/23/2016 9:51:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH121	AZ45908	1	NAPHTHALENE	11/14/2016 1:50:00 PM	11/23/2016 9:51:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH122	AZ45909	1	1-METHYLNAPHTHALENE	11/15/2016 9:40:00 AM	11/23/2016 10:23:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH122	AZ45909	1	2-METHYLNAPHTHALENE	11/15/2016 9:40:00 AM	11/23/2016 10:23:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH122	AZ45909	1	NAPHTHALENE	11/15/2016 9:40:00 AM	11/23/2016 10:23:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH126	AZ45910	1	1-METHYLNAPHTHALENE	11/15/2016 9:40:00 AM	11/23/2016 10:55:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH126	AZ45910	1	2-METHYLNAPHTHALENE	11/15/2016 9:40:00 AM	11/23/2016 10:55:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH126	AZ45910	1	NAPHTHALENE	11/15/2016 9:40:00 AM	11/23/2016 10:55:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH128	AZ45911	1	1-METHYLNAPHTHALENE	11/14/2016 5:30:00 PM	11/23/2016 11:27:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH128	AZ45911	1	2-METHYLNAPHTHALENE	11/14/2016 5:30:00 PM	11/23/2016 11:27:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH128	AZ45911	1	NAPHTHALENE	11/14/2016 5:30:00 PM	11/23/2016 11:27:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
METHOD: RSK-175													
ERH117	AZ45907	10	METHANE	11/14/2016 4:00:00 PM	11/19/2016 2:05:00 PM	C	7500	UG_L		50.0	10.00		
ERH121	AZ45908	1	METHANE	11/14/2016 1:50:00 PM	11/19/2016 12:34:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH122	AZ45909	1	METHANE	11/15/2016 9:40:00 AM	11/19/2016 12:36:00 PM	D	1.00	UG_L	U	5.0	1.00	U	
ERH126	AZ45910	1	METHANE	11/15/2016 9:40:00 AM	11/19/2016 12:39:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH128	AZ45911	1	METHANE	11/14/2016 5:30:00 PM	11/19/2016 12:41:00 PM	C	1.00	UG_L	U	5.0	1.00	U	

LDC #: 37669

EDD POPULATION COMPLETENESS WORKSHEET

Date: 1/6/17
 Page: 1 of 1
 2nd Reviewer: [Signature]

The LDC job number listed above was entered by SE

	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% of <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	NAUFAC
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?	NA	
IIIe.	- Do blank concentrations in report match EDD where data was qualified due to blank contamination?	NA	
IIIf.	- Were any results reported above calibration range? If so, were results qualified appropriately?	Y/Y	
IIIg.	- Is the readme complete? If applicable, were edits or discrepancies listed in the readme?	Y	

Notes: *see discrepancy sheet

The attached zipped file contains one file:

<u>File</u>	<u>Format</u>	<u>Description</u>
1) Readme_RedHill_010617.docx	MS Word 2007	A "Readme" file (this document).
	MS Excel 2007	<u>A spreadsheet for the following SDGs:</u>
2) 81492_RH_COPC_dva.xlsx		81492 37669A
3) 81500_RH_COPC_dva.xlsx		81500 37669B

No discrepancies were observed between the hardcopy data packages and the electronic data deliverables during verification.

Please contact Stella Cuenco or Judy Ecklund at (760) 827-1100 if you have any questions regarding this electronic data submittal.



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 Thach

January 9, 2017

SUBJECT: Red Hill Bulk Storage Facility, CTO 0053, Data Validation

Dear Ms. Thach,

Enclosed is the final validation report for the fractions listed below. This SDG was received on December 14, 2016. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #37734:

<u>SDG #</u>	<u>Fraction</u>
81515	Volatiles, Phenol, 2-(2-Methoxyethoxy)-ethanol, Polynuclear Aromatic Hydrocarbons, Metals, TPH as Gasoline, TPH as Extractables, Methane, Ethylene Dibromide, Wet Chemistry

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:

- Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i, August 2016
- Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i, Revision 01, November 2016
- Project Procedures Manual Naval Facilities Engineering Command, Environmental Restoration Program, NAVFAC Pacific, DON 2015
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

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

Sincerely,

Stella Cuenco
Operations Manager/Senior Chemist

EDD 90/10

LDC #37734 (AECOM-Honolulu, HI / Red Hill Bulk Storage Facility, CTO 0053)

LDC	SDG#	DATE REC'D	(3) DATE DUE	BTEX 1,2-DCA (8260B)		3 PAHs (8270D -SIM)		Phenol (8270D)		2,2-MEE (8270D-M)		(5) Metals (6010C)		TPH-G (8260B)		TPH-E (8015B)		EDB (8011)		Methane (175)		Alk. (2320B)		Br,Cl,F NO ₃ ,SO ₄ (300.0)		Si (4500 -Si)		Diss. Si (4500 -Si)		Fe II (3500-Fe B)							
				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	81515	12/14/15	01/06/17	9	0	7	0	7	0	7	0	4	0	9	0	7	0	1	0	6	0	4	0	4	0	4	0	4	0	4	0	4	0				
A	81515	12/14/15	01/06/17	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0				
Total	T/SC			10	0	8	0	8	0	8	0	5	0	10	0	8	0	2	0	7	0	5	0	5	0	5	0	5	0	5	0	0	0	0	0	91	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 4, 2017

Parameters: Volatiles

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81515

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH118	AZ45988	Water	11/15/16
ERH119	AZ45989	Water	11/15/16
ERH123	AZ45990	Water	11/15/16
ERH124	AZ45991	Water	11/15/16
ERH125	AZ45992	Water	11/15/16
ERH127	AZ45993	Water	11/16/16
ERH129**	AZ45994**	Water	11/15/16
ERH130	AZ45995	Water	11/16/16
ERH131	AZ45996	Water	11/16/16
ERH132	AZ45997	Water	11/16/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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. 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 ERH123 and ERH132 were identified as trip blanks. No contaminants were found.

Sample ERH130 was identified as an equipment blank. No contaminants were found.

Sample ERH131 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH118 and ERH119 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Laboratory Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Field Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

LDC #: 37734A1
 SDG #: 81515
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 12/26/16
 Page: 6 of 7
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC/MS Volatiles (BTEX) (EPA SW 846 Method 8260B)
 + 1,2-DCA

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	% PSD ≤ 15 1σ ≤ 20
IV.	Continuing calibration / ending CV	Δ	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	EB = 8 FB = 9 TB = 10
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	A	LC5
X.	Field duplicates	ND	D = 1, 2
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	1 ERH118	AZ45988	Water	11/15/16
2	2 ERH119	AZ45989	Water	11/15/16
3	1 ERH123 TB + 1,2-DCA	AZ45990	Water	11/15/16
4	2 ERH124	AZ45991	Water	11/15/16
5	2 ERH125	AZ45992	Water	11/15/16
6	2 ERH127	AZ45993	Water	11/16/16
7	2 ERH129** + 1,2-DCA	AZ45994**	Water	11/15/16
8	2 ERH130 EB	AZ45995	Water	11/16/16
9	2 ERH131 FB	AZ45996	Water	11/16/16
10	1 ERH132 TB	AZ45997	Water	11/16/16
11				
12	1 161119 AL			
13	2 161119 BL			

LDC #: 37734A

VALIDATION FINDINGS CHECKLIST

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

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	<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"/>	
II. GC/MS Instrument performance check				
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"/>	
IIIa. Initial calibration				
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 checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	F7
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 all percent relative standard deviations (%RSD) $\leq 30\%$ / 15% and relative response factors (RRF) > 0.05 ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IIIb. Initial Calibration Verification				
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) $< 20\%$ or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing calibration				
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 checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) $\leq 20\%$ and relative response factors (RRF) ≥ 0.05 ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
V. Laboratory Blanks				
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 completeness worksheet.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
VI. Field blanks				
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"/>	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	

LDC #: 37734A

VALIDATION FINDINGS CHECKLIST

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

Validation Area	Yes	No	NA	Findings/Comments
VIII: Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX: Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X: Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI: Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII: Compound quantitation				
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?	/			
XIII: Target compound identification				
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?	/			
XIV: System performance				
System performance was found to be acceptable.	/			
XV: Overall assessment of data				
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	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.

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	1119232 CCV	11/20/16	Y (IS1)	1.9710	2.151	2.151	9.1	9.1
			EE (IS2)	2.3520	2.591	2.591	10	10
			BB (IS3)	0.9935	0.9301	0.9301	6.4	6.4
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3								
4								

LDC #: 37734A1

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 SpikedSample ID: 7

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane	75.0	23.45	93.8	93.8	0
1,2-Dichloroethane-d4	↓	26.42	106	106	↓
Toluene-d8	↓	25.84	103	103	↓
Bromofluorobenzene	↓	24.66	98.6	98.6	↓

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 #: 37734A1

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: 161119BL - LCS

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	NA	10.9	NA	109	109				
Toluene	10.0	↓	10.4	↓	104	104	NA			
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.

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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. 1611982 ✓
 Conc. = $\frac{599506 (25.0)}{696832 (1.9710)}$
 = 10.9 ug/L

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 4, 2017

Parameters: Phenol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81515

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH118	AZ45988	Water	11/15/16
ERH119	AZ45989	Water	11/15/16
ERH124	AZ45991	Water	11/15/16
ERH125	AZ45992	Water	11/15/16
ERH127	AZ45993	Water	11/16/16
ERH129**	AZ45994**	Water	11/15/16
ERH130	AZ45995	Water	11/16/16
ERH131	AZ45996	Water	11/16/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% 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 ERH130 was identified as an equipment blank. No contaminants were found.

Sample ERH131 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

Samples ERH118 and ERH119 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Laboratory Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Field Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

LDC #: 37734A2a
 SDG #: 81515
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 12/26/16
 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 ICV ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	EB = 7 FB = 8
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LOS ID
X.	Field duplicates	ND	D = #1, 2
XI.	Internal standards	A	
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	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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH118	AZ45988	Water	11/15/16
2	ERH119	AZ45989	Water	11/15/16
3	ERH124	AZ45991	Water	11/15/16
4	ERH125	AZ45992	Water	11/15/16
5	ERH127	AZ45993	Water	11/16/16
6	ERH129**	AZ45994**	Water	11/15/16
7	ERH130 EB	AZ45995	Water	11/16/16
8	ERH131 FB	AZ45996	Water	11/16/16
9				
10	161122B			
11				
12				
13				

LDC #: 37734 A2a

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
 Reviewer: PA
 2nd Reviewer: RL

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

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check (Not required)				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) ≤ 20% ?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) < 20% and relative response factors (RRF) > 0.05?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.			/	
VI. Field blanks				
Were field blanks identified in this SDG?	/			
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
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?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike/duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37734A2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: [Signature]

METHOD: GCMS 82700 ^D

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_x = Area of compound

C_x = Concentration of compound

S = Standard deviation of the RRFs

X = Mean of the RRFs

A_{is} = Area of associated internal standard

C_{is} = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 40 std)	Recalculated (RRF40 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	11/17/2016	A	2.010	2.010	1.996	1.996	1.40	1.40
	Yoda								

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

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	1117Y139	11/28/16	Pheno 1 (1st IS)	1.996	2.052	2.052	2.8	2.8
			(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 #: 37734A2a

VALIDATION FINDINGS WORKSHEET

Surrogate Results Verification

Page: 1 of 1Reviewer: FT2nd reviewer: K

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 SpikedSample ID: #6

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	93.458	59.97736	64.2	64.2	0
2-Fluorobiphenyl	↓	57.52966	61.6	61.6	
Terphenyl-d14	↓	68.20139	73.0	73.0	
Phenol-d5	186.916	33.19329	17.8	17.8	
2-Fluorophenol	↓	59.72955	32.0	32.0	
2,4,6-Tribromophenol	↓	131.91346	70.6	70.6	✓
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					

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

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: 161122B 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	50.0	50.0	20.5	17.5	41.0	41.0	35.0	35.0	15.8	15.8
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 0053

LDC Report Date: January 4, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81515

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH118	AZ45988	Water	11/15/16
ERH119	AZ45989	Water	11/15/16
ERH124	AZ45991	Water	11/15/16
ERH124RX	AZ45991RX	Water	11/15/16
ERH125	AZ45992	Water	11/15/16
ERH127	AZ45993	Water	11/16/16
ERH127RX	AZ45993RX	Water	11/16/16
ERH129**	AZ45994**	Water	11/15/16
ERH130	AZ45995	Water	11/16/16
ERH130RX	AZ45995RX	Water	11/16/16
ERH131	AZ45996	Water	11/16/16
ERH131RX	AZ45996RX	Water	11/16/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 with the following exceptions:

Sample	Compound	Total Days From Sample Collection Until Extraction	Required Holding Time (in Days) From Sample Collection Until Extraction	Flag	A or P
ERH124RX ERH127RX ERH130RX ERH131RX	All compounds	20	7	UJ (all non-detects)	A

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

Samples ERH130 and ERH130RX was identified as equipment blanks. No contaminants were found.

Sample ERH131 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 with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
ERH124RX	2-Fluorobiphenyl	51.1 (53-106)	All compounds	NA	-
ERH127RX	2-Fluorobiphenyl	48.3 (53-106)	All compounds	NA	-
ERH130RX	2-Fluorobiphenyl	52.1 (53-106)	All compounds	NA	-
ERH131RX	2-Fluorobiphenyl	51.3 (53-106)	All compounds	NA	-

The laboratory indicated that although the %Rs for 2-Fluorobiphenyl were outside QC limits, the %Rs for the associated surrogate, Nitrobenzene-d5, were within QC limits. Using professional judgment, no data were qualified due to low surrogate recoveries in the original analyses since the samples were reextracted outside holding time with all surrogate %Rs 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

Samples ERH118 and ERH119 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.

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	Flag	A or P
ERH124RX ERH127RX ERH130RX ERH131RX	All compounds	R	A

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
 Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 81515**

Sample	Compound	Flag	A or P	Reason (Code)
ERH124RX ERH127RX ERH130RX ERH131RX	All compounds	R	A	Overall assessment of data (D)

**Red Hill Bulk Storage Facility, CTO 0053
 Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
 Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

37734A2b

LDC #: 37669B2b
 SDG #: 81500-81515
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 12/26/16
 Page: 1 of 1
 Reviewer: PJ
 2nd Reviewer: JE

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	Δ 1 SW	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ 1 A	% RSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration / closing CV	A	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	EB = 9, 10 FB = 11
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	100% ID
X.	Field duplicates	ND	D = 1, 2
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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH118	AZ45988	Water	11/15/16
2	ERH119	AZ45989	Water	11/15/16
3	ERH124	AZ45991	Water	11/15/16
4	ERH124RX	AZ45991RX	Water	11/15/16
5	ERH125	AZ45992	Water	11/15/16
6	ERH127	AZ45993	Water	11/16/16
7	ERH127RX	AZ45993RX	Water	11/16/16
8	ERH129**	AZ45994**	Water	11/15/16
9	ERH130 EB	AZ45995	Water	11/16/16
10	ERH130RX EB	AZ45995RX	Water	11/16/16
11	ERH131 FB	AZ45996	Water	11/16/16
12	ERH131RX	AZ45996RX	Water	11/16/16
13				

TTT, W, S only

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

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?		<input checked="" type="checkbox"/>		
Was cooler temperature criteria met?	<input checked="" type="checkbox"/>			
II. GC/MS Instrument performance check (Not required)				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	<input checked="" type="checkbox"/>			
Were all samples analyzed within the 12 hour clock criteria?	<input checked="" type="checkbox"/>			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	<input checked="" type="checkbox"/>			
Were all percent relative standard deviations (%RSD) \leq 15% and relative response factors (RRF) $>$ 0.05?	<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"/>	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	<input checked="" type="checkbox"/>			
Were all percent differences (%D) \leq 20% ?	<input checked="" type="checkbox"/>			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	<input checked="" type="checkbox"/>			
Were all percent differences (%D) $<$ 20% and relative response factors (RRF) $>$ 0.05?	<input checked="" type="checkbox"/>			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	<input checked="" type="checkbox"/>			
Was a laboratory blank analyzed for each matrix and concentration?	<input checked="" type="checkbox"/>			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.			<input checked="" type="checkbox"/>	
VI. Field blanks				
Were field blanks identified in this SDG?	<input checked="" type="checkbox"/>			
Were target compounds detected in the field blanks?		<input checked="" type="checkbox"/>		
VII. Surrogate spikes				
Were all surrogate percent differences (%R) within QC limits?		<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 checked="" type="checkbox"/>	
If any percent recoveries (%R) was less than 10 percent, was a reanalysis performed to confirm %R?			<input checked="" type="checkbox"/>	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37669B26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GCMS 8270^D

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 (RRF5 std)	Recalculated (RRF 5 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL Linus	10/26/2016	S (IS1)	1.079	1.079	1.020	1.020	5.80	5.80

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	11292003 CC1	11/29/16	S (1st IS)	1.020	1.064	1.064	4.4	4.4
			(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: #8

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	4.673	4.02190	86.1	86.1	0
2-Fluorobiphenyl	↓	2.45236	52.5	52.5	↓
Terphenyl-d14	↓	4.54630	97.3	97.5	↓
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					

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 16122A LCS/D

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	5.00	5.00	3.44	3.00	68.8	68.8	60.0	60.0	13.7	13.7

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 0053

LDC Report Date: January 4, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81515

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH118	AZ45988	Water	11/15/16
ERH119	AZ45989	Water	11/15/16
ERH124	AZ45991	Water	11/15/16
ERH125	AZ45992	Water	11/15/16
ERH127	AZ45993	Water	11/16/16
ERH129**	AZ45994**	Water	11/15/16
ERH130	AZ45995	Water	11/16/16
ERH131	AZ45996	Water	11/16/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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%.

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 ERH130 was identified as an equipment blank. No contaminants were found.

Sample ERH131 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 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

Samples ERH118 and ERH119 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81515**

No Sample Data Qualified in this SDG

LDC #: 37734A2c
 SDG #: 81515
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 12/26/16

Page: 1 of 1

Reviewer: F

2nd Reviewer: A

METHOD: GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-SIM) ^{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/D	
II.	GC/MS Instrument performance check	A	r^2
III.	Initial calibration/ICV	A/D	2/10 RSD ≤ 15% ICV ≤ 20
IV.	Continuing calibration /closing CV	Δ	COV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	EB = 7 FB = 8
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LOQ ID
X.	Field duplicates	ND	D = 1, 2
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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH118	AZ45988	Water	11/15/16
2	ERH119	AZ45989	Water	11/15/16
3	ERH124	AZ45991	Water	11/15/16
4	ERH125	AZ45992	Water	11/15/16
5	ERH127	AZ45993	Water	11/16/16
6	ERH129**	AZ45994**	Water	11/15/16
7	ERH130 EB	AZ45995	Water	11/16/16
8	ERH131 FB	AZ45996	Water	11/16/16
9				
10				
11	161122A			
12				
13				

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

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	<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"/>	
II. GC/MS Instrument performance check (Not required)				
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"/>	
IIIa. Initial calibration				
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"/>	
IIIb. Initial Calibration Verification				
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"/>	
IV. Continuing calibration				
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) $>$ 0.05?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
V. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VI. Field blanks				
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"/>	
VII. Surrogate spikes				
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"/>	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 3773 A2C

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
		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 surrogate percent recoveries were within QC limits in the phenol analysis.		
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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

LDC#: 37734 A2C
 SDG#: see lower

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

Method: GCMS 8270D Modified

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
10/23/2016	Yoda	2-(2-Methoxyethoxy)ethanol	1	0.16913682	2.5
			2	0.508719353	5
			3	1.985671266	10
			4	2.585315275	12.5
			5	3.229177548	15
			6	4.416010128	20
			7	5.520756674	25

Regression Output

Reported

Constant	-0.518212	-0.518212
Std Err of Y Est		
R Squared	0.997237	0.999000
Degrees of Freedom		
X Coefficient(s)	0.244914	0.244914
Std Err of Coef.		
Correlation Coefficient	0.998617	
Coefficient of Determination (r ²)	0.997237	0.999000

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	11237012 CCW	11/23/16	2-(2-MEE) (1st IS)	500	545.84	545.84	9.2	9.2
			(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.

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 16122A - LCS

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>500</u>	<u>500</u>	<u>366</u>	<u>437</u>	<u>73.2</u>	<u>73.2</u>	<u>87.4</u>	<u>87.4</u>	<u>17.7</u>	<u>17.7</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.

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 4, 2017

Parameters: Metals

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81515

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH118	AZ45988	Water	11/15/16
ERH124	AZ45991	Water	11/15/16
ERH125	AZ45992	Water	11/15/16
ERH127	AZ45993	Water	11/16/16
ERH129**	AZ45994**	Water	11/15/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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	Calcium	29 ug/L	All samples in SDG 81515

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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Metals - Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Metals - Laboratory Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Metals - Field Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

LDC #: 37734A4b
 SDG #: 81515
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 12/28/16
 Page: 1 of 1
 Reviewer: SSD
 2nd Reviewer: AC

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	11/15-16/16
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	CS
VII.	Duplicate sample analysis	N	
VIII.	Serial Dilution	N	Not Performed
IX.	Laboratory control samples	A	LC5
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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH118	AZ45988	Water	11/15/16
2	ERH124	AZ45991	Water	11/15/16
3	ERH125	AZ45992	Water	11/15/16
4	ERH127	AZ45993	Water	11/16/16
5	ERH129**	AZ45994**	Water	11/15/16
6				
7				
8				
9				
10				
11				
12				
13				
14				

Notes: _____

Method:Metals (EPA SW 846 Method 6010B/7000/6020)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	/			
Cooler temperature criteria was met.	/			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?			/	
Were %RSD of isotopes in the tuning solution ≤5%?			/	
III. Calibration				
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 all initial calibration correlation coefficients > 0.995?	/			
IV. Blanks				
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.	/			
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	/			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	/			
VI. Matrix spike/Matrix spike duplicates				
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) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were < 5X the RL.			/	
VII. Laboratory control samples				
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?	/			


Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
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?			/	
IX. ICP Serial Dilution				
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.			/	
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.		/		
Target analytes were detected in the field duplicates.			/	
XIII. Field blanks				
Field blanks were identified in this SDG.		/		
Target analytes were detected in the field blanks.			/	

VALIDATION FINDINGS WORKSHEET
PB/ICB/CCB QUALIFIED SAMPLES

METHOD: Metals (EPA SW 864 Method 6010/6020/7000)

Soil preparation factor applied: _____

Sample Concentration units, unless otherwise noted: _____ ug/L

Associated Samples: _____ All 

					Sample Identification											
Analyte	Maximum PB ^a (mg/Kg)	Maximum PB ^a (ug/l)	Maximum ICB/CCB ^a (ug/l)	Blank Action Limit	No Qual.											
Ca			29	145												

Samples with analyte concentrations within five times the associated ICB, CCB or PB concentration are listed above with the identifications from the Validation Completeness Worksheet. These sample results were qualified as not detected, "U".

Note : a - The listed analyte concentration is the highest ICB, CCB, or PB detected in the analysis of each element.

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

METHOD: Trace Metals (See cover)

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 12:02	ICP (Initial calibration)	Ca	12060 ug/L	12500 ug/L	96.5%R	96.5%R	Y
	ICP/MS (Initial calibration)						
	CVAA (Initial calibration)						
CCV 13:53	ICP (Continuing calibration)	Mg	18730 ug/L	18750 ug/L	99.9%R	99.9%R	Y
	ICP/MS (Continuing calibration)						
	CVAA (Contining calibration)						
	GFAA (Initial calibration)						
	GFAA (Continuing calibration)						

Comments: _____

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

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	
ICS AB 12:42	ICP interference check	Mn	282 ug/L	250 ug/L	113%R	113%R	Y ↓
LCS 12:58	Laboratory control sample	K	510 ug/L	5000 ug/L	102%R	102%R	
2	Matrix spike		(SSR-SR)				
2	Duplicate						
2	ICP serial dilution						

Comments: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 4, 2017

Parameters: Wet Chemistry

Validation Level: Level C & D

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81515

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH118	AZ45988	Water	11/15/16
ERH124	AZ45991	Water	11/15/16
ERH125	AZ45992	Water	11/15/16
ERH127	AZ45993	Water	11/16/16
ERH129**	AZ45994**	Water	11/15/16
ERH124MS	AZ45991MS	Water	11/15/16
ERH124MSD	AZ45991MSD	Water	11/15/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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, and Sulfate by Environmental Protection Agency (EPA) Method 300.0

Ferrous Iron by Standard Method 3500 Fe B

Silica and Dissolved Silica by Standard Method 4500 Si

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
ERH118	Nitrate	50.58 hours	48 hours	J (all detects)	P
ERH124	Nitrate	56.55 hours	48 hours	J (all detects)	P
ERH125	Nitrate	54.23 hours	48 hours	J (all detects)	P
ERH129**	Nitrate	50.03 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.

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) were analyzed as required by the methods. Percent recoveries (%R) 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.

XI. Overall Assessment of Data

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

Due to technical holding time, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Data Qualification Summary - SDG 81515**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH118 ERH124 ERH125 ERH129**	Nitrate	J (all detects)	P	Technical holding times (H)

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Field Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

LDC #: 37734A6

VALIDATION COMPLETENESS WORKSHEET

Date: 11/15/16

SDG #: 81515

Level C/D

Page: 1 of 1

Laboratory: APPL Labs

Reviewer: JS

2nd Reviewer: A

METHOD: (Analyte) Alkalinity (SM2320B), Bromide, Chloride, Fluoride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B), Silica, Dissolved Silica (SM4500-Si)

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	SW	11/15-16/16
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	MSD = (6.7)
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH118	AZ45988	Water	11/15/16
2	ERH124	AZ45991	Water	11/15/16
3	ERH125	AZ45992	Water	11/15/16
4	ERH127	AZ45993	Water	11/16/16
5	ERH129**	AZ45994**	Water	11/15/16
6	#2MS	AK		
7	#2MSD	↓		
8				
9				
10				
11				
12				
13				
14				
15				

Notes:

Method: Inorganics (EPA Method See Cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.		/		
Cooler temperature criteria was met.	/			
II. Calibration				
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)			/	
III. Blanks				
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.		/		
IV. Matrix spike/Matrix spike duplicates and Duplicates				
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) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL (≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.	/			
V. Laboratory control samples				
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?	/			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?			/	
Were the performance evaluation (PE) samples within the acceptance limits?			/	

LDC #: 37734A

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
Reviewer: SD
2nd Reviewer: AC

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
Were detection limits < RL?	/			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.		/		
Target analytes were detected in the field duplicates.			/	
X. Field blanks				
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 Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄ (Br) (Fe ⁺²) (Silica) (Diss Silica)
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
Qc: 6-7	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄

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:		Nitrate					
Technical holding time:		48 Hrs					
Sample ID	Sampling date	Analysis date	Analysis date	Analysis date	Analysis date	Analysis date	Qualifier
1	11/15/16 17:15	11/17/16 19:50	50.58 Hrs				J/UJ/P (det) (H)
2	11/15/16 11:30	11/17/16 20:03	56.55 Hrs				J/UJ/P (det) (H)
3	11/15/16 14:15	11/17/16 20:29	54.23 Hrs				J/UJ/P (det) (H)
5	11/15/16 15:40	11/17/16 20:42	50.03 Hrs				J/UJ/P (det) (H)

LDC #: 37346

Validation Findings Worksheet
Initial and Continuing Calibration Calculation Verification

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

Method: Inorganics, Method See Cover

The correlation coefficient (r) for the calibration of Silica was recalculated. Calibration date: 11/21/10

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 ²	r or r ²	
Initial calibration	Silica	s1	0.0	0	0.9992546	0.9992546	Y
		s2	1	0.025			
		s3	2	0.049			
		s4	4	0.099			
		s5	10	0.24			
		s6	20	0.456			
ICV 11:09 Calibration verification	Silica	<u>Found</u> 4.11mg/L	<u>True</u> 4mg/L		102.8%R	102.8%R	Y
ICV 12:41 Calibration verification	Fe+2	3.0mg/L	3mg/L		100.3%R	100.5%R	
ICV 12:37 Calibration verification	NO ₃	22.05mg/L	22.1mg/L		90.7%R	90.8%R	

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.

* Rounding

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

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	
LCS 18:33	Laboratory control sample	Fe ⁺²	288 mg/L	3 mg/L	96.3%R	96.3%R	Y
MS	Matrix spike sample	Alkalinity	(SSR-SR) 225 mg/L	250 mg/L	90.0%R	90.0%R	Y
MSD	Duplicate sample	Alkalinity	421 mg/L	428 mg/L	1.6%RPD	1.6%RPD	↓

Comments: _____

LDC #: 3734AP

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page: 1 of 1
Reviewer: SS
2nd reviewer: T

METHOD: Inorganics, Method See Cover

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

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

Compound (analyte) results for (5) Alkalinity reported with a positive detect were recalculated and verified using the following equation:

Concentration = $\frac{T \times N \times 50000}{V}$ Recalculation: $\frac{(1.614 \text{ mg/L}) (0.0206) (50000)}{(25 \text{ ml})} = 66.5 \text{ mg/L}$

$V = 25 \text{ ml}$
 $T = 1.614 \text{ mg/L}$
 $N = 0.0206$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
	5	Cl	51.5	51.4	Y*
		Alkalinity	66.5	66.5	Y
		Dissolved Silica	53.7	53.7	↓

* Round

Note: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 4, 2017

Parameters: Total Petroleum Hydrocarbons as Gasoline

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81515

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH118	AZ45988	Water	11/15/16
ERH119	AZ45989	Water	11/15/16
ERH123	AZ45990	Water	11/15/16
ERH124	AZ45991	Water	11/15/16
ERH125	AZ45992	Water	11/15/16
ERH127	AZ45993	Water	11/16/16
ERH129**	AZ45994**	Water	11/15/16
ERH130	AZ45995	Water	11/16/16
ERH131	AZ45996	Water	11/16/16
ERH132	AZ45997	Water	11/16/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 Gasoline 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 ERH123 and ERH132 were identified as trip blanks. No contaminants were found.

Sample ERH130 was identified as an equipment blank. No contaminants were found.

Sample ERH131 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH118 and ERH119 were identified as field duplicates. No results were detected in any of the samples.

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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG
81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification
Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification
Summary - SDG 81515**

No Sample Data Qualified in this SDG

LDC #: 37734A7
 SDG #: 81515
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 12/26/16
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC/MS TPH as Gasoline (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	r ² ICV ≤ 20
IV.	Continuing calibration	Δ	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 3, 10 EB = 8 FB = 9
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	ND	D = 1, 2
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH118	AZ45988	Water	11/15/16
2	ERH119	AZ45989	Water	11/15/16
3	ERH123 TB	AZ45990	Water	11/15/16
4	ERH124	AZ45991	Water	11/15/16
5	ERH125	AZ45992	Water	11/15/16
6	ERH127	AZ45993	Water	11/16/16
7	ERH129**	AZ45994**	Water	11/15/16
8	ERH130 EB	AZ45995	Water	11/16/16
9	ERH131 FB	AZ45996	Water	11/16/16
10	ERH132 TB	AZ45997	Water	11/16/16
11				
12	16119AL1			
13	16119BL			

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical Holding Times				
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"/>	
II. Initial Calibration				
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 checked="" 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 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"/>	
III. Initial Calibration Verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing Calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
V. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VI. Field Blanks				
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"/>	
VII. Surrogate Spikes				
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"/>	
VIII. Matrix Spikes/Matrix Spike Duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

LDC #: 37734A7

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: FJ
 2nd Reviewer: A

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
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 QC limits?	/			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	/			
XII. Overall assessment of data				
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	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#: 3773YA7
 SDG#: pel cones

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

Method: GRO (8260B)

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
7/18/2016	GCMS Loki	Gasoline Range Organics	1	10.66716622	0.8
			2	11.62553247	2
			3	13.7084338	4
			4	21.31832367	12
			5	33.10763147	24
			6	40.2471884	32
			7	48.33253021	40

Regression Output

Reported

Constant	9.829751	9.830000
Std Err of Y Est		
R Squared	0.999867	1.000000
Degrees of Freedom		
X Coefficient(s)	0.959918	0.960000
Std Err of Coef.		
Correlation Coefficient	0.999934	
Coefficient of Determination (r ²)	0.999867	1.000000

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	1119207 ccv	11/20/16	gasoline (IS1)	300	276	276.212	7.9	7.9
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
2	1119234 ccv	11/21/16	↓ (IS1)	300	264	264.07	12	12
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3								
4								

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: #7

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene	<u>75.0</u>	<u>24.66</u>	<u>98.6</u>	<u>98.6</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 #: 3773447

VALIDATION FINDINGS WORKSHEET Laboratory Control Sample Results Verification

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

METHOD: GC/MS VOA (EPA SW 846 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: 16119BL - LCS

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
Gasoline Range organics 1,1-Dichloroethene	300	NA	264	NA	88.0	88.0	NA			
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.

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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. LCS Gasoline

$$\text{Conc.} = \frac{[(30741936/1539478) - 9.8297]}{(0.959918)} [1/2]$$

=

264 ug/L

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification

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

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 4, 2017

Parameters: Total Petroleum Hydrocarbons as Extractables

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81515

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH118	AZ45988	Water	11/15/16
ERH119	AZ45989	Water	11/15/16
ERH124	AZ45991	Water	11/15/16
ERH125	AZ45992	Water	11/15/16
ERH127	AZ45993	Water	11/16/16
ERH129**	AZ45994**	Water	11/15/16
ERH130	AZ45995	Water	11/16/16
ERH131	AZ45996	Water	11/16/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds

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 ERH130 was identified as an equipment blank. No contaminants were found.

Sample ERH131 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

Samples ERH118 and ERH119 were identified as field duplicates. No results were detected in any of the samples.

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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -
SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data
Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification
Summary - SDG 81515**

No Sample Data Qualified in this SDG

LDC #: 37734A8
 SDG #: 81515
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 12/26/16
 Page: 1 of 1
 Reviewer: FA
 2nd Reviewer: FA

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	Δ / Δ	% RSD / ICV \leq 20
III.	Continuing calibration	Δ	COV \leq 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	EB = 7 FB = 8
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	see ID
IX.	Field duplicates	ND	D = 1, 2
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	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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH118	AZ45988	Water	11/15/16
2	ERH119 ✓	AZ45989	Water	11/15/16
3	ERH124 ✓	AZ45991	Water	11/15/16
4	ERH125 ✓	AZ45992	Water	11/15/16
5	ERH127	AZ45993	Water	11/16/16
6	ERH129**	AZ45994**	Water	11/15/16
7	ERH130 EB	AZ45995	Water	11/16/16
8	ERH131 FB	AZ45996	Water	11/16/16
9				
10				
11				
12				

Notes:

-	161122A				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical Holding Times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. Initial Calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) < 20%?	/			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?			/	
Were the RT windows properly established?	/			
III. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	/			
IV. Continuing Calibration				
Was a continuing calibration analyzed daily?	/			
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	/			
Were all the retention times within the acceptance windows?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.	/			
VI. Field Blanks				
Were field blanks identified in this SDG?	/			
Were target compounds detected in the field blanks?		/		
VII. Surrogate Spikes				
Were all surrogate percent recovery (%R) within the QC limits?	/			
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			/	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			/	
VIII. Matrix Spike/Matrix Spike Duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	

LDC #: 37134-AS0

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: FJ
 2nd Reviewer: t

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was an LCS analyzed per 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"/>	
IX. Field duplicates				
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 type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
X. Compound quantitation				
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"/>	
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
XII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

LDC #: 37734 A8

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

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=400)	Recalculated (CF4 std=400)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	11/3/2016	Diesel C10-C24)	1625582	Diesel C10-C24)	1727130	1727130	9.6	9.6
	Apollo								

LDC #: 37734A8

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	CCV 1123047	11/24/16	Diesel (C10-C14)	1727130	1732090	1732090	0.29	0.29
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 #: 37734A8

VALIDATION FINDINGS WORKSHEET

Surrogate Results Verification

Page: 1 of 1

Reviewer: FT

2nd reviewer: K

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: 6

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
octacosane	DB-5	40.0	29.684	92.4	92.4	0
o-terphenyl	↓	40.0	36.956	74.2	74.2	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	Tripentyltin	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 #: 37734A8

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT

2nd Reviewer: ~~AK~~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: 161122A vs 1D

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)	1330	1330	1070	1070	80.3	80.3	80.3	80.3	0	0	
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.

LDC #: 37734 A8

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

Concentration = $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

Example:

Sample ID: 161122A Compound Name: Diesel (exp-c24)

- A= Area or height of the compound to be measured
- Fv= Final Volume of extract
- Df= Dilution Factor
- RF= Average response factor of the compound
In the initial calibration
- Vs= Initial volume of the sample
- Ws= Initial weight of the sample
- %S= Percent Solid

Concentration = $\frac{2784244509 (2) (1000)}{1727130 (1500) (2)}$ =
= 1070 ug/l

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053
LDC Report Date: January 4, 2017
Parameters: Ethylene Dibromide
Validation Level: Level C & D
Laboratory: APPL, Inc.
Sample Delivery Group (SDG): 81515

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH123	AZ45990	Water	11/15/16
ERH129**	AZ45994**	Water	11/15/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% for all compounds.

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% for all compounds with the following exceptions:

Date	Standard	Column	Compound	%D	Associated Samples	Flag	A or P
11/22/16	ICV-Herbie	DB-35MS	Ethylene dibromide	22	All samples in SDG i1515	UJ (all non-detects)	A

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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

Sample ERH123 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) were analyzed as required by the method. Percent recoveries (%R) 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.

Due to ICV %D, data were qualified as estimated in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Data Qualification Summary - SDG 81515**

Sample	Compound	Flag	A or P	Reason (Code)
ERH123 ERH129**	Ethylene dibromide	UJ (all non-detects)	A	Initial calibration verification (%D) (C)

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Laboratory Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Field Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

LDC #: 37734A10
 SDG #: 81515
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 12/26/16
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC Ethylene Dibromide (EPA SW 846 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	Δ, SW	% PSD / ICV ≤ 20
III.	Continuing calibration	Δ	
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 1
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	Δ	LCS
IX.	Field duplicates	N	
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH123 TB	AZ45990	Water	11/15/16
2	ERH129**	AZ45994**	Water	11/15/16
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Notes:

161122A				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical Holding Times				
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"/>	
II. Initial Calibration				
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"/>	
III. Initial Calibration Verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
IV. Continuing Calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
V. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VI. Field Blanks				
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"/>	
VII. Surrogate Spikes				
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"/>	
VIII. Matrix Spike/Matrix Spike Duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

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

LDC #: 37734A/D

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

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".

What type of initial calibration verification calculation was performed? ___ %D or ___ %R

Y/N/N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?

Y/N/N/A Did the initial calibration verification standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

code = C

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	Associated Samples	Qualifications
	11/22/16	ICV- Herbie	DB-35MS	Ethylene Dibromide	22	All	J/US/A ND

LDC #: 37734 A10

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	11/22/2016	EDB (DB-35MS)	see curve					
	Herbie		EDB (DB-XLB)	1820586	1820586	1691361	1691361	5.5	5.5

LDC#: 37734 A10
 SDG#: see report

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

Method: 8011 Ethylene Dibromide

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
11/22/2016	Herbie	EDB DB-35MS	1	36220	0.04
			2	133557	0.2
			3	330365	0.5
			4	548370	1
			5	826365	1.5
			6	1169605	2

Regression Output

Reported

Constant	18041.906655	NR
Std Err of Y Est		
R Squared	0.995771	NR
Degrees of Freedom		
X Coefficient(s)	560349.343525	NR
Std Err of Coef.		
Correlation Coefficient	0.997883	
Coefficient of Determination (r ²)	0.995771	NR

LDC #: 3773/A10

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:

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

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 2:00	11/22/16	EOB DB-3SMS	0.097	0.119	0.119	22	22.6
			DB-X2B	0.097	0.110	0.110	13	13.4
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 #: 3773410

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page: 1 of 1

Reviewer: FT

2nd reviewer: 9

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: # 2

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>0.341</u>	<u>0.370</u>	<u>109</u>	<u>109</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 Tripentyltin	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 #: 3773KA10

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT2nd Reviewer: AKMETHOD: 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: 161122A LCS

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)										
EDB	0.250	NA	0.241	NA	96.4	96.4	NA			

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.

LDC #: 37734 A10

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

$$\text{Concentration} = \frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$$

Example:

Sample ID: 161122A-103 Compound Name EDB

- A= Area or height of the compound to be measured
- Fv= Final Volume of extract
- Df= Dilution Factor
- RF= Average response factor of the compound
In the initial calibration
- Vs= Initial volume of the sample
- Ws= Initial weight of the sample
- %S= Percent Solid

$$\text{Concentration} = \frac{(0.4937)(0.98)}{2} = 0.241 \text{ ug/L}$$

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications
	EDB Response (DB-3SMS) = 294717				
	multiplier =	0.98			
	294717 = 560349.3(x) + 18041.91				
	x = 0.4937				

Comments: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 4, 2017

Parameters: Methane

Validation Level: Level C & D

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81515

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH118	AZ45988	Water	11/15/16
ERH123	AZ45990	Water	11/15/16
ERH124	AZ45991	Water	11/15/16
ERH125	AZ45992	Water	11/15/16
ERH127	AZ45993	Water	11/16/16
ERH129**	AZ45994**	Water	11/15/16
ERH132	AZ45997	Water	11/16/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 of all compounds in the calibration standards were within the established retention time windows. 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 ERH123 and ERH132 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Laboratory Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Field Blank Data Qualification Summary - SDG 81515**

No Sample Data Qualified in this SDG

LDC #: 37734A51
 SDG #: 81515
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 12/28/16
 Page: 1 of 1
 Reviewer: FJ
 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 ² ICV ≤ 20
III.	Continuing calibration	A	CCV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	TB = 2, 7
VI.	Matrix spike/Matrix spike duplicates	N	CS
VII.	Laboratory control samples	A	LOS
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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH118	AZ45988	Water	11/15/16
2	ERH123 TB	AZ45990	Water	11/15/16
3	ERH124	AZ45991	Water	11/15/16
4	ERH125	AZ45992	Water	11/15/16
5	ERH127	AZ45993	Water	11/16/16
6	ERH129**	AZ45994**	Water	11/15/16
7	ERH132 TB	AZ45997	Water	11/16/16
8				
9				
10				
11				
12				
13				

Notes:

161119A					

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. Initial calibration				
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"/>	
III. Initial calibration verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
III. Continuing calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
IV. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
V. Field Blanks				
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"/>	
VI. Surrogate spikes				
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"/>	
VII. Matrix spike/matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

LDC #: 31734A51

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: F7
 2nd Reviewer: R

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
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 QC limits?	/			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	-	/		
Were target compounds detected in the field duplicates?			/	
X. Compound identification				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	/			
XII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

LDC#: 37734AS
 SDG#: Ju coney

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

Method: RSK 175

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
9/1/2016	Ints 7890	Methane	1	6703	0.9
			2	10209	1.8
			3	15515	5.1
			4	45792	13.33
			5	28664	26.7
			6	67137	66.75
			7	126422	106.8
			8	421052	320.4
			9	723824	667.5
			10	1454283	1335

Regression Output

Reported

Constant	14373.549641	14400.00
Std Err of Y Est		
R Squared	0.997596	0.998000
Degrees of Freedom		
X Coefficient(s)	1083.161249	1083.00
Std Err of Coef.		
Correlation Coefficient	0.998797	
Coefficient of Determination (r ²)	0.997596	0.998000

LDC #: 37734A5)

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:

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

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	1119000 CCV	11/19/16	methane	320.4	305.689	305.689	4.6	4.6
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 #: 37734A5

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: 16119A-LCS

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)	320	NA	306	NA	95.5	95.5	NA			
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.

LDC #: 37734AS

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

$$\text{Concentration} = \frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$$

Example:

Sample ID: 105 Compound Name: Methane

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound
in the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

$$\text{Concentration} = \frac{(345484 - 14373.549)}{(1083161249)} = 306 \text{ ug/l}$$

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

**Red Hill Bulk Storage Facility, CTO 0053 - SDG 81515
LDC 37734**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 2320B													
ERH118	AZ45988	1	ALKALINITY, AS CaCO3	11/15/2016 5:15:00 PM	11/21/2016 4:00:00 PM	C	161	MG_L		2.0	1.70		
ERH118	AZ45988	1	ALKALINITY, BICARBONATE	11/15/2016 5:15:00 PM	11/21/2016 4:00:00 PM	C	161	MG_L		2.0	1.70		
ERH118	AZ45988	1	ALKALINITY, CARBONATE	11/15/2016 5:15:00 PM	11/21/2016 4:00:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH124	AZ45991	1	ALKALINITY, AS CaCO3	11/15/2016 11:30:00 AM	11/21/2016 4:09:00 PM	C	196	MG_L		2.0	1.70		
ERH124	AZ45991	1	ALKALINITY, BICARBONATE	11/15/2016 11:30:00 AM	11/21/2016 4:09:00 PM	C	196	MG_L		2.0	1.70		
ERH124	AZ45991	1	ALKALINITY, CARBONATE	11/15/2016 11:30:00 AM	11/21/2016 4:09:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH125	AZ45992	1	ALKALINITY, AS CaCO3	11/15/2016 2:15:00 PM	11/21/2016 5:02:00 PM	C	285	MG_L		2.0	1.70		
ERH125	AZ45992	1	ALKALINITY, BICARBONATE	11/15/2016 2:15:00 PM	11/21/2016 5:02:00 PM	C	285	MG_L		2.0	1.70		
ERH125	AZ45992	1	ALKALINITY, CARBONATE	11/15/2016 2:15:00 PM	11/21/2016 5:02:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH127	AZ45993	1	ALKALINITY, AS CaCO3	11/16/2016 11:50:00 AM	11/21/2016 5:17:00 PM	C	50.0	MG_L		2.0	1.70		
ERH127	AZ45993	1	ALKALINITY, BICARBONATE	11/16/2016 11:50:00 AM	11/21/2016 5:17:00 PM	C	50.0	MG_L		2.0	1.70		
ERH127	AZ45993	1	ALKALINITY, CARBONATE	11/16/2016 11:50:00 AM	11/21/2016 5:17:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH129	AZ45994	1	ALKALINITY, AS CaCO3	11/15/2016 1:40:00 PM	11/21/2016 5:22:00 PM	D	66.5	MG_L		2.0	1.70		
ERH129	AZ45994	1	ALKALINITY, BICARBONATE	11/15/2016 1:40:00 PM	11/21/2016 5:22:00 PM	D	66.5	MG_L		2.0	1.70		
ERH129	AZ45994	1	ALKALINITY, CARBONATE	11/15/2016 1:40:00 PM	11/21/2016 5:22:00 PM	D	1.70	MG_L	U	2.0	1.70		U
METHOD: 300.0													
ERH118	AZ45988	5	BROMIDE	11/15/2016 5:15:00 PM	11/17/2016 7:50:00 PM	C	3.2	MG_L		2.5	0.80		
ERH118	AZ45988	100	CHLORIDE	11/15/2016 5:15:00 PM	11/18/2016 2:09:00 PM	C	1070	MG_L		100.0	20.00		
ERH118	AZ45988	5	FLUORIDE	11/15/2016 5:15:00 PM	11/17/2016 7:50:00 PM	C	0.45	MG_L	U	0.5	0.45		U
ERH118	AZ45988	5	NITRATE	11/15/2016 5:15:00 PM	11/17/2016 7:50:00 PM	C	8.1	MG_L		2.5	0.90	J	h
ERH118	AZ45988	100	SULFATE	11/15/2016 5:15:00 PM	11/18/2016 2:09:00 PM	C	368	MG_L		100.0	20.00		
ERH124	AZ45991	1	BROMIDE	11/15/2016 11:30:00 AM	11/17/2016 8:03:00 PM	C	0.26	MG_L	J	0.5	0.16	J	
ERH124	AZ45991	1	CHLORIDE	11/15/2016 11:30:00 AM	11/17/2016 8:03:00 PM	C	39.0	MG_L		1.0	0.20		
ERH124	AZ45991	1	FLUORIDE	11/15/2016 11:30:00 AM	11/17/2016 8:03:00 PM	C	0.78	MG_L		0.1	0.09		
ERH124	AZ45991	1	NITRATE	11/15/2016 11:30:00 AM	11/17/2016 8:03:00 PM	C	0.45	MG_L	J	0.5	0.18	J	h

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 300.0													
ERH124	AZ45991	1	SULFATE	11/15/2016 11:30:00 AM	11/17/2016 8:03:00 PM	C	1.2	MG_L		1.0	0.20		
ERH125	AZ45992	1	BROMIDE	11/15/2016 2:15:00 PM	11/17/2016 8:16:00 PM	C	0.29	MG_L	J	0.5	0.16	J	
ERH125	AZ45992	1	CHLORIDE	11/15/2016 2:15:00 PM	11/17/2016 8:16:00 PM	C	47.2	MG_L		1.0	0.20		
ERH125	AZ45992	1	FLUORIDE	11/15/2016 2:15:00 PM	11/17/2016 8:16:00 PM	C	0.25	MG_L		0.1	0.09		
ERH125	AZ45992	1	NITRATE	11/15/2016 2:15:00 PM	11/17/2016 8:16:00 PM	C	7.6	MG_L		0.5	0.18	J	h
ERH125	AZ45992	1	SULFATE	11/15/2016 2:15:00 PM	11/17/2016 8:16:00 PM	C	45.7	MG_L		1.0	0.20		
ERH127	AZ45993	1	BROMIDE	11/16/2016 11:50:00 AM	11/17/2016 8:29:00 PM	C	0.37	MG_L	J	0.5	0.16	J	
ERH127	AZ45993	5	CHLORIDE	11/16/2016 11:50:00 AM	11/18/2016 2:35:00 PM	C	84.7	MG_L		5.0	1.00		
ERH127	AZ45993	1	FLUORIDE	11/16/2016 11:50:00 AM	11/17/2016 8:29:00 PM	C	0.17	MG_L		0.1	0.09		
ERH127	AZ45993	1	NITRATE	11/16/2016 11:50:00 AM	11/17/2016 8:29:00 PM	C	1.2	MG_L		0.5	0.18		
ERH127	AZ45993	1	SULFATE	11/16/2016 11:50:00 AM	11/17/2016 8:29:00 PM	C	27.6	MG_L		1.0	0.20		
ERH129	AZ45994	1	BROMIDE	11/15/2016 1:40:00 PM	11/17/2016 8:42:00 PM	D	0.29	MG_L	J	0.5	0.16	J	
ERH129	AZ45994	2	CHLORIDE	11/15/2016 1:40:00 PM	11/18/2016 2:48:00 PM	D	51.5	MG_L		2.0	0.40		
ERH129	AZ45994	1	FLUORIDE	11/15/2016 1:40:00 PM	11/17/2016 8:42:00 PM	D	0.17	MG_L		0.1	0.09		
ERH129	AZ45994	1	NITRATE	11/15/2016 1:40:00 PM	11/17/2016 8:42:00 PM	D	2.3	MG_L		0.5	0.18	J	h
ERH129	AZ45994	1	SULFATE	11/15/2016 1:40:00 PM	11/17/2016 8:42:00 PM	D	10.1	MG_L		1.0	0.20		
METHOD: 3500_FE_B													
ERH118	AZ45988	1	IRON, FERROUS	11/15/2016 5:15:00 PM	11/17/2016 6:34:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
ERH124	AZ45991	1	IRON, FERROUS	11/15/2016 11:30:00 AM	11/17/2016 6:35:00 PM	C	2.9	MG_L		1.0	0.32		
ERH125	AZ45992	1	IRON, FERROUS	11/15/2016 2:15:00 PM	11/17/2016 6:36:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
ERH127	AZ45993	1	IRON, FERROUS	11/16/2016 11:50:00 AM	11/17/2016 6:37:00 PM	C	2.4	MG_L		1.0	0.32		
ERH129	AZ45994	1	IRON, FERROUS	11/15/2016 1:40:00 PM	11/17/2016 6:38:00 PM	D	0.32	MG_L	U	1.0	0.32	U	
METHOD: 4500_SI_D													
ERH118	AZ45988	5	SILICA	11/15/2016 5:15:00 PM	11/21/2016 3:17:00 PM	C	58.9	MG_L		5.0	4.00		
ERH118	AZ45988	5	SILICA	11/15/2016 5:15:00 PM	11/21/2016 12:50:00 PM	C	64.4	MG_L		5.0	4.00		
ERH124	AZ45991	5	SILICA	11/15/2016 11:30:00 AM	11/21/2016 3:18:00 PM	C	84.4	MG_L		5.0	4.00		
ERH124	AZ45991	5	SILICA	11/15/2016 11:30:00 AM	11/21/2016 12:51:00 PM	C	83.7	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
METHOD: 4500_SI_D													
ERH125	AZ45992	5	SILICA	11/15/2016 2:15:00 PM	11/21/2016 3:00:00 PM	C	87.4	MG_L		5.0	4.00		
ERH125	AZ45992	5	SILICA	11/15/2016 2:15:00 PM	11/21/2016 3:19:00 PM	C	83.5	MG_L		5.0	4.00		
ERH127	AZ45993	5	SILICA	11/16/2016 11:50:00 AM	11/21/2016 3:01:00 PM	C	67.0	MG_L		5.0	4.00		
ERH127	AZ45993	5	SILICA	11/16/2016 11:50:00 AM	11/21/2016 3:20:00 PM	C	62.7	MG_L		5.0	4.00		
ERH129	AZ45994	5	SILICA	11/15/2016 1:40:00 PM	11/21/2016 3:02:00 PM	D	46.7	MG_L		5.0	4.00		
ERH129	AZ45994	5	SILICA	11/15/2016 1:40:00 PM	11/21/2016 3:21:00 PM	D	53.7	MG_L		5.0	4.00		
METHOD: 6010C													
ERH118	AZ45988	20	CALCIUM	11/15/2016 5:15:00 PM	11/28/2016 1:03:00 PM	C	115000	UG_L	D	20000	1500.0		
ERH118	AZ45988	20	MAGNESIUM	11/15/2016 5:15:00 PM	11/28/2016 1:03:00 PM	C	220000	UG_L	D	10000	600.0		
ERH118	AZ45988	1	MANGANESE	11/15/2016 5:15:00 PM	11/28/2016 1:25:00 PM	C	4.00	UG_L	U	10.0	4.00		U
ERH118	AZ45988	1	POTASSIUM	11/15/2016 5:15:00 PM	11/28/2016 1:25:00 PM	C	7640	UG_L		3000	500.0		
ERH118	AZ45988	20	SODIUM	11/15/2016 5:15:00 PM	11/28/2016 1:03:00 PM	C	350000	UG_L	D	100000	10000.0		
ERH124	AZ45991	1	CALCIUM	11/15/2016 11:30:00 AM	11/28/2016 1:31:00 PM	C	12600	UG_L		1000	75.0		
ERH124	AZ45991	1	MAGNESIUM	11/15/2016 11:30:00 AM	11/28/2016 1:31:00 PM	C	24800	UG_L		500	30.0		
ERH124	AZ45991	1	MANGANESE	11/15/2016 11:30:00 AM	11/28/2016 1:31:00 PM	C	1950	UG_L		10.0	4.00		
ERH124	AZ45991	1	POTASSIUM	11/15/2016 11:30:00 AM	11/28/2016 1:31:00 PM	C	2440	UG_L	J	3000	500.0		J
ERH124	AZ45991	5	SODIUM	11/15/2016 11:30:00 AM	11/28/2016 2:00:00 PM	C	53600	UG_L	D	25000	2500.0		
ERH125	AZ45992	1	CALCIUM	11/15/2016 2:15:00 PM	11/28/2016 1:36:00 PM	C	25000	UG_L		1000	75.0		
ERH125	AZ45992	1	MAGNESIUM	11/15/2016 2:15:00 PM	11/28/2016 1:36:00 PM	C	33400	UG_L		500	30.0		
ERH125	AZ45992	1	MANGANESE	11/15/2016 2:15:00 PM	11/28/2016 1:36:00 PM	C	36.7	UG_L		10.0	4.00		
ERH125	AZ45992	1	POTASSIUM	11/15/2016 2:15:00 PM	11/28/2016 1:36:00 PM	C	3700	UG_L		3000	500.0		
ERH125	AZ45992	5	SODIUM	11/15/2016 2:15:00 PM	11/28/2016 2:05:00 PM	C	104000	UG_L	D	25000	2500.0		
ERH127	AZ45993	1	CALCIUM	11/16/2016 11:50:00 AM	11/28/2016 1:42:00 PM	C	12900	UG_L		1000	75.0		
ERH127	AZ45993	1	MAGNESIUM	11/16/2016 11:50:00 AM	11/28/2016 1:42:00 PM	C	17500	UG_L		500	30.0		
ERH127	AZ45993	1	MANGANESE	11/16/2016 11:50:00 AM	11/28/2016 1:42:00 PM	C	56.1	UG_L		10.0	4.00		
ERH127	AZ45993	1	POTASSIUM	11/16/2016 11:50:00 AM	11/28/2016 1:42:00 PM	C	608	UG_L	J	3000	500.0		J
ERH127	AZ45993	5	SODIUM	11/16/2016 11:50:00 AM	11/28/2016 2:09:00 PM	C	57100	UG_L	D	25000	2500.0		

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 6010C													
ERH129	AZ45994	1	CALCIUM	11/15/2016 1:40:00 PM	11/28/2016 1:47:00 PM	D	12900	UG_L		1000	75.0		
ERH129	AZ45994	1	MAGNESIUM	11/15/2016 1:40:00 PM	11/28/2016 1:47:00 PM	D	11600	UG_L		500	30.0		
ERH129	AZ45994	1	MANGANESE	11/15/2016 1:40:00 PM	11/28/2016 1:47:00 PM	D	4.00	UG_L	U	10.0	4.00	U	
ERH129	AZ45994	1	POTASSIUM	11/15/2016 1:40:00 PM	11/28/2016 1:47:00 PM	D	2110	UG_L	J	3000	500.0	J	
ERH129	AZ45994	1	SODIUM	11/15/2016 1:40:00 PM	11/28/2016 1:47:00 PM	D	36600	UG_L		5000	500.0		
METHOD: 8011													
ERH123	AZ45990	1	1,2-DIBROMOETHANE	11/15/2016 8:00:00 AM	11/22/2016 10:00:00 PM	C	0.020	UG_L	U	0.02	0.020	UJ	c
ERH129	AZ45994	1	1,2-DIBROMOETHANE	11/15/2016 1:40:00 PM	11/22/2016 10:20:00 PM	D	0.020	UG_L	U	0.02	0.020	UJ	c
METHOD: 8015B_E													
ERH118	AZ45988	1	TPH-DIESEL RANGE	11/15/2016 5:15:00 PM	11/24/2016 3:01:00 AM	C	25.00	UG_L	U	40.0	25.00	U	
ERH118	AZ45988	1	TPH-OIL RANGE	11/15/2016 5:15:00 PM	11/24/2016 3:01:00 AM	C	40.00	UG_L	U	40.0	40.00	U	
ERH119	AZ45989	1	TPH-DIESEL RANGE	11/15/2016 5:20:00 PM	11/24/2016 3:21:00 AM	C	25.00	UG_L	U	40.0	25.00	U	
ERH119	AZ45989	1	TPH-OIL RANGE	11/15/2016 5:20:00 PM	11/24/2016 3:21:00 AM	C	40.00	UG_L	U	40.0	40.00	U	
ERH124	AZ45991	1	TPH-DIESEL RANGE	11/15/2016 11:30:00 AM	11/24/2016 3:42:00 AM	C	1300	UG_L	T6	40.0	25.00		
ERH124	AZ45991	1	TPH-OIL RANGE	11/15/2016 11:30:00 AM	11/24/2016 3:42:00 AM	C	100	UG_L		40.0	40.00		
ERH125	AZ45992	1	TPH-DIESEL RANGE	11/15/2016 2:15:00 PM	11/24/2016 4:02:00 AM	C	51	UG_L	T31	40.0	25.00		
ERH125	AZ45992	1	TPH-OIL RANGE	11/15/2016 2:15:00 PM	11/24/2016 4:02:00 AM	C	42	UG_L		40.0	40.00		
ERH127	AZ45993	1	TPH-DIESEL RANGE	11/16/2016 11:50:00 AM	11/24/2016 4:22:00 AM	C	25.00	UG_L	U	40.0	25.00	U	
ERH127	AZ45993	1	TPH-OIL RANGE	11/16/2016 11:50:00 AM	11/24/2016 4:22:00 AM	C	40.00	UG_L	U	40.0	40.00	U	
ERH129	AZ45994	1	TPH-DIESEL RANGE	11/15/2016 1:40:00 PM	11/24/2016 4:43:00 AM	D	25.00	UG_L	U	40.0	25.00	U	
ERH129	AZ45994	1	TPH-OIL RANGE	11/15/2016 1:40:00 PM	11/24/2016 4:43:00 AM	D	40.00	UG_L	U	40.0	40.00	U	
ERH130	AZ45995	1	TPH-DIESEL RANGE	11/16/2016 12:50:00 PM	11/24/2016 5:03:00 AM	C	25.00	UG_L	U	40.0	25.00	U	
ERH130	AZ45995	1	TPH-OIL RANGE	11/16/2016 12:50:00 PM	11/24/2016 5:03:00 AM	C	40.00	UG_L	U	40.0	40.00	U	
ERH131	AZ45996	1	TPH-DIESEL RANGE	11/16/2016 1:10:00 PM	11/24/2016 5:23:00 AM	C	25.00	UG_L	U	40.0	25.00	U	
ERH131	AZ45996	1	TPH-OIL RANGE	11/16/2016 1:10:00 PM	11/24/2016 5:23:00 AM	C	40.00	UG_L	U	40.0	40.00	U	
METHOD: 8260B													
ERH118	AZ45988	1	BENZENE	11/15/2016 5:15:00 PM	11/20/2016 6:44:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH118	AZ45988	1	ETHYLBENZENE	11/15/2016 5:15:00 PM	11/20/2016 6:44:00 PM	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
METHOD: 8260B													
ERH118	AZ45988	1	TOLUENE	11/15/2016 5:15:00 PM	11/20/2016 6:44:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH118	AZ45988	1	TPH-GASOLINE RANGE C6-C10	11/15/2016 5:15:00 PM	11/20/2016 6:43:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH118	AZ45988	1	XYLENES, TOTAL	11/15/2016 5:15:00 PM	11/20/2016 6:44:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH119	AZ45989	1	BENZENE	11/15/2016 5:20:00 PM	11/21/2016 3:36:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH119	AZ45989	1	ETHYLBENZENE	11/15/2016 5:20:00 PM	11/21/2016 3:36:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH119	AZ45989	1	TOLUENE	11/15/2016 5:20:00 PM	11/21/2016 3:36:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH119	AZ45989	1	TPH-GASOLINE RANGE C6-C10	11/15/2016 5:20:00 PM	11/21/2016 3:37:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH119	AZ45989	1	XYLENES, TOTAL	11/15/2016 5:20:00 PM	11/21/2016 3:36:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH123	AZ45990	1	1,2-DICHLOROETHANE	11/15/2016 8:00:00 AM	11/20/2016 5:47:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH123	AZ45990	1	BENZENE	11/15/2016 8:00:00 AM	11/20/2016 5:47:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH123	AZ45990	1	ETHYLBENZENE	11/15/2016 8:00:00 AM	11/20/2016 5:47:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH123	AZ45990	1	TOLUENE	11/15/2016 8:00:00 AM	11/20/2016 5:47:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH123	AZ45990	1	TPH-GASOLINE RANGE C6-C10	11/15/2016 8:00:00 AM	11/20/2016 5:48:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH123	AZ45990	1	XYLENES, TOTAL	11/15/2016 8:00:00 AM	11/20/2016 5:47:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH124	AZ45991	1	BENZENE	11/15/2016 11:30:00 AM	11/21/2016 4:05:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH124	AZ45991	1	ETHYLBENZENE	11/15/2016 11:30:00 AM	11/21/2016 4:05:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH124	AZ45991	1	TOLUENE	11/15/2016 11:30:00 AM	11/21/2016 4:05:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH124	AZ45991	1	TPH-GASOLINE RANGE C6-C10	11/15/2016 11:30:00 AM	11/21/2016 4:04:00 AM	C	26	UG_L	G3D	20	18.0		
ERH124	AZ45991	1	XYLENES, TOTAL	11/15/2016 11:30:00 AM	11/21/2016 4:05:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH125	AZ45992	1	BENZENE	11/15/2016 2:15:00 PM	11/21/2016 4:33:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH125	AZ45992	1	ETHYLBENZENE	11/15/2016 2:15:00 PM	11/21/2016 4:33:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH125	AZ45992	1	TOLUENE	11/15/2016 2:15:00 PM	11/21/2016 4:33:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH125	AZ45992	1	TPH-GASOLINE RANGE C6-C10	11/15/2016 2:15:00 PM	11/21/2016 4:32:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH125	AZ45992	1	XYLENES, TOTAL	11/15/2016 2:15:00 PM	11/21/2016 4:33:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH127	AZ45993	1	BENZENE	11/16/2016 11:50:00 AM	11/21/2016 5:00:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH127	AZ45993	1	ETHYLBENZENE	11/16/2016 11:50:00 AM	11/21/2016 5:00:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH127	AZ45993	1	TOLUENE	11/16/2016 11:50:00 AM	11/21/2016 5:00:00 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
METHOD: 8260B													
ERH127	AZ45993	1	TPH-GASOLINE RANGE C6-C10	11/16/2016 11:50:00 AM	11/21/2016 5:01:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH127	AZ45993	1	XYLENES, TOTAL	11/16/2016 11:50:00 AM	11/21/2016 5:00:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH129	AZ45994	1	1,2-DICHLOROETHANE	11/15/2016 1:40:00 PM	11/21/2016 5:28:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH129	AZ45994	1	BENZENE	11/15/2016 1:40:00 PM	11/21/2016 5:28:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH129	AZ45994	1	ETHYLBENZENE	11/15/2016 1:40:00 PM	11/21/2016 5:28:00 AM	D	0.50	UG_L	U	1.0	0.50	U	
ERH129	AZ45994	1	TOLUENE	11/15/2016 1:40:00 PM	11/21/2016 5:28:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH129	AZ45994	1	TPH-GASOLINE RANGE C6-C10	11/15/2016 1:40:00 PM	11/21/2016 5:29:00 AM	D	18.0	UG_L	U	20	18.0	U	
ERH129	AZ45994	1	XYLENES, TOTAL	11/15/2016 1:40:00 PM	11/21/2016 5:28:00 AM	D	0.30	UG_L	U	2.0	0.30	U	
ERH130	AZ45995	1	BENZENE	11/16/2016 12:50:00 PM	11/21/2016 5:56:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH130	AZ45995	1	ETHYLBENZENE	11/16/2016 12:50:00 PM	11/21/2016 5:56:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH130	AZ45995	1	TOLUENE	11/16/2016 12:50:00 PM	11/21/2016 5:56:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH130	AZ45995	1	TPH-GASOLINE RANGE C6-C10	11/16/2016 12:50:00 PM	11/21/2016 5:57:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH130	AZ45995	1	XYLENES, TOTAL	11/16/2016 12:50:00 PM	11/21/2016 5:56:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH131	AZ45996	1	BENZENE	11/16/2016 1:10:00 PM	11/21/2016 6:24:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH131	AZ45996	1	ETHYLBENZENE	11/16/2016 1:10:00 PM	11/21/2016 6:24:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH131	AZ45996	1	TOLUENE	11/16/2016 1:10:00 PM	11/21/2016 6:24:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH131	AZ45996	1	TPH-GASOLINE RANGE C6-C10	11/16/2016 1:10:00 PM	11/21/2016 6:25:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH131	AZ45996	1	XYLENES, TOTAL	11/16/2016 1:10:00 PM	11/21/2016 6:24:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH132	AZ45997	1	BENZENE	11/16/2016 12:45:00 PM	11/20/2016 6:15:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH132	AZ45997	1	ETHYLBENZENE	11/16/2016 12:45:00 PM	11/20/2016 6:15:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH132	AZ45997	1	TOLUENE	11/16/2016 12:45:00 PM	11/20/2016 6:15:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH132	AZ45997	1	TPH-GASOLINE RANGE C6-C10	11/16/2016 12:45:00 PM	11/20/2016 6:16:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH132	AZ45997	1	XYLENES, TOTAL	11/16/2016 12:45:00 PM	11/20/2016 6:15:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
METHOD: 8270D													
ERH118	AZ45988	1	2-(2-METHOXYETHOXY)-ETHANOL	11/15/2016 5:15:00 PM	11/23/2016 10:13:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH118	AZ45988	1	PHENOL	11/15/2016 5:15:00 PM	11/28/2016 7:04:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH119	AZ45989	1	2-(2-METHOXYETHOXY)-ETHANOL	11/15/2016 5:20:00 PM	11/23/2016 10:43:00 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
METHOD: 8270D													
ERH119	AZ45989	1	PHENOL	11/15/2016 5:20:00 PM	11/28/2016 7:33:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH124	AZ45991	1	2-(2-METHOXYETHOXY)-ETHANOL	11/15/2016 11:30:00 AM	11/23/2016 11:12:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH124	AZ45991	1	PHENOL	11/15/2016 11:30:00 AM	11/28/2016 8:02:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH125	AZ45992	1	2-(2-METHOXYETHOXY)-ETHANOL	11/15/2016 2:15:00 PM	11/23/2016 11:41:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH125	AZ45992	1	PHENOL	11/15/2016 2:15:00 PM	11/28/2016 8:32:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH127	AZ45993	1	2-(2-METHOXYETHOXY)-ETHANOL	11/16/2016 11:50:00 AM	11/24/2016 12:10:00 AM	C	80.0	UG_L	U	100	80.0	U	
ERH127	AZ45993	1	PHENOL	11/16/2016 11:50:00 AM	11/28/2016 9:56:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH129	AZ45994	1	2-(2-METHOXYETHOXY)-ETHANOL	11/15/2016 1:40:00 PM	11/24/2016 12:40:00 AM	D	80.0	UG_L	U	100	80.0	U	
ERH129	AZ45994	1	PHENOL	11/15/2016 1:40:00 PM	11/28/2016 10:25:00 PM	D	4.00	UG_L	U	5.0	4.00	U	
ERH130	AZ45995	1	2-(2-METHOXYETHOXY)-ETHANOL	11/16/2016 12:50:00 PM	11/24/2016 1:09:00 AM	C	80.0	UG_L	U	100	80.0	U	
ERH130	AZ45995	1	PHENOL	11/16/2016 12:50:00 PM	11/28/2016 10:54:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH131	AZ45996	1	2-(2-METHOXYETHOXY)-ETHANOL	11/16/2016 1:10:00 PM	11/24/2016 1:38:00 AM	C	80.0	UG_L	U	100	80.0	U	
ERH131	AZ45996	1	PHENOL	11/16/2016 1:10:00 PM	11/28/2016 11:24:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
METHOD: 8270D_SIM													
ERH118	AZ45988	1	1-METHYLNAPHTHALENE	11/15/2016 5:15:00 PM	11/24/2016 1:36:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH118	AZ45988	1	2-METHYLNAPHTHALENE	11/15/2016 5:15:00 PM	11/24/2016 1:36:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH118	AZ45988	1	NAPHTHALENE	11/15/2016 5:15:00 PM	11/24/2016 1:36:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH119	AZ45989	1	1-METHYLNAPHTHALENE	11/15/2016 5:20:00 PM	11/29/2016 6:31:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH119	AZ45989	1	2-METHYLNAPHTHALENE	11/15/2016 5:20:00 PM	11/29/2016 6:31:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH119	AZ45989	1	NAPHTHALENE	11/15/2016 5:20:00 PM	11/29/2016 6:31:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH124	AZ45991	1	1-METHYLNAPHTHALENE	11/15/2016 11:30:00 AM	11/24/2016 2:41:00 AM	C	29	UG_L		0.2	0.10		
ERH124	AZ45991	1	1-METHYLNAPHTHALENE	11/15/2016 11:30:00 AM	12/8/2016 8:54:00 PM	C	26	UG_L		0.2	0.10	R	d
ERH124	AZ45991	1	2-METHYLNAPHTHALENE	11/15/2016 11:30:00 AM	12/8/2016 8:54:00 PM	C	10	UG_L		0.2	0.10	R	d
ERH124	AZ45991	1	2-METHYLNAPHTHALENE	11/15/2016 11:30:00 AM	11/24/2016 2:41:00 AM	C	12	UG_L		0.2	0.10		
ERH124	AZ45991	1	NAPHTHALENE	11/15/2016 11:30:00 AM	11/24/2016 2:41:00 AM	C	58	UG_L		0.2	0.10		
ERH124	AZ45991	1	NAPHTHALENE	11/15/2016 11:30:00 AM	12/8/2016 8:54:00 PM	C	50	UG_L		0.2	0.10	R	d
ERH125	AZ45992	1	1-METHYLNAPHTHALENE	11/15/2016 2:15:00 PM	11/29/2016 7:03:00 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
METHOD: 8270D_SIM													
ERH125	AZ45992	1	2-METHYLNAPHTHALENE	11/15/2016 2:15:00 PM	11/29/2016 7:03:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH125	AZ45992	1	NAPHTHALENE	11/15/2016 2:15:00 PM	11/29/2016 7:03:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH127	AZ45993	1	1-METHYLNAPHTHALENE	11/16/2016 11:50:00 AM	11/29/2016 7:35:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH127	AZ45993	1	1-METHYLNAPHTHALENE	11/16/2016 11:50:00 AM	12/8/2016 9:28:00 PM	C	0.10	UG_L	U	0.2	0.10	R	d
ERH127	AZ45993	1	2-METHYLNAPHTHALENE	11/16/2016 11:50:00 AM	12/8/2016 9:28:00 PM	C	0.10	UG_L	U	0.2	0.10	R	d
ERH127	AZ45993	1	2-METHYLNAPHTHALENE	11/16/2016 11:50:00 AM	11/29/2016 7:35:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH127	AZ45993	1	NAPHTHALENE	11/16/2016 11:50:00 AM	11/29/2016 7:35:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH127	AZ45993	1	NAPHTHALENE	11/16/2016 11:50:00 AM	12/8/2016 9:28:00 PM	C	0.10	UG_L	U	0.2	0.10	R	d
ERH129	AZ45994	1	1-METHYLNAPHTHALENE	11/15/2016 1:40:00 PM	11/29/2016 8:08:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH129	AZ45994	1	2-METHYLNAPHTHALENE	11/15/2016 1:40:00 PM	11/29/2016 8:08:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH129	AZ45994	1	NAPHTHALENE	11/15/2016 1:40:00 PM	11/29/2016 8:08:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH130	AZ45995	1	1-METHYLNAPHTHALENE	11/16/2016 12:50:00 PM	12/8/2016 10:01:00 PM	C	0.10	UG_L	U	0.2	0.10	R	d
ERH130	AZ45995	1	1-METHYLNAPHTHALENE	11/16/2016 12:50:00 PM	11/29/2016 8:40:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH130	AZ45995	1	2-METHYLNAPHTHALENE	11/16/2016 12:50:00 PM	12/8/2016 10:01:00 PM	C	0.10	UG_L	U	0.2	0.10	R	d
ERH130	AZ45995	1	2-METHYLNAPHTHALENE	11/16/2016 12:50:00 PM	11/29/2016 8:40:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH130	AZ45995	1	NAPHTHALENE	11/16/2016 12:50:00 PM	11/29/2016 8:40:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH130	AZ45995	1	NAPHTHALENE	11/16/2016 12:50:00 PM	12/8/2016 10:01:00 PM	C	0.10	UG_L	U	0.2	0.10	R	d
ERH131	AZ45996	1	1-METHYLNAPHTHALENE	11/16/2016 1:10:00 PM	11/29/2016 9:12:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH131	AZ45996	1	1-METHYLNAPHTHALENE	11/16/2016 1:10:00 PM	12/8/2016 10:34:00 PM	C	0.10	UG_L	U	0.2	0.10	R	d
ERH131	AZ45996	1	2-METHYLNAPHTHALENE	11/16/2016 1:10:00 PM	11/29/2016 9:12:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH131	AZ45996	1	2-METHYLNAPHTHALENE	11/16/2016 1:10:00 PM	12/8/2016 10:34:00 PM	C	0.10	UG_L	U	0.2	0.10	R	d
ERH131	AZ45996	1	NAPHTHALENE	11/16/2016 1:10:00 PM	11/29/2016 9:12:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH131	AZ45996	1	NAPHTHALENE	11/16/2016 1:10:00 PM	12/8/2016 10:34:00 PM	C	0.10	UG_L	U	0.2	0.10	R	d
METHOD: RSK-175													
ERH118	AZ45988	1	METHANE	11/15/2016 5:15:00 PM	11/19/2016 12:48:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH123	AZ45990	1	METHANE	11/15/2016 8:00:00 AM	11/19/2016 12:51:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH124	AZ45991	50	METHANE	11/15/2016 11:30:00 AM	11/19/2016 2:00:00 PM	C	20000	UG_L		250.0	50.00		

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: RSK-175													
ERH125	AZ45992	1	METHANE	11/15/2016 2:15:00 PM	11/19/2016 12:55:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH127	AZ45993	1	METHANE	11/16/2016 11:50:00 AM	11/19/2016 12:57:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH129	AZ45994	1	METHANE	11/15/2016 1:40:00 PM	11/19/2016 1:01:00 PM	D	1.00	UG_L	U	5.0	1.00	U	
ERH132	AZ45997	1	METHANE	11/16/2016 12:45:00 PM	11/19/2016 1:03:00 PM	C	1.00	UG_L	U	5.0	1.00	U	

The attached zipped file contains one file:

<u>File</u>	<u>Format</u>	<u>Description</u>
1) Readme_RedHill_010617.docx	MS Word 2007	A "Readme" file (this document).
2) 81515_RH_COPC_dva.xlsx	MS Excel 2007	<u>A spreadsheet for the following SDGs:</u> 81515 37734A

No discrepancies were observed between the hardcopy data packages and the electronic data deliverables during verification.

Please contact Stella Cuenco or Judy Ecklund at (760) 827-1100 if you have any questions regarding this electronic data submittal.

LDC #: 37734

EDD POPULATION COMPLETENESS WORKSHEET

Date: 1/9/10
Page: 1 of 1
2nd Reviewer: BAThe LDC job number listed above was entered by JE.

	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 100% verification of EDD?	Y	
II.	EDD Preparation/Entry	-	
IIa.	- Carryover U/J?	Y	
IIb.	- Reason Codes used? If so, note which codes.	Y	NAVFAC
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?	X	
IIIe.	- Do blank concentrations in report match EDD where data was qualified due to blank contamination?	-	
IIIf.	- Were any results reported above calibration range? If so, were results qualified appropriately?	4/4	
IIIg.	- Is the readme complete? If applicable, were edits or discrepancies listed in the readme?	Y	

Notes: *see discrepancy sheet



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 Thach

January 25, 2017

**SUBJECT: Data Quality Assessment Report
Investigation and Remediation of Releases and
Groundwater Protection and Evaluation
Red Hill Bulk Fuel Storage Facility
Joint Base Pearl Harbor-Hickam
Oahu, Hawaii
CTO 0053**

Dear Ms. Thach,

Enclosed is the Data Quality Assessment Report, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, Oahu, Hawaii, CTO 0053

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,

Stella Cuenco
Operations Manager/Senior Chemist

DATA QUALITY ASSESSMENT REPORT

**INVESTIGATION AND REMEDIATION OF RELEASES AND
GROUNDWATER PROTECTION AND EVALUATION
RED HILL BULK FUEL STORAGE FACILITY
JOINT BASE PEARL HARBOR-HICKAM
OAHU, HAWAII**

CTO 0053

January 25, 2017

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GLOSSARY

ASTM	American Society for Testing and Materials
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes, total
COPC	Compounds of Potential Concern
CTO	Contract Task Order
DCA	1,2-Dichloroethane
DQAR	Data Quality Assessment Report
DOD	Department of Defense
DL	Detection Limit
EB	Equipment Blank
EDB	Ethylene Dibromide
FB	Field Blank
FD	Field Duplicate
LCS	Laboratory Control Sample
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
TPH	Total Petroleum Hydrocarbons
%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 investigation and remediation of petroleum product releases and protection and evaluation of groundwater were conducted 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 19 environmental and quality control (QC) samples. The analyses were performed by the following methods:

Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), and 1,2-Dichloroethane (DCA) by Environmental Protection Agency (EPA) SW-846 Method 8260B

Phenol by EPA SW-846 Method 8270D

2-(2-Methoxyethoxy)-ethanol (MEE) by EPA SW-846 Method 8270D Modified

Polynuclear Aromatic Hydrocarbons (PAH) by EPA SW-846 Method 8270D-Selected Ion Monitoring (SIM) mode

Total Petroleum Hydrocarbons (TPH) as Gasoline by EPA SW-846 Method 8260B

TPH as Extractables by EPA SW-846 Method 8015B

Ethylene Dibromide (EDB) by EPA SW-846 Method 8011

Methane by Method RSK 175

Metals by EPA SW 846 Method 6010C

Wet Chemistry:

Alkalinity by Standard Method 2320B

Bromide, Chloride, Fluoride, Nitrate 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

Analytical services were provided by APPL, Inc. whom performed analyses on the water samples. The samples were grouped into sample delivery groups (SDGs) as received by each 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 5.0 (DoD 2013)*.

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 11 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, laboratory control samples/ laboratory control sample duplicates (LCS/LCSD), (LCS), matrix spike/matrix spike duplicates (MS/MSD), equipment blanks (EB), field blanks (FB), trip blanks (TB) and field duplicates (FD).

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 5 times the concentration in any associated blank.
- 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):

$$RPD = (D1 - D2) / \{1/2(D1 + D2)\} \times 100$$

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 (FD) 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. Non-aqueous LCSs are prepared using solid media approved by the American Society for Testing and Materials (ASTM) for their homogeneity. The LCS measures laboratory efficiency in recovering target analytes from either a solid or 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.

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, ambient blanks, field 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 all BTEX, DCA, TPH as gasoline, EDB, 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 all BTEX, phenol, PAH, MEE, TPH as gasoline and TPH as extractables.

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 all BTEX, phenol, PAH, MEE, TPH as gasoline, and TPH as extractables.

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 for contaminants.

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 BENZENE, TOLUENE, ETHYLBENZENE, XYLENES, TOTAL AND 1,2-DICHLOROETHANE

A total of 19 water samples were analyzed for BTEX and a total of 3 water samples were analyzed for DCA by EPA SW-846 Method 8260B. All BTEX and DCA data were assessed to be valid since none of the 79 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.

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 acceptance criteria of 0.05 in the initial and continuing calibrations.

The %RSDs met the acceptance criteria of 15 percent in the initial calibration. The %Ds in the continuing calibration verifications and closing continuing calibration verifications met the acceptance criteria of 20 and 50 percent, respectively.

The %Ds in the initial calibration verification were within the acceptance criteria of 20 percent.

2.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria.

2.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

2.1.4 LCS Samples

All LCS %Rs were within the acceptance criteria.

2.1.5 Internal Standards

All internal standard areas and retention times were within the acceptance criteria.

2.1.6 Field Duplicate Samples

No BTEX were detected in the field duplicate samples ERH115 and ERH116 and samples ERH118 and ERH119.

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 compound identification 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, equipment blanks, field blanks and trip blanks 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 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 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 Trip Blanks

No contaminants were detected in the trip blanks for this analysis.

2.2.2.3 Equipment and Field Blanks

No contaminants were detected in the equipment and field 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 BTEX and DCA 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 work plan.

3.0 PHENOL AND 2-(2-METHOXYETHOXY)-ETHANOL

A total of 16 water samples were analyzed for phenol by EPA SW-846 Method 8270D and 16 water samples were analyzed for MEE by EPA SW-846 Method 8270D Modified. All phenol and MEE data were assessed to be valid since none of the 32 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.

3.1 Precision and Accuracy

3.1.1 Instrument Calibration

The RRFs met the acceptance criteria of 0.05 in the initial and continuing calibrations.

The %RSDs met the acceptance criteria of 15 percent in the initial calibration. The %Ds in the continuing calibration verifications and closing continuing calibration verifications met the acceptance criteria of 20 and 50 percent, respectively.

The %Ds in the initial calibration verification were within the acceptance criteria of 20 percent.

3.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria for the phenol analysis.

3.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

3.1.4 LCS Samples

All LCS/D %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 Field Duplicate Samples

No phenol or MEE were detected in the field duplicate samples ERH115 and ERH116 and samples ERH118 and ERH119.

3.1.7 Proficiency Testing Samples

Proficiency testing (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, equipment blanks and field blanks were collected and analyzed to evaluate representativeness.

3.2.2.1 Method Blanks

No contaminants were detected in the method blanks for this analysis.

3.2.2.2 Equipment and Field Blanks

No contaminants were detected in the equipment 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 and 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.

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 16 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 48 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 acceptance criteria of 0.05 in the initial and continuing calibrations.

The %RSDs met the acceptance criteria of 15 percent in the initial calibration. The %Ds in the continuing calibration verifications and closing continuing calibration verifications met the acceptance criteria of 20 and 50 percent, respectively.

The %Ds in the initial calibration verification were within the acceptance criteria of 20 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/D %Rs and RPDs 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

No PAH were detected in the field duplicate samples ERH115 and ERH116 and samples ERH118 and ERH119.

4.1.7 Proficiency Testing Samples

Proficiency testing (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.

In instances where surrogate %Rs were outside criteria and associated samples were subsequently reextracted and reanalyzed, the data were qualified as not reportable by the validators in order to yield only one complete set of data for a given sample.

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, equipment blanks, and field blanks 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 Equipment and Field Blanks

No contaminants were detected in the equipment 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 TOTAL PETROLEUM HYDROCARBONS AS GASOLINE

A total of 19 water samples were analyzed for TPH as gasoline by EPA SW-846 Method 8260B. All TPH as gasoline data were assessed to be valid since none of the 19 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 coefficient of determination (r^2) was ≥ 0.990 in the initial calibration. The %Ds in the initial and continuing calibration verifications met the acceptance criteria of 20 percent.

5.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria.

5.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

5.1.4 LCS Samples

All LCS %Rs were within the acceptance criteria.

5.1.5 Field Duplicate Samples

No TPH as gasoline was detected in the field duplicate samples ERH115 and ERH116 and samples ERH118 and ERH119.

5.1.6 Proficiency Testing Samples

PT samples were not performed for the sampling event.

5.1.7 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, equipment blanks, field blanks and trip blanks 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 Trip Blanks

No contaminants were detected in the trip blanks for this analysis.

5.2.2.3 Equipment and Field Blanks

No contaminants were detected in the equipment 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 TPH as gasoline 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 TOTAL PETROLEUM HYDROCARBONS AS EXTRACTABLES

A total of 16 water samples and one water sample with silica gel clean-up (SGCU) were analyzed for diesel and oil by EPA SW-846 Method 8015B. All TPH as extractable data were assessed to be valid since none of the 34 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 %RSDs met the acceptance criteria of 20 percent in the initial calibration. The %Ds in the initial and continuing calibration verifications met the acceptance criteria of 20 percent.

6.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria.

6.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

6.1.4 LCS/D Samples

All LCS/D %Rs and RPDs were within the acceptance criteria.

6.1.5 Field Duplicate Samples

No TPH as extractables were detected in the field duplicate samples ERH115 and ERH116 and samples ERH118 and ERH119.

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, equipment blanks and field blanks 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 Equipment and Field Blanks

No contaminants were detected in the equipment and field blanks for this analysis.

6.3 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.

6.4 Completeness

The completeness level attained for TPH as extractable 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 ETHYLENE DIBROMIDE

A total of 3 water samples were analyzed for EDB by EPA SW-846 Method 8011. All EDB data were assessed to be valid since none of the 3 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 continuing calibration verifications met the acceptance criteria of 20 percent.

As a result of %Ds in the initial calibration verifications outside of the acceptance criteria of 20 percent, the EDB result in samples ERH122, ERH123, and ERH129 was qualified as non-detected estimated (UJ). Bias is indeterminate.

7.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria.

7.1.3 MS/MSD Samples

MS/MSDs were not performed for the water samples. Since the LCS %Rs met the acceptance criteria, the absence of MS/MSD samples was judged to have no impact on the data quality and no qualifications were made.

7.1.4 LCS Samples

All LCS %Rs were within the acceptance criteria.

7.1.5 Field Duplicate Samples

Field duplicates were not collected for the EDB analysis.

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. All holding times were met.

7.2.2 Blanks

Method blanks and trip blanks 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 Trip Blanks

No contaminants were detected in the trip blank for this analysis.

7.3 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.

7.4 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.

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 METHANE

A total of 15 water samples were analyzed for methane by EPA Method RSK 175. All methane data were assessed to be valid since none of the 15 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 coefficient of determination (r^2) was ≥ 0.990 in the initial calibration. The %Ds in the initial and continuing calibration verifications met the acceptance criteria of 20 percent.

8.1.2 MS/MSD Samples

No data were qualified due to high ERH115MS/MSD %Rs. The methane result in the associated sample was not detected.

All MS/MSD RPDs were within the acceptance criteria.

8.1.3 LCS Samples

All LCS %Rs were within the acceptance criteria.

8.1.4 Field Duplicate Samples

Field duplicates were not collected for the analysis.

8.1.5 Proficiency Testing Samples

PT samples were not performed for the sampling event.

8.1.6 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 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 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 and LODs attained were below the specified LOQs. The comparability of the data is regarded as acceptable.

8.4 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.

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 METALS

A total of 12 water samples were analyzed for metals by EPA SW-846 Method 6010C. All metals data were assessed to be valid since none of the 60 total results were rejected based on holding time or QC exceedances. This section discusses the QA/QC supporting documentation as defined by the PARCC criteria and evaluated based on the PQOs.

9.1 Precision and Accuracy

9.1.1 Instrument Calibration

Initial and continuing calibration verification results provide a means of evaluating accuracy within a particular SDG. Correlation coefficient (r) and percent recovery (%R) are the two major parameters used to measure the effectiveness of instrument calibration. The correlation coefficient indicates the linearity of the calibration curve. %R is used to verify the on going 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/or percent recoveries in the continuing calibration verifications met the method acceptance criteria of ≥ 0.995 and 90-110 percent, respectively.

9.1.2 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

9.1.3 LCS Samples

All LCS %Rs were within the acceptance criteria.

9.1.4 ICP Serial Dilution

All ICP serial dilution %Ds were within the acceptance criteria.

9.1.5 ICP Interference Check Sample

All ICP interference check %Rs were within the acceptance criteria.

9.1.6 Field Duplicate Samples

Field duplicates were not collected for the analysis.

9.1.7 Proficiency Testing Samples

Proficiency testing samples were not performed for the sampling event.

9.1.8 Sample Result Verification

All sample results were found to be acceptable.

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

As previously discussed in Section 2.2.2, method blanks were analyzed to evaluate representativeness.

9.2.2.1 Method Blanks

No data were qualified due to contaminants detected in the method blanks.

9.3 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 analytes detected below the reporting limits flagged (J) by the laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

9.4 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.

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 WET CHEMISTRY

A total of 12 water samples were analyzed for alkalinity by Standard Method 2320B, anions by EPA Method 300.0, ferrous iron by Standard Method 3500 Fe B, and silica and dissolved silica by Standard Method 4500 Si. All wet chemistry data were assessed to be valid since none of the 132 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.

10.1 Precision and Accuracy

10.1.1 Instrument Calibration

The correlation coefficients in the initial calibrations and percent recoveries in the initial and continuing calibration verifications were within the acceptance criteria of ≥ 0.995 and 90-110 percent, respectively.

10.1.2 MS/MSD Samples

The chloride and silica results in sample ERH115 were qualified as detected estimated (J) as a result of high MS/MSD %Rs. High MS/MSD %Rs indicate that the matrix may be introducing a high bias.

10.1.3 LCS Samples

All LCS %Rs were within the acceptance criteria.

10.1.4 FD Samples

Field duplicates were not collected for the analysis.

10.1.5 Proficiency Testing Samples

PT samples were not performed for the sampling event.

10.1.6 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 all wet chemistry methods was conducted. All water samples met the 28-day analysis holding time criteria for bromide, chloride, fluoride, sulfate, silica and dissolved silica, the 14-day analysis holding time criteria for alkalinity and the 7-day analysis holding time criteria for ferrous iron.

Due to holding time criteria exceedance, the nitrate results for samples ERH118, ERH124, ERH125 and ERH129 were qualified as detected estimated (J). The analysis holding time criteria is 48 hours.

10.2.2 Blanks

Method blanks were analyzed to evaluate representativeness.

10.2.2.1 Method Blanks

No data were qualified due to a low level alkalinity in one method 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 analytes 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 wet chemistry 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 DLs and LOQs met the specified requirements described in the work plan.

11.0 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.

12.0 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.

12.1 Precision and Accuracy

Bias cannot be determined for associated EDB results when initial calibration verification %Ds are outside of the acceptance criteria.

High MS/MSD %Rs indicates that the associated chloride and silica results may be biased high for the associated samples.

Precision and accuracy were evaluated using data quality indicators such as calibration, surrogates, MS/MSD, LCS, 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.

12.2 Representativeness

All samples for each method and matrix were evaluated for holding time compliance. All holding times were met with the exception noted in Section 10.2.1. All samples were associated with a method blank in each individual SDG. The representativeness of the project data is considered acceptable after qualification for holding time.

12.3 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.

12.4 Completeness

Of the 422 total results reported, none of the results were rejected. The completeness for all SDGs is as follows:

Parameter	Total Analytes	No. of Rejects	% Completeness
BTEX and DCA	79	0	100
Phenol	16	0	100
MEE	16	0	100
PAHs	48	0	100
TPHG	19	0	100
TPHE	34	0	100
EDB	3	0	100
Methane	15	0	100
Metals	60	0	100
Wet chemistry	132	0	100
Total	422	0	100

The completeness percentage based on rejected data met the 90 percent PQO goal.

12.5 Sensitivity

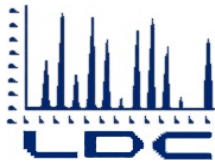
Sensitivity was achieved by the laboratory to support the PQOs. Calibration concentrations, DLs, LODs and LOQs met the project requirements and low level contamination in one method blank did not affect sensitivity.

Table I. Validation Sample Table

SDG	Client Sample ID	Lab Sample ID	Matrix	QC Type	Sample Date	Validation Level	BTEX (8260B)	DCA (8260B)	Phenol (8270D)	MEE (8270D Mod)	PAH (8270D-SIM)	TPHG (8260B)	TPHE (8015B)	TPHE SGCU (8015B)	EDB (8011)
81492	ERH114	AZ45865	Water	TB	11/14/2016	Level C	X					X			
81492	ERH115	AZ45866	Water	FD2	11/14/2016	Level C	X		X	X	X	X	X		
81492	ERH116	AZ45867	Water	FD2	11/14/2016	Level C	X		X	X	X	X	X		
81492	ERH120	AZ45868	Water		11/14/2016	Level C	X		X	X	X	X	X		
81500	ERH117	AZ45907	Water		11/14/2016	Level C	X		X	X	X	X	X		
81500	ERH121	AZ45908	Water		11/14/2016	Level C	X		X	X	X	X	X		
81500	ERH122	AZ45909	Water		11/15/2016	Level D	X	X	X	X	X	X	X	X	X
81500	ERH126	AZ45910	Water		11/15/2016	Level C	X		X	X	X	X	X		
81500	ERH128	AZ45911	Water		11/14/2016	Level C	X		X	X	X	X	X		
81515	ERH118	AZ45988	Water	FD1	11/15/2016	Level C	X		X	X	X	X	X		
81515	ERH119	AZ45989	Water	FD1	11/15/2016	Level C	X		X	X	X	X	X		
81515	ERH123	AZ45990	Water	TB	11/15/2016	Level C	X	X				X			X
81515	ERH124	AZ45991	Water		11/15/2016	Level C	X		X	X	X	X	X		
81515	ERH125	AZ45992	Water		11/15/2016	Level C	X		X	X	X	X	X		
81515	ERH127	AZ45993	Water		11/16/2016	Level C	X		X	X	X	X	X		
81515	ERH129	AZ45994	Water		11/15/2016	Level D	X	X	X	X	X	X	X		X
81515	ERH130	AZ45995	Water	EB	11/16/2016	Level C	X		X	X	X	X	X		
81515	ERH131	AZ45996	Water	FB	11/16/2016	Level C	X		X	X	X	X	X		
81515	ERH132	AZ45997	Water	TB	11/16/2016	Level C	X					X			

Table I. Validation Sample Table

SDG	Client Sample ID	Lab Sample ID	Matrix	QC Type	Sample Date	Validation Level	Methane (RSK175)	Metals (6010C)	Alkalinity (2320B)	Anions (300.0)	Fe II (3500 FeB)	Si/Diss Si (4500Si)
81492	ERH114	AZ45865	Water	TB	11/14/2016	Level C	X					
81492	ERH115	AZ45866	Water	FD2	11/14/2016	Level C	X	X	X	X	X	X
81492	ERH116	AZ45867	Water	FD2	11/14/2016	Level C						
81492	ERH120	AZ45868	Water		11/14/2016	Level C	X	X	X	X	X	X
81500	ERH117	AZ45907	Water		11/14/2016	Level C	X	X	X	X	X	X
81500	ERH121	AZ45908	Water		11/14/2016	Level C	X	X	X	X	X	X
81500	ERH122	AZ45909	Water		11/15/2016	Level D	X	X	X	X	X	X
81500	ERH126	AZ45910	Water		11/15/2016	Level C	X	X	X	X	X	X
81500	ERH128	AZ45911	Water		11/14/2016	Level C	X	X	X	X	X	X
81515	ERH118	AZ45988	Water	FD1	11/15/2016	Level C	X	X	X	X	X	X
81515	ERH119	AZ45989	Water	FD1	11/15/2016	Level C						
81515	ERH123	AZ45990	Water	TB	11/15/2016	Level C	X					
81515	ERH124	AZ45991	Water		11/15/2016	Level C	X	X	X	X	X	X
81515	ERH125	AZ45992	Water		11/15/2016	Level C	X	X	X	X	X	X
81515	ERH127	AZ45993	Water		11/16/2016	Level C	X	X	X	X	X	X
81515	ERH129	AZ45994	Water		11/15/2016	Level D	X	X	X	X	X	X
81515	ERH130	AZ45995	Water	EB	11/16/2016	Level C						
81515	ERH131	AZ45996	Water	FB	11/16/2016	Level C						
81515	ERH132	AZ45997	Water	TB	11/16/2016	Level C	X					



LABORATORY DATA CONSULTANTS, INC.

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AECOM
1001 Bishop Street Suite 1600
Honolulu, HI 96813
ATTN: Ms. Margie Thach

January 27, 2017

SUBJECT: Red Hill Bulk Storage Facility, CTO 0053, Data Validation

Dear Ms. Thach,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on January 6, 2017. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #37870:

<u>SDG #</u>	<u>Fraction</u>
81734	Volatiles, Polynuclear Aromatic Hydrocarbons, Phenol, 2-(2-Methoxyethoxy)-
81760	ethanol, Wet Chemistry, TPH as Gasoline, TPH as Extractables, Ethylene
81776	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:

- Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i, August 2016
- Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i, Revision 01, November 2016
- Project Procedures Manual Naval Facilities Engineering Command, Environmental Restoration Program, NAVFAC Pacific, DON 2015
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

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

Sincerely,

Stella Cuenco
Operations Manager/Senior Chemist

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053
LDC Report Date: January 23, 2017
Parameters: Volatiles
Validation Level: Level C & D
Laboratory: APPL, Inc.
Sample Delivery Group (SDG): 81734

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH137	AZ47343	Water	12/12/16
ERH141**	AZ47344**	Water	12/12/16
ERH135**	AZ47345**	Water	12/12/16
ERH135MS	AZ47345MS	Water	12/12/16
ERH135MSD	AZ47345MSD	Water	12/12/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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. 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).
- 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 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH137 and ERH135** 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Laboratory Blank Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Field Blank Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

LDC #: 37870A1
 SDG #: 81734
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 1/16/17
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: FR

METHOD: GC/MS Volatiles (BTEX) (EPA SW 846 Method 8260B)
 † 1,2-Dichloroethane

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 ICV ≤ 20
IV.	Continuing calibration / closing of CV	Δ	CW ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	N	
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	A	LOS
X.	Field duplicates	ND	D = 1, 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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH137 D	AZ47343	Water	12/12/16
2	ERH141** + DCA	AZ47344**	Water	12/12/16
3	ERH135** D	AZ47345**	Water	12/12/16
4	ERH135MS	AZ47345MS	Water	12/12/16
5	ERH135MSD	AZ47345MSD	Water	12/12/16
6				
7				
8				
9				

Notes:

161215AL				

LDC #: 37870 A 1

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
 Reviewer: FF
 2nd Reviewer: FF

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. GC/MS Instrument performance check				
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"/>	
IIIa. Initial calibration				
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 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 all percent relative standard deviations (%RSD) $\leq 30\%$ <u>15%</u> and relative response factors (RRF) ≥ 0.05 ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IIIb. Initial Calibration Verification				
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) $< 20\%$ or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing calibration				
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 checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) $\leq 20\%$ and relative response factors (RRF) ≥ 0.05 ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
V. Laboratory Blanks				
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 completeness worksheet.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
VI. Field blanks				
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"/>	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	

LDC #: 37870A

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: PT
 2nd Reviewer: KF

Validation Area	Yes	No	NA	Findings/Comments
VIII: Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
IX: Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X: Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI: Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII: Compound quantitation				
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?	/			
XIII: Target compound identification				
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?	/			
XIV: System performance				
System performance was found to be acceptable.	/			
XV: Overall assessment of data				
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.

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	acv 1215103	12/15/16	✓ (IS1)	2.0320	2.079	2.079	2.3	2.3
			EE (IS2)	2.4170	2.584	2.584	6.9	6.9
			(IS3)					
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3								
4								

LDC #: 37870A1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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	25.0	25.22	101	101	0
1,2-Dichloroethane-d4	↓	23.81	95.2	95.2	↓
Toluene-d8	↓	24.50	98	98	↓
Bromofluorobenzene	↓	23.90	95.6	95.6	↓

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					

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

$\text{RPD} = | \text{MSC} - \text{MSC} | * 2 / (\text{MSC} + \text{MSDC})$

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD sample: 4 + 5

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalculated
1,1-Dichloroethene											
Trichloroethene											
Benzene	10.0	10.0	ND	9.33	8.70	93.3	93.3	87.0	87.0	7.0	7.0
Toluene	↓	↓	↓	9.53	9.15	95.3	95.3	91.5	91.5	4.1	4.1
Chlorobenzene											

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

LDC #: 37870 A |

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

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

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: 161215AL LO

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	NA	10.2	NA	102	102				
Toluene	10.0	↓	10.7	↓	107	107	NA			
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 0053

LDC Report Date: January 24, 2017

Parameters: Phenol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81734

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH137	AZ47343	Water	12/12/16
ERH141**	AZ47344**	Water	12/12/16
ERH135**	AZ47345**	Water	12/12/16
ERH135MS	AZ47345MS	Water	12/12/16
ERH135MSD	AZ47345MSD	Water	12/12/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH137 and ERH135** 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Laboratory Blank Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Field Blank Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

LDC #: 37870A2a

VALIDATION COMPLETENESS WORKSHEET

SDG #: 81734

Level C/D

Laboratory: APPL, Inc.

Date: 1/16/17

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 CV ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	N	
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	ND	D = 1, 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	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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH137	AZ47343	Water	12/12/16
2	ERH141**	AZ47344**	Water	12/12/16
3	ERH135**	AZ47345**	Water	12/12/16
4	ERH135MS	AZ47345MS	Water	12/12/16
5	ERH135MSD	AZ47345MSD	Water	12/12/16
6				
7				
8				

Notes:

161214 Δ				

LDC #: 37870A2a

VALIDATION FINDINGS CHECKLIST

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

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times:				
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"/>	
II. GC/MS Instrument performance check:				
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"/>	
IIIa. Initial calibration:				
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) ≤ 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"/>	
IIIb. Initial Calibration Verification:				
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"/>	
IV. Continuing calibration:				
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) within method criteria?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
V. Laboratory Blanks:				
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 completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VI. Field blanks:				
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"/>	
VII. Surrogate spikes:				
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"/>	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?			/	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37870A2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GCMS 8270C

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 40 std)	Recalculated (RRF40 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	12/7/2016	A	2.002	2.002	1.974	1.974	2.00	2.00
	Yoda								

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 * (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, A_{is} = Area of associated internal standard
 C_x = Concentration of compound, 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	ceV 1207/161	12/16/16	Phenol (1st IS)	1.974	2.014	2.014	2.0	2.0
			(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 #: 37870A2a

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1

Reviewer: FT
 2nd reviewer: PK

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: #2

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	93.458	67.78230	72.5	72.5	0
2-Fluorobiphenyl	↓	67.27923	72.0	72.0	
Terphenyl-d14	↓	72.62764	77.7	77.7	
Phenol-d5	186.916	51.90840	27.8	27.8	
2-Fluorophenol	↓	84.49868	45.2	45.2	
2,4,6-Tribromophenol	↓	137.69969	73.7	73.7	↓
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					

VALIDATION FINDINGS WORKSHEET

Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = $|MSC - MSC| * 2 / (MSC + MSDC)$

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: 4 + 5

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol	50.0	50.0	ND	19.2	19.3	38.4	38.6	38.6	38.6	0.52	0.52
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene											
Pentachlorophenol											
Pyrene											

Comments: Refer to Matrix Spike/Matrix Spike 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
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 161214A 1C>

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	50.0	NA	19.3	NA	38.6	38.6	NA			
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 0053

LDC Report Date: January 24, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81734

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH137	AZ47343	Water	12/12/16
ERH141**	AZ47344**	Water	12/12/16
ERH135**	AZ47345**	Water	12/12/16
ERH135MS	AZ47345MS	Water	12/12/16
ERH135MSD	AZ47345MSD	Water	12/12/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH137 and ERH135** 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification
Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -
SDG 81734**

No Sample Data Qualified in this SDG

LDC #: 37870A2b
 SDG #: 81734
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 1/16/17
 Page: 1 of 7
 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	Δ / Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ / Δ	% RSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration / closing cal	Δ	COV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	N	
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	Δ	LCS
X.	Field duplicates	ND	D = 1, 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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH137	AZ47343	Water	12/12/16
2	ERH141**	AZ47344**	Water	12/12/16
3	ERH135**	AZ47345**	Water	12/12/16
4	ERH135MS	AZ47345MS	Water	12/12/16
5	ERH135MSD	AZ47345MSD	Water	12/12/16
6				
7				
8				

Notes:

TTT, W + S only

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. GC/MS instrument performance check				
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"/>	
IIIa. Initial calibration				
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 checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IIIb. Initial Calibration Verification				
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"/>	
IV. Continuing calibration				
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"/>	
V. Laboratory Blanks				
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 completeness worksheet.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
VI. Field blanks				
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"/>	
VII. Surrogate spikes				
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"/>	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	/	W	FJ	
Were target compounds detected in the field duplicates?		/		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37870A26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: LK

METHOD: GCMS ^D 8270C

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 (RRF5 std)	Recalculated (RRF 5 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL Linus	12/12/2016	S (IS1)	1.118	1.118	1.009	1.009	5.70	5.70

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 * (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, A_{is} = Area of associated internal standard
 C_x = Concentration of compound, 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 12124104	12/16/16	S (1st IS)	1.009	1.017	1.017	0.00	0.00
			(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 #: 37870A2b

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1

Reviewer: FT

2nd reviewer: PK

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: # 2

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	4.673	3.54493	75.9	75.9	0
2-Fluorobiphenyl	↓	3.26862	70.0	70.0	↓
Terphenyl-d14	↓	4.15877	89.0	89.0	↓
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 #: 37870A2b

VALIDATION FINDINGS WORKSHEET

Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

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

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = $100 * |MSC - MSCD| / (MSC + MSCD)$

MSC = Matrix spike concentration

MSCD = Matrix spike duplicate concentration

MS/MSD samples: 4 + 5

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol											
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene											
Pentachlorophenol											
Pyrene											
S	5.0	5.0	NA	3.06	3.13	61.2	61.2	62.6	62.6	2.3	2.3

Comments: Refer to Matrix Spike/Matrix Spike 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
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 161214A LC5

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>S</u>	<u>5.0</u>	<u>NA</u>	<u>3.42</u>	<u>NA</u>	<u>68.4</u>	<u>68.4</u>	<u>NA</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.

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 27, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81734

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH137	AZ47343	Water	12/12/16
ERH141**	AZ47344**	Water	12/12/16
ERH135**	AZ47345**	Water	12/12/16
ERH155	AZ47431	Water	12/18/16*
ERH135MS	AZ47345MS	Water	12/12/16
ERH135MSD	AZ47345MSD	Water	12/12/16

*Indicates collection date is the receipt date

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

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%.

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 and MS/MSD percent recoveries were within QC limits. Additionally, all 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 with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
ERH135MS/MSD (ERH135**)	2-(2-Methoxyethoxy)-ethanol	31.8 (≤ 20)	NA	-

IX. Laboratory Control Samples/Reference Material

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Reference materials (RM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

Compound	ERH155		RPD (Limits)
	True Value	Laboratory Result	
2-(2-Methoxyethoxy)-ethanol	1000	700	35 (≤ 100)

X. Field Duplicates

Samples ERH137 and ERH135** 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81734**

No Sample Data Qualified in this SDG

LDC #: 37870A2c
 SDG #: 81734
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 1/16/17
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

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

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

	Validation Area	Findings	Comments
I.	Sample receipt/Technical holding times	Δ / SW	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ Δ	% PSD \leq 15 ICV \leq 20
IV.	Continuing calibration / closing CV	Δ	CV \leq 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples / RM	Δ / Δ	ICV
X.	Field duplicates	ND	D = 1, 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	SW / Δ	RTA = 4

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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH137 D	AZ47343	Water	12/12/16
2	ERH141**	AZ47344**	Water	12/12/16
3	ERH135** D	AZ47345**	Water	12/12/16
4	ERH155 PT	AZ47431	Water	12/12/16
5	ERH135MS	AZ47345MS	Water	11/18/16 12/12/16
6	ERH135MSD	AZ47345MSD	Water	12/12/16
7				
8				
9				

Notes: * Receipt date

161219A				

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/	X		
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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) 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?		/		
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) < 20% ?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed 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 completeness worksheet.		/		
VI. Field blanks				
Were field blanks were identified in this SDG?		/		
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
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 ?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII: Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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 checked="" type="checkbox"/>	<input type="checkbox"/>	
IX: Laboratory control samples				
Was an LCS analyzed for this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
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"/>	
X: Field duplicates				
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 type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
XI: Internal standards				
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"/>	
XII: Compound quantitation				
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"/>	
XIII: Target compound identification				
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"/>	
XIV: System performance				
System performance was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
XV: Overall assessment of data				
Overall assessment of data was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37870A2c

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GCMS 8270C

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:
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 400 std)	Recalculated (RRF400 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	12/20/2016	2-(2-Methoxyethoxy) Ethanol	0.2253	0.2253	0.2214	0.2214	9.90	9.90
	Yoda								

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 * (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	12207011	12/20/16	2-(2-ME)-E (1st IS)	0.2144	0.2388	0.2388	11	11
			(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 #: 37870A2C

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page: 1 of 1

Reviewer: FT

2nd reviewer: KK

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: surrogate not added see phenol analysis

	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					

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 #: 37870A2c

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

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

Where: SSC = Spiked sample concentration
SA = Spike added

SC = Sample concentration

RPD = $|MSC - MSC| * 2 / (MSC + MSDC)$

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: 5 + 6

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol											
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene											
Pentachlorophenol											
Pyrene											
2-(2-ME)-E	80.0	80.0	ND	52.9	38.4	66.1	66.1	48.0	48.0	31.8	31.8

Comments: Refer to Matrix Spike/Matrix Spike 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
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 161219A LCSD

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										
2-(2-ME)-Ethanol	80.0	NA	43.5	NA	54.4	54.4	NA			

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.

LDC #: 37870Ade

VALIDATION FINDINGS WORKSHEET
Reference Material = ERH155

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

METHOD: GC/MS 22MEE (EPA SW 846 Method 8270D Modified)

Compound	SampleID : ERH155		RPD = <u>100</u>
	True Value	Laboratory Result	
2-(2-Methoxyethoxy)-Ethanol	1000	700	35

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 24, 2017

Parameters: Wet Chemistry

Validation Level: Level D

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81734

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH141	AZ47344	Water	12/12/16
ERH135	AZ47345	Water	12/12/16
ERH135MS	AZ47345MS	Water	12/12/16
ERH135MSD	AZ47345MSD	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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

All sample results were subjected to Level D data validation, which is comprised of the quality control (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
ERH141	Nitrate as N	172.02 hours	48 hours	J (all detects)	P
ERH135	Nitrate as N	179.00 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	Associated Samples
PB (prep blank)	Alkalinity	1.5 mg/L	All samples in SDG 81734

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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
ERH135MS/MSD (ERH135)	Chloride	114 (90-110)	114 (90-110)	J (all detects)	A
ERH135MS/MSD (ERH135)	Nitrate/Nitrite as N	-	87.2 (90-110)	J (all detects)	A

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) were analyzed as required by the methods. Percent recoveries (%R) 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.

XI. Overall Assessment of Data

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

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

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Data Qualification Summary - SDG 81734**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH141 ERH135	Nitrate as N	J (all detects)	P	Technical holding time (holding time) (H)
ERH135	Chloride Nitrate/Nitrite as N	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R) (Q)

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Field Blank Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

LDC #: 37870A6

VALIDATION COMPLETENESS WORKSHEET

Date: 1/18/17

SDG #: 81734

Level D

Page: 1 of 1

Laboratory: APPL Labs

Reviewer: 30

2nd Reviewer: PF

METHOD: (Analyte) Alkalinity (SM2320B), Chloride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B) Nitrate/Nitrite-N (EPA Method 353.2)

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	SW	12/12/16
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	MS/D = (3,4)
VII.	Duplicate sample analysis	2	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	2	
X.	Sample result verification	A	
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	ERH141	AZ47344	Water	12/12/16
2	ERH135	AZ47345	Water	12/12/16
3	ERH135MS	AZ47345MS	Water	12/12/16
4	ERH135MSD	AZ47345MSD	Water	12/12/16
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes:

Method: Inorganics (EPA Method See Cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.		/		
II. Calibration				
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)			/	
III. Blanks				
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.		/		
IV. Matrix spike/Matrix spike duplicates and Duplicates				
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.	/			
V. Laboratory control samples				
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?	/			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?			/	
Were the performance evaluation (PE) samples within the acceptance limits?			/	

LDC #: 37870A

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: SD
 2nd Reviewer: PK

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

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

All circled dates have exceeded the technical holding time.
 N/A Were all samples preserved as applicable to each method ?
 N/A Were all cooler temperatures within validation criteria?

Method:		300.0					
Parameters:		NO3					
Technical holding time:		48 Hrs					
Sample ID	Sampling date	Analysis date	Analysis date	Analysis date	Analysis date	Analysis date	Qualifier
1	12/12/16 10:50	12/19/16 14:51	172.02 Hrs				J/R/P (det) (H)
2-4	12/12/16 10:20	12/19/16 21:20	179.00 Hrs				J/R/P (det) (H)

VALIDATION FINDINGS WORKSHEET
Blanks

METHOD: Inorganics, Method See Cover

Conc. units: mg/L

Associated Samples: All (3)

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB	ICB/CCB (mg/L)		No Qualifiers									
Alkalinity	1.5		7.5										

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".

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

METHOD: Trace metals (EPA SW 846 Method 6010/7000)

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

- Y N N/A Was a matrix spike analyzed for each matrix in this SDG?
 - Y N N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.
 - Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for samples?
- LEVEL IV ONLY:**
- Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
	3/4	W	Cl	114 (90-110)	114 (90-110)		2	Jdet/A (det) (Q)
			NO3/NO2-N		87.2 (90-110)			J/UJ/A (det) (Q)

Comments: _____

LDC #: 37870A6

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

Page: 1 of 1
 Reviewer: JD
 2nd Reviewer: KK

Method: Inorganics, Method See Cover

The correlation coefficient (r) for the calibration of Fe⁺² was recalculated. Calibration date: 12/13/16

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 ²	r or r ²	
Initial calibration	Fe ⁺²	s1	0.0	0	0.9998278	0.9998278	Y
		s2	1	0.101			
		s3	2	0.201			
		s4	4	0.403			
		s5	5	0.512			
		s6	10	0.999			
ICV 12:41 Calibration verification	Fe ⁺²	<u>Found</u> 3.01mg/L	<u>True</u> 3mg/L		100%R	100%R	Y
ICV 12:37 Calibration verification	Cl	18.18mg/L	20mg/L		90.9%R	91.1%R	Y*
ICV 16:35 Calibration verification	NO ₃ -N	2.35mg/L	2.5mg/L		94.0%R	94.2%R	Y*

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

*Re unring

LDC #: 37870AP

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Page: 1 of 1Reviewer: SD2nd Reviewer: RKMETHOD: 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	
LCS	Laboratory control sample	Alkalinity	244.3mg/L	250mg/L	97.7%R	97.6%R	Y*
MS 14124	Matrix spike sample	Fe ⁺²	(SSR-SR) 2957mg/L	3mg/L	98.6%R	98.4%R	Y*
MSD 2202	Duplicate sample	NO ₃	5.13mg/L	5.14mg/L	0.19%RPD	0.44%RPD	Y*

Comments: *Rounding

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

METHOD: Inorganics, Method See Cover

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

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

Compound (analyte) results for (1) SO4 reported with a positive detect were recalculated and verified using the following equation:

Concentration = (A - (-0.060)) / 0.122
Recalculation: (1.861 - (-0.060)) / 0.122 x 5 = 78.7 mg/L
D11=5
A=1.861

Table with 6 columns: #, Sample ID, Analyte, Reported Concentration (mg/L), Calculated Concentration (mg/L), and Acceptable (Y/N). Rows include data for SO4, NO3/NO2-N, and Alkalinity.

Note:

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053
LDC Report Date: January 24, 2017
Parameters: Total Petroleum Hydrocarbons as Gasoline
Validation Level: Level C & D
Laboratory: APPL, Inc.
Sample Delivery Group (SDG): 81734

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH137	AZ47343	Water	12/12/16
ERH141**	AZ47344**	Water	12/12/16
ERH135**	AZ47345**	Water	12/12/16
ERH135MS	AZ47345MS	Water	12/12/16
ERH135MSD	AZ47345MSD	Water	12/12/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 Gasoline 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH137 and ERH135** were identified as field duplicates. No results were detected in any of the samples.

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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG
81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification
Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification
Summary - SDG 81734**

No Sample Data Qualified in this SDG

LDC #: 37870A7
 SDG #: 81734
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 1/16/17
 Page: 1 of 1
 Reviewer: FJ
 2nd Reviewer: KK

METHOD: GC/MS TPH as Gasoline (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	Δ / Δ	ICV ≤ 20
IV.	Continuing calibration	Δ	CA ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	N	
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	A	LCs
X.	Field duplicates	ND	D = 1, 3
XI.	Internal standards	Δ	
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	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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH137 D	AZ47343	Water	12/12/16
2	ERH141**	AZ47344**	Water	12/12/16
3	ERH135** D	AZ47345**	Water	12/12/16
4	ERH135MS	AZ47345MS	Water	12/12/16
5	ERH135MSD	AZ47345MSD	Water	12/12/16
6				
7				
8				
9				

Notes:

161215 AL				

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical: holding times				
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"/>	
II. GC/MS: Instrument performance check				
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"/>	
IIIa. Initial calibration				
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 > 0.990?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) > 0.05?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
IIIb. Initial Calibration Verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing calibration				
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) ≤ 20% and relative response factors (RRF) ≥ 0.05?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
V. Laboratory Blanks				
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 completeness worksheet.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
VI. Field blanks				
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"/>	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	

LDC #: 31870 A-7

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: PF
 2nd Reviewer: PK

Validation Area	Yes	No	NA	Findings/Comments
VIII: Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
IX: Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X: Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI: Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII: Compound quantitation				
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?	/			
XIII: Target compound identification				
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?	/			
XIV: System performance				
System performance was found to be acceptable.	/			
XV: Overall assessment of data				
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#: 37870A7
 SDG#: 34 Lower

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
 Reviewer: F2
 2nd Reviewer: KK

Method: GRO (8260B)

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
12/11/2016	GCMS Loki	Gasoline Range Organics	1	10.18435782	0.8
			2	11.18009694	2
			3	13.09944718	4
			4	19.9450385	12
			5	30.38777183	24
			6	37.47624539	32
			7	44.32712806	40

Regression Output

Reported

Constant	9.505833	9.510000
Std Err of Y Est		
R Squared	0.999977	1.000000
Degrees of Freedom		
X Coefficient(s)	0.871596	0.872000
Std Err of Coef.		
Correlation Coefficient	0.999988	
Coefficient of Determination (r ²)	0.999977	1.000000

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 1215105	12/15/16	Gasoline C ₆ -C ₁₀ (IS1)	300	259.10	259.10	14	14
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3								
4								

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: #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>23.90</u>	<u>95.6</u>	<u>95.6</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					

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

% Recovery = 100 * (SSC - SC)/SA

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = |MSC - MSC1| * 2 / (MSC + MSC1)

MSC = Matrix spike concentration

MSC1 = Matrix spike duplicate concentration

MS/MSD sample: 445

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalculated
GR0 1,1-Dichloroethene	300	300	ND	250	247	83.3	83.3	82.3	82.3	1.2	1.2
Trichloroethene											
Benzene											
Toluene											
Chlorobenzene											

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

LDC #: 37870A7

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

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

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 = $|LCSC - LCSD| * 2 / (LCSC + LCSD)$

LCSC = Laboratory control sample concentration LCSD = Laboratory control sample duplicate concentration

LCS ID: 161215AL 125

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
GRU										
1,1-Dichloroethene	300	NA	259	NA	86.3	86.3	NA			
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 0053

LDC Report Date: January 24, 2017

Parameters: Total Petroleum Hydrocarbons as Extractables

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81734

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH137	AZ47343	Water	12/12/16
ERH141**	AZ47344**	Water	12/12/16
ERH135**	AZ47345**	Water	12/12/16
ERH135MS	AZ47345MS	Water	12/12/16
ERH135MSD	AZ47345MSD	Water	12/12/16

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH137 and ERH135** were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)
	ERH137	ERH135**	
Diesel (C10-C24)	25.0U	14J	200 (≤50)
Oil (C24-C40)	40.0U	16J	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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation, all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -
SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data
Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification
Summary - SDG 81734**

No Sample Data Qualified in this SDG

LDC #: 37870A8
 SDG #: 81734
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 1/16/17
 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	Δ Δ	
II.	Initial calibration/ICV	Δ Δ	% PSD / ICV ≤ 20
III.	Continuing calibration	Δ	COV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	N	
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	Δ	
VIII.	Laboratory control samples	Δ	LED
IX.	Field duplicates	SW	D = 1, 3
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH137 D	AZ47343	Water	12/12/16
2	ERH141**	AZ47344**	Water	12/12/16
3	ERH135** D	AZ47345**	Water	12/12/16
4	ERH135MS	AZ47345MS	Water	12/12/16
5	ERH135MSD	AZ47345MSD	Water	12/12/16
6				
7				
8				
9				
10				
11				
12				

Notes:

161214 A				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. Initial calibration				
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"/>	
III. Initial calibration verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
V. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VI. Field Blanks				
Were field blanks 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"/>	
VII. Surrogate spikes				
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"/>	
VIII. Matrix spike/matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

LDC #: 37870A8

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: FJ
 2nd Reviewer: EV

Validation Area	Yes	No	NA	Findings/Comments
VII. Laboratory control samples				
Was an LCS analyzed for this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was an LCS analyzed per 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"/>	
VIII. Field duplicates				
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"/>	
IX. Compound quantitation				
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"/>	
X. Target compound identification				
Were the retention times of reported detects within the RT windows?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

VALIDATION FINDINGS WORKSHEET

Field Duplicates

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>3</u>		
Diesel (C ₁₀ -C ₂₄)	<u>25.0 u</u>	<u>14 J</u>	<u>200</u>	/
oil (C ₂₄ -C ₄₀)	<u>40.0 u</u>	<u>16 J</u>	<u>200</u>	

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

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

LDC #: 37870A8

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

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=400)	Recalculated (CF4 std=400)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	11/3/2016	Diesel C10-C24)	1625582	Diesel C10-C24)	1727130	1727130	9.6	9.6
	Apollo								

LDC #: 37870A8

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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

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	CCV 219002	12/19/16	Diesel (C ₁₀ -C ₂₄)	1727130	1715640	1715640	0.67	0.67
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 #: 37870A8

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1

Reviewer: FT
 2nd reviewer: KK

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: #2

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
octacosane	/	40.0	38.980	97.5	97.5	0
ortho-terphenyl		↓	32.621	81.6	81.6	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		

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

METHOD: GC HPLC

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

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

Where

SSC = Spiked sample concentration

MS = Matrix spike

SC = Sample concentration

MSD = Matrix spike duplicate

SA = Spike added

$\text{RPD} = ((\text{SSCMS} - \text{SSCMSD}) * 2) / (\text{SSCMS} + \text{SSCMSD}) * 100$

MS/MSD samples: 4-5

Compound	Spike Added (ug/L)		Sample Conc. (ug/L)	Spike Sample Concentration (ug/L)		Matrix spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)											
Diesel (8015)	1330	1330	14	1050	1020	77.7	77.7	75.5	75.5	2.9	2.9
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 Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 37870A

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT
2nd Reviewer: KK

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: 161214A 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)	1330	NA	1010	NA	75.8	75.8	NA			
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.

LDC #: 37870A9

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

$$\text{Concentration} = \frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$$

Example:

Sample ID: #2 Compound Name: Diesel (C10-C24)

- A= Area or height of the compound to be measured
- Fv= Final Volume of extract
- Df= Dilution Factor
- RF= Average response factor of the compound
In the initial calibration
- Vs= Initial volume of the sample
- Ws= Initial weight of the sample
- %S= Percent Solid

$$\text{Concentration} = \frac{(70225590)(2)(1000)}{(1727130)(2)(1500)} = 27 \text{ ug/L}$$

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 23, 2017

Parameters: Ethylene Dibromide

Validation Level: Level D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81734

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH141	AZ47344	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 D data validation, which is comprised of the quality control (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% for all compounds.

Retention time windows were established as required by the method.

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 required frequencies.

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

Retention times of all compounds in the calibration standards were within the established retention time windows.

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

All compound quantitations met validation criteria.

XI. Target Compound Identification

All target compound identifications met validation criteria.

XII. Overall Assessment of Data

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

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Laboratory Blank Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Field Blank Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

LDC #: 37870A10

VALIDATION COMPLETENESS WORKSHEET

Date: 1/16/17

SDG #: 81734

Level D

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: [Signature]
2nd Reviewer: [Signature]

METHOD: GC Ethylene Dibromide (EPA SW 846 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 IA	
II.	Initial calibration/ICV	Δ Δ	% RSD / 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	CS
VIII.	Laboratory control samples	Δ	CS
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	Δ	
XI.	Target compound identification	Δ	
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	ERH141	AZ47344	Water	12/12/16
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Notes:

1	161219A				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. Initial calibration				
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"/>	
III. Initial calibration verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
III. Continuing calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
IV. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
V. Field Blanks				
Were field blanks 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"/>	
VI. Surrogate spikes				
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"/>	
VII. Matrix spike/matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

Validation Area	Yes	No	NA	Findings/Comments
VII. Laboratory control samples				
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 QC limits?	/			
VIII. Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
IX. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	/			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

LDC #: 37870A10

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

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	12/19/2016	EDB (DB-35MS)	859828	859828	837164	837164	10.0	10.0
	Herbie		EDB (DB-XLB)	1821074	1821074	1892084	1892084	5.9	5.9

LDC #: 37870A10

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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

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	CON 1214060	12/19/16	EPB (PB-35MS)	837164	937210	937210	12	12
			↓ (DB-XLB)	1892080	1909140	1909140	0.90	0.90
2	CON 1214070	12/19/16	↓	↓	895160	895160	6.9	6.9
					2139080	2139080	13	13
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 #: 37870A10

VALIDATION FINDINGS WORKSHEET

Surrogate Results Verification

Page: 1 of 1Reviewer: FT2nd reviewer: KKMETHOD: 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 SpikedSample ID: #1

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
<u>1,3-Dibromopropane</u>	<u>DB 35 MS</u>	<u>0.350</u>	<u>0.317</u>	<u>90.57</u>	<u>90.57</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	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 #: 37870A10

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT

2nd Reviewer: KK

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:

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

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

Where SSC = Spiked sample concentration
LCS = Laboratory Control Sample

SA = Spike added
LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: 161219A LCS

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)										
EPB	0.250	NA	0.164	NA	65.6	65.6	NA			

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.

LDC #: 37870A10

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

Concentration = $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

Example:

Sample ID: 161219A103 Compound Name EDB

- A= Area or height of the compound to be measured
- Fv= Final Volume of extract
- Df= Dilution Factor
- RF= Average response factor of the compound
In the initial calibration
- Vs= Initial volume of the sample
- Ws= Initial weight of the sample
- %S= Percent Solid

Concentration = $\frac{275414}{837164(2)}$ =
0.164 ug/l

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 23, 2017

Parameters: Methane

Validation Level: Level D

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81734

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH141	AZ47344	Water	12/12/16
ERH135	AZ47345	Water	12/12/16
ERH135MS	AZ47345MS	Water	12/12/16
ERH135MSD	AZ47345MSD	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 D data validation, which is comprised of the quality control (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% with the following exceptions:

Date	Standard	Compound	%D	Associated Samples	Flag	A or P
12/17/16	CCV-1217007	Methane	22	All samples in SDG 81734	UJ (all non-detects)	A

Retention times of all compounds in the calibration standards were within the established retention time windows. 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

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 with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
ERH135MS/MSD (ERH135)	Methane	60.5 (73-125)	143 (73-125)	UJ (all non-detects)	A

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

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
ERH135MS/MSD (ERH135)	Methane	80.8 (≤ 30)	NA	-

VII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

VIII. Field Duplicates

No field duplicates were identified in this SDG.

IX. Compound Quantitation

All compound quantitations met validation criteria.

X. Target Compound Identification

All target compound identifications met validation criteria.

XI. Overall Assessment of Data

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

Due to continuing calibration %D and MS/MSD %R, data were qualified as estimated in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Data Qualification Summary - SDG 81734**

Sample	Compound	Flag	A or P	Reason (Code)
ERH141 ERH135	Methane	UJ (all non-detects)	A	Continuing calibration (%D) (C)
ERH135	Methane	UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R) (Q)

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Laboratory Blank Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Field Blank Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

LDC #: 37870A51

VALIDATION COMPLETENESS WORKSHEET

Date: 1/16/17

SDG #: 81734

Level D

Page: 1 of 1

Laboratory: APPL Labs

Reviewer: KH

2nd Reviewer: KH

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 / A	ICV ≤ 20
III.	Continuing calibration	SW	CV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	N	
VI.	Matrix spike/Matrix spike duplicates	SW	
VII.	Laboratory control samples	A	LC5
VIII.	Field duplicates	N	
IX.	Compound quantitation RL/LOQ/LODs	A	
X.	Target compound identification	A	
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	ERH141	AZ47344	Water	12/12/16
2	ERH135	AZ47345	Water	12/12/16
3	ERH135MS	AZ47345MS	Water	12/12/16
4	ERH135MSD	AZ47345MSD	Water	12/12/16
5				
6				
7				
8				
9				
10				
11				
12				
13				

Notes:

1	161217A				

LDC #: 37870AS

VALIDATION FINDINGS CHECKLIST

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

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. Initial calibration				
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"/>	
III. Initial calibration verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Were all the retention times within the acceptance windows?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
V. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VI. Field Blanks				
Were field blanks 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"/>	
VII. Surrogate spikes				
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"/>	
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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 checked="" type="checkbox"/>	<input type="checkbox"/>	

LDC #: 37870A5 |

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: F7
 2nd Reviewer: KL

Validation Area	Yes	No	NA	Findings/Comments
VII. Laboratory control samples				
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 QC limits?	/			
VIII. Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
IX. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	/			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

LDC #: 37870AS1

VALIDATION FINDINGS WORKSHEET Continuing Calibration

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

METHOD: GC HPLC

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

What type of continuing calibration calculation was performed? %D or %R

Y N N/A Were continuing calibration standards analyzed at the required frequencies?

Y N N/A Did the continuing calibration standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?

Level IV Only

Y N N/A Were the retention times for all calibrated compounds within their respective acceptance windows?

#	Date	Standard ID	Detector/ Column	Compound	%D (Limit ≤ 20.0)	RT (limit)	Associated Samples	Qualifications
	12/17/16	CCV-1217007	/	Methane	22		All (C)	J/U/A (all ND)

LDC #: 37870 AS)

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

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 matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?

Y N N/A Was an MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

Y N N/A Were the MS/MSD percent recoveries (%R) and relative percent differences (RPD) within QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	314	Methane	60.5 (73-125)	143 (73-125)	()	2 (G)	J/W/A ND
		↓	()	()	10.8 (30)	↓ (E)	J/W/A ↓
			()	()	()		
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LDC#: 37870 AS
 SDG#: See lower

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
 Reviewer: FD
 2nd Reviewer: KK

Method: RSK 175

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
9/1/2016	Ints 7890	Methane	1	6703	0.9
			2	10209	1.8
			3	15515	5.1
			4	45792	13.33
			5	28664	26.7
			6	67137	66.75
			7	126422	106.8
			8	421052	320.4
			9	723824	667.5
			10	1454283	1335

Regression Output

Reported

Constant	14373.549641	14400.00
Std Err of Y Est		
R Squared	0.997596	0.998000
Degrees of Freedom		
X Coefficient(s)	1083.161249	1083.00
Std Err of Coef.		
Correlation Coefficient	0.998797	
Coefficient of Determination (r ²)	0.997596	0.998000

LDC #: 37870 AS

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

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 1217007	12/17/16	Methane	667.5	815.052	815.052	22	22
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 #: 37870 AS

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

METHOD: GC HPLC

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

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

Where

SSC = Spiked sample concentration

MS = Matrix spike

SC = Sample concentration

MSD = Matrix spike duplicate

SA = Spike added

$\text{RPD} = ((\text{SSCMS} - \text{SSCMSD}) * 2) / (\text{SSCMS} + \text{SSCMSD}) * 100$

MS/MSD samples: 3 + 4

Compound	Spike Added (ug/L)		Sample Conc. (ug/L)	Spike Sample Concentration (ug/L)		Matrix spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)											
Diesel (8015)											
Benzene (8021B)											
Methane (RSK-175)	320	320	ND	194	457	60.5	60.5	143	143	80.8	80.9
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 Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 37070AS

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT
2nd Reviewer: KK

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: 161217A LCS

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)	668	NA	815	NA	22	22	NA			
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.

LDC #: 37870AS

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

Concentration = $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

Example:

Sample ID: LES-161217 Compound Name Methane

- A= Area or height of the compound to be measured
- Fv= Final Volume of extract
- Df= Dilution Factor
- RF= Average response factor of the compound
In the initial calibration
- Vs= Initial volume of the sample
- Ws= Initial weight of the sample
- %S= Percent Solid

Concentration = _____ =

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications
	<u>897206 =</u>	<u>10830 (X) + 14400</u>			
	<u>X =</u>	<u>815 ug/l</u>			

Comments: _____

**Red Hill Bulk Storage Facility, CTO 0053 - SDG 81734
LDC 37870**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 2320B													
ERH141	AZ47344	1	ALKALINITY, AS CaCO3	12/12/2016 10:50:00 AM	12/19/2016 5:19:00 PM	D	59.1	MG_L		2.0	1.70		
ERH141	AZ47344	1	ALKALINITY, BICARBONATE	12/12/2016 10:50:00 AM	12/19/2016 5:19:00 PM	D	59.1	MG_L		2.0	1.70		
ERH141	AZ47344	1	ALKALINITY, CARBONATE	12/12/2016 10:50:00 AM	12/19/2016 5:19:00 PM	D	1.70	MG_L	U	2.0	1.70		U
ERH135	AZ47345	1	ALKALINITY, AS CaCO3	12/12/2016 10:20:00 AM	12/19/2016 5:24:00 PM	D	61.9	MG_L		2.0	1.70		
ERH135	AZ47345	1	ALKALINITY, BICARBONATE	12/12/2016 10:20:00 AM	12/19/2016 5:24:00 PM	D	61.9	MG_L		2.0	1.70		
ERH135	AZ47345	1	ALKALINITY, CARBONATE	12/12/2016 10:20:00 AM	12/19/2016 5:24:00 PM	D	1.70	MG_L	U	2.0	1.70		U
METHOD: 300.0													
ERH141	AZ47344	5	CHLORIDE	12/12/2016 10:50:00 AM	12/19/2016 4:36:00 PM	D	171	MG_L	D	5.0	1.00		
ERH141	AZ47344	1	NITRATE	12/12/2016 10:50:00 AM	12/19/2016 2:51:00 PM	D	2.2	MG_L		0.5	0.18	J	h
ERH141	AZ47344	5	SULFATE	12/12/2016 10:50:00 AM	12/19/2016 4:36:00 PM	D	78.7	MG_L	D	5.0	1.00		
ERH135	AZ47345	2	CHLORIDE	12/12/2016 10:20:00 AM	12/19/2016 9:23:00 PM	D	85.3	MG_L		2.0	0.40	J	q
ERH135	AZ47345	1	NITRATE	12/12/2016 10:20:00 AM	12/19/2016 9:10:00 PM	D	2.5	MG_L		0.5	0.18	J	h
ERH135	AZ47345	1	SULFATE	12/12/2016 10:20:00 AM	12/19/2016 9:10:00 PM	D	14.9	MG_L		1.0	0.20		
METHOD: 3500_FE_B													
ERH141	AZ47344	1	IRON, FERROUS	12/12/2016 10:50:00 AM	12/13/2016 2:22:00 PM	D	0.32	MG_L	U	1.0	0.32		U
ERH135	AZ47345	1	IRON, FERROUS	12/12/2016 10:20:00 AM	12/13/2016 2:23:00 PM	D	0.32	MG_L	U	1.0	0.32		U
METHOD: 353.2													
ERH141	AZ47344	1	NITRATE-NITRITE AS NITROGEN	12/12/2016 10:50:00 AM	12/20/2016 5:28:00 PM	D	0.33	MG_L		0.10	0.100		
ERH135	AZ47345	1	NITRATE-NITRITE AS NITROGEN	12/12/2016 10:20:00 AM	12/20/2016 5:30:00 PM	D	0.40	MG_L		0.10	0.100	J	q
METHOD: 8011													
ERH141	AZ47344	1	1,2-DIBROMOETHANE	12/12/2016 10:50:00 AM	12/20/2016 3:09:00 PM	D	0.020	UG_L	U	0.02	0.020		U
METHOD: 8015B_E													
ERH137	AZ47343	1	TPH-DIESEL RANGE	12/12/2016 10:20:00 AM	12/19/2016 11:53:00 AM	C	25.00	UG_L	U	40.0	25.00		U
ERH137	AZ47343	1	TPH-OIL RANGE	12/12/2016 10:20:00 AM	12/19/2016 11:53:00 AM	C	40.00	UG_L	U	40.0	40.00		U
ERH141	AZ47344	1	TPH-DIESEL RANGE	12/12/2016 10:50:00 AM	12/19/2016 12:14:00 PM	D	27	UG_L	JT3I	40.0	25.00		
ERH141	AZ47344	1	TPH-OIL RANGE	12/12/2016 10:50:00 AM	12/19/2016 12:14:00 PM	D	29	UG_L	J	40.0	40.00		J
ERH135	AZ47345	1	TPH-DIESEL RANGE	12/12/2016 10:20:00 AM	12/19/2016 12:34:00 PM	D	14	UG_L	JT3I	40.0	25.00		

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8015B_E													
ERH135	AZ47345	1	TPH-OIL RANGE	12/12/2016 10:20:00 AM	12/19/2016 12:34:00 PM	D	16	UG_L	J	40.0	40.00	J	
METHOD: 8260B													
ERH137	AZ47343	1	BENZENE	12/12/2016 10:20:00 AM	12/15/2016 7:21:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH137	AZ47343	1	ETHYLBENZENE	12/12/2016 10:20:00 AM	12/15/2016 7:21:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH137	AZ47343	1	TOLUENE	12/12/2016 10:20:00 AM	12/15/2016 7:21:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH137	AZ47343	1	TPH-GASOLINE RANGE C6-C10	12/12/2016 10:20:00 AM	12/15/2016 7:20:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH137	AZ47343	1	XYLENES, TOTAL	12/12/2016 10:20:00 AM	12/15/2016 7:21:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH141	AZ47344	1	1,2-DICHLOROETHANE	12/12/2016 10:50:00 AM	12/15/2016 7:49:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH141	AZ47344	1	BENZENE	12/12/2016 10:50:00 AM	12/15/2016 7:49:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH141	AZ47344	1	ETHYLBENZENE	12/12/2016 10:50:00 AM	12/15/2016 7:49:00 PM	D	0.50	UG_L	U	1.0	0.50	U	
ERH141	AZ47344	1	TOLUENE	12/12/2016 10:50:00 AM	12/15/2016 7:49:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH141	AZ47344	1	TPH-GASOLINE RANGE C6-C10	12/12/2016 10:50:00 AM	12/15/2016 7:48:00 PM	D	18.0	UG_L	U	20	18.0	U	
ERH141	AZ47344	1	XYLENES, TOTAL	12/12/2016 10:50:00 AM	12/15/2016 7:49:00 PM	D	0.30	UG_L	U	2.0	0.30	U	
ERH135	AZ47345	1	BENZENE	12/12/2016 10:20:00 AM	12/15/2016 8:17:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH135	AZ47345	1	ETHYLBENZENE	12/12/2016 10:20:00 AM	12/15/2016 8:17:00 PM	D	0.50	UG_L	U	1.0	0.50	U	
ERH135	AZ47345	1	TOLUENE	12/12/2016 10:20:00 AM	12/15/2016 8:17:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH135	AZ47345	1	TPH-GASOLINE RANGE C6-C10	12/12/2016 10:20:00 AM	12/15/2016 8:16:00 PM	D	18.0	UG_L	U	20	18.0	U	
ERH135	AZ47345	1	XYLENES, TOTAL	12/12/2016 10:20:00 AM	12/15/2016 8:17:00 PM	D	0.30	UG_L	U	2.0	0.30	U	
METHOD: 8270D													
ERH137	AZ47343	1	2-(2-METHOXYETHOXY)-ETHANOL	12/12/2016 10:20:00 AM	12/20/2016 4:14:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH137	AZ47343	1	PHENOL	12/12/2016 10:20:00 AM	12/16/2016 1:31:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH141	AZ47344	1	2-(2-METHOXYETHOXY)-ETHANOL	12/12/2016 10:50:00 AM	12/20/2016 4:45:00 PM	D	80.0	UG_L	U	100	80.0	U	
ERH141	AZ47344	1	PHENOL	12/12/2016 10:50:00 AM	12/16/2016 2:02:00 PM	D	4.00	UG_L	U	5.0	4.00	U	
ERH135	AZ47345	1	2-(2-METHOXYETHOXY)-ETHANOL	12/12/2016 10:20:00 AM	12/20/2016 5:15:00 PM	D	80.0	UG_L	U	100	80.0	U	
ERH135	AZ47345	1	PHENOL	12/12/2016 10:20:00 AM	12/16/2016 3:33:00 PM	D	4.00	UG_L	U	5.0	4.00	U	
ERH155	AZ47431	2	2-(2-METHOXYETHOXY)-ETHANOL	11/18/2016 10:00:00 AM	12/21/2016 2:15:00 AM	C	700	UG_L		200	160.0		
METHOD: 8270D_SIM													
ERH137	AZ47343	1	1-METHYLNAPHTHALENE	12/12/2016 10:20:00 AM	12/16/2016 1:20:00 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
METHOD: 8270D_SIM													
ERH137	AZ47343	1	2-METHYLNAPHTHALENE	12/12/2016 10:20:00 AM	12/16/2016 1:20:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH137	AZ47343	1	NAPHTHALENE	12/12/2016 10:20:00 AM	12/16/2016 1:20:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH141	AZ47344	1	1-METHYLNAPHTHALENE	12/12/2016 10:50:00 AM	12/16/2016 1:54:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH141	AZ47344	1	2-METHYLNAPHTHALENE	12/12/2016 10:50:00 AM	12/16/2016 1:54:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH141	AZ47344	1	NAPHTHALENE	12/12/2016 10:50:00 AM	12/16/2016 1:54:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH135	AZ47345	1	1-METHYLNAPHTHALENE	12/12/2016 10:20:00 AM	12/16/2016 4:41:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH135	AZ47345	1	2-METHYLNAPHTHALENE	12/12/2016 10:20:00 AM	12/16/2016 4:41:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH135	AZ47345	1	NAPHTHALENE	12/12/2016 10:20:00 AM	12/16/2016 4:41:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
METHOD: RSK-175													
ERH141	AZ47344	1	METHANE	12/12/2016 10:50:00 AM	12/17/2016 11:40:00 AM	D	1.00	UG_L	U	5.0	1.00	UJ	c
ERH135	AZ47345	1	METHANE	12/12/2016 10:20:00 AM	12/17/2016 11:43:00 AM	D	1.00	UG_L	U	5.0	1.00	UJ	c,q

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 23, 2017

Parameters: Volatiles

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81760

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH134	AZ47493	Water	12/12/16
ERH139	AZ47494	Water	12/12/16
ERH136	AZ47495	Water	12/12/16
ERH143	AZ47496	Water	12/13/16
ERH145	AZ47497	Water	12/13/16
ERH146	AZ47498	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 ERH134 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Laboratory Blank Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Field Blank Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

LDC #: 37870B1

VALIDATION COMPLETENESS WORKSHEET

Date: 1/13/17

SDG #: 81760

Level C

Page: 1 of 1

Laboratory: APPL, Inc.

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, Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	A, Δ	% RSD ≤ 15 1 CV ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 1
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	CS
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	ERH134 TB	AZ47493	Water	12/12/16
2	ERH139	AZ47494	Water	12/12/16
3	ERH136	AZ47495	Water	12/12/16
4	ERH143	AZ47496	Water	12/13/16
5	ERH145	AZ47497	Water	12/13/16
6	ERH146	AZ47498	Water	12/12/16
7				
8				
9				

Notes:

161218AL				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 24, 2017

Parameters: Phenol

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81760

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH139	AZ47494	Water	12/12/16
ERH136	AZ47495	Water	12/12/16
ERH143	AZ47496	Water	12/13/16
ERH145	AZ47497	Water	12/13/16
ERH146	AZ47498	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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%.

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% 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Laboratory Blank Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Field Blank Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

LDC #: 37870B2a
 SDG #: 81760
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 1/13/17
 Page: 1 of 7
 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	A, A	% PSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration / closing cov	Δ	cov ≤ 20
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	CS
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	ERH139	AZ47494	Water	12/12/16
2	ERH136	AZ47495	Water	12/12/16
3	ERH143	AZ47496	Water	12/13/16
4	ERH145	AZ47497	Water	12/13/16
5	ERH146	AZ47498	Water	12/12/16
6				
7				
8				

Notes:

161219A				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 24, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81760

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH139	AZ47494	Water	12/12/16
ERH136	AZ47495	Water	12/12/16
ERH143	AZ47496	Water	12/13/16
ERH145	AZ47497	Water	12/13/16
ERH146	AZ47498	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification
Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -
SDG 81760**

No Sample Data Qualified in this SDG

LDC #: 37870B2b
 SDG #: 81760
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 1/13/17
 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	% RSD ≤ 15 10X ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20
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	CS
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	ERH139	AZ47494	Water	12/12/16
2	ERH136	AZ47495	Water	12/12/16
3	ERH143	AZ47496	Water	12/13/16
4	ERH145	AZ47497	Water	12/13/16
5	ERH146	AZ47498	Water	12/12/16
6				
7				
8				

Notes:

161219A				

TTT, W, S

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 24, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81760

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH139	AZ47494	Water	12/12/16
ERH136	AZ47495	Water	12/12/16
ERH143	AZ47496	Water	12/13/16
ERH145	AZ47497	Water	12/13/16
ERH146	AZ47498	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% 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%.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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 percent recoveries were within QC limits. Additionally, all 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81760**

No Sample Data Qualified in this SDG

LDC #: 37870B2c
 SDG #: 81760
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 1/13/17
 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 1CV ≤ 20
IV.	Continuing calibration	Δ	CV ≤ 20
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
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	ERH139	AZ47494	Water	12/12/16
2	ERH136	AZ47495	Water	12/12/16
3	ERH143	AZ47496	Water	12/13/16
4	ERH145	AZ47497	Water	12/13/16
5	ERH146	AZ47498	Water	12/12/16
6				
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Notes:

161219A				

LDC #: 3787082c

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

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

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
		Surrogates were not added to all samples as required by the method. Using professional judgment, no data were qualified, since the LCS percent recoveries were within QC limits. Additionally, all surrogate percent recoveries were within QC limits in the phenol analysis.		<i>Text</i>
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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 0053

LDC Report Date: January 24, 2017

Parameters: Wet Chemistry

Validation Level: Level C

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81760

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH139	AZ47494	Water	12/12/16
ERH136	AZ47495	Water	12/12/16
ERH143	AZ47496	Water	12/13/16
ERH145	AZ47497	Water	12/13/16
ERH146	AZ47498	Water	12/12/16
ERH146MS	AZ47498MS	Water	12/12/16
ERH146MSD	AZ47498MSD	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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

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
ERH139	Nitrate	49.63 hours	48 hours	J (all detects)	P
ERH136	Nitrate	48.60 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	Associated Samples
PB (prep blank)	Alkalinity	1.6 mg/L	All samples in SDG 81760

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) were analyzed as required by the methods. Percent recoveries (%R) 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. No results were rejected in this SDG.

Due to technical holding time, data were qualified as estimated in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
 Wet Chemistry - Data Qualification Summary - SDG 81760**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH139 ERH136	Nitrate	J (all detects)	P	Technical holding times (H)

**Red Hill Bulk Storage Facility, CTO 0053
 Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
 Wet Chemistry - Field Blank Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

LDC #: 37870B6

VALIDATION COMPLETENESS WORKSHEET

Date: 1/18/17

SDG #: 81760

Level C

Page: 1 of 1

Laboratory: APPL Labs

Reviewer: *[Signature]*
2nd Reviewer: *[Signature]*

METHOD: (Analyte) Alkalinity (SM2320B), Chloride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B)

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	SW	12/12-13/16
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	MSD = (6.7)
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
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	ERH139	AZ47494	Water	12/12/16
2	ERH136	AZ47495	Water	12/12/16
3	ERH143	AZ47496	Water	12/13/16
4	ERH145	AZ47497	Water	12/13/16
5	ERH146	AZ47498	Water	12/12/16
6	ERH146MS	<i>AK</i> AZ47498MS	Water	12/12/16
7	ERH146MSD	<i>↓</i> AZ47498MSD	Water	12/12/16
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Notes: _____

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>NO₃</u> <u>NO₂</u> <u>SO₄</u> O-PO ₄ <u>Alk</u> CN NH ₃ TKN TOC Cr6+ ClO ₄ <u>Fe⁺²</u>
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
DC:6-7	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ <u>Alk</u> CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
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	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
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	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄

Comments: _____

LDC #: 37870B6

VALIDATION FINDINGS WORKSHEET Blanks

Page: 1 of 1
Reviewer: JD
2nd Reviewer: KK

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)		No Qualifiers								
Alkalinity	1.6		8									

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 0053
LDC Report Date: January 24, 2017
Parameters: Total Petroleum Hydrocarbons as Gasoline
Validation Level: Level C
Laboratory: APPL, Inc.
Sample Delivery Group (SDG): 81760

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH134	AZ47493	Water	12/12/16
ERH139	AZ47494	Water	12/12/16
ERH136	AZ47495	Water	12/12/16
ERH143	AZ47496	Water	12/13/16
ERH145	AZ47497	Water	12/13/16
ERH146	AZ47498	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 Gasoline 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 ERH134 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG
81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification
Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification
Summary - SDG 81760**

No Sample Data Qualified in this SDG

LDC #: 37870B7

VALIDATION COMPLETENESS WORKSHEET

Date: 1/13/17

SDG #: 81760

Level C

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: [Signature]
2nd Reviewer: [Signature]

METHOD: GC/MS TPH as Gasoline (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	Δ, Δ	1 ² ICV ≤ 20
IV.	Continuing calibration	Δ	CV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
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	ERH134 TB	AZ47493	Water	12/12/16
2	ERH139	AZ47494	Water	12/12/16
3	ERH136	AZ47495	Water	12/12/16
4	ERH143	AZ47496	Water	12/13/16
5	ERH145	AZ47497	Water	12/13/16
6	ERH146	AZ47498	Water	12/12/16
7				
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9				

Notes:

16/2/8A L				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053
LDC Report Date: January 24, 2017
Parameters: Total Petroleum Hydrocarbons as Extractables
Validation Level: Level C
Laboratory: APPL, Inc.
Sample Delivery Group (SDG): 81760

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH139	AZ47494	Water	12/12/16
ERH136	AZ47495	Water	12/12/16
ERH143	AZ47496	Water	12/13/16
ERH145	AZ47497	Water	12/13/16
ERH146	AZ47498	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

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 ERH149 (from SDG 81776) was identified as an equipment blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH149	12/14/16	Diesel (C10-C24)	25 ug/L	ERH143 ERH145

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 with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
ERH143	Diesel (C10-C24)	96 ug/L	96U ug/L

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) were analyzed as required by the method. Percent recoveries (%R) 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.

Due to equipment blank contamination, data were qualified as not detected in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -
SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data
Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification
Summary - SDG 81760**

Sample	Compound	Modified Final Concentration	A or P	Code
ERH143	Diesel (C10-C24)	96U ug/L	A	F

LDC #: 37870B8
 SDG #: 81760
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 1/13/17
 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	% RSD/ICV ≤ 20
III.	Continuing calibration	Δ	CCV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	SW	EB = ERH149 (81776)
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	Δ	
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	ERH139	AZ47494	Water	12/12/16
2	ERH136	AZ47495	Water	12/12/16
3	ERH143	AZ47496	Water	12/13/16
4	ERH145	AZ47497	Water	12/13/16
5	ERH146	AZ47498	Water	12/12/16
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Notes:

161219A				

LDC #: 7187086

VALIDATION FINDINGS WORKSHEET Field Blanks

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

METHOD: GC

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: 12/14/16

Field blank type: (circle one) Field Blank / Rinsate (Other) EB Associated Samples: 3,4

Compound	Blank ID	Sample Identification							
	<u>ER4149</u>	<u>3</u>							
<u>Diethyl (1,10-024)</u>	<u>25</u>	<u>964</u>							

Blank units: _____ Associated sample units: _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification							

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".

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 23, 2017

Parameters: Ethylene Dibromide

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81760

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH134	AZ47493	Water	12/12/16
ERH146	AZ47498	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% for all compounds.

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 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 ERH134 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Laboratory Blank Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Field Blank Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

LDC #: 37870B10
 SDG #: 81760
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C

Date: 1/13/17
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC Ethylene Dibromide (EPA SW 846 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, Δ	% RSD/ICV ≤ 20
III.	Continuing calibration	Δ	CCV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 1
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	CS
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	ERH134 TB	AZ47493	Water	12/12/16
2	ERH146	AZ47498	Water	12/12/16
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Notes:

161219A				

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

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 23, 2017

Parameters: Methane

Validation Level: Level C

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81760

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH134	AZ47493	Water	12/12/16
ERH139	AZ47494	Water	12/12/16
ERH136	AZ47495	Water	12/12/16
ERH143	AZ47496	Water	12/13/16
ERH145	AZ47497	Water	12/13/16
ERH146	AZ47498	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 is comprised of the quality control (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.

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 ERH134 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Laboratory Blank Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Field Blank Data Qualification Summary - SDG 81760**

No Sample Data Qualified in this SDG

LDC #: 37870B51
 SDG #: 81760
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 1/13/17
 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	Δ Δ	1 ² ICV = 20
III.	Continuing calibration	Δ	CCV = 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 1
VI.	Matrix spike/Matrix spike duplicates	N	CS
VII.	Laboratory control samples	A	LC5
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 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	ERH134 TB	AZ47493	Water	12/12/16
2	ERH139	AZ47494	Water	12/12/16
3	ERH136	AZ47495	Water	12/12/16
4	ERH143	AZ47496	Water	12/13/16
5	ERH145	AZ47497	Water	12/13/16
6	ERH146	AZ47498	Water	12/12/16
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Notes:

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**Red Hill Bulk Storage Facility, CTO 0053 - SDG 81760
LDC 37870**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 2320B													
ERH139	AZ47494	1	ALKALINITY, AS CaCO3	12/12/2016 1:30:00 PM	12/20/2016 3:56:00 PM	C	114	MG_L		2.0	1.70		
ERH139	AZ47494	1	ALKALINITY, BICARBONATE	12/12/2016 1:30:00 PM	12/20/2016 3:56:00 PM	C	114	MG_L		2.0	1.70		
ERH139	AZ47494	1	ALKALINITY, CARBONATE	12/12/2016 1:30:00 PM	12/20/2016 3:56:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH136	AZ47495	1	ALKALINITY, AS CaCO3	12/12/2016 2:45:00 PM	12/20/2016 4:03:00 PM	C	102	MG_L		2.0	1.70		
ERH136	AZ47495	1	ALKALINITY, BICARBONATE	12/12/2016 2:45:00 PM	12/20/2016 4:03:00 PM	C	102	MG_L		2.0	1.70		
ERH136	AZ47495	1	ALKALINITY, CARBONATE	12/12/2016 2:45:00 PM	12/20/2016 4:03:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH143	AZ47496	1	ALKALINITY, AS CaCO3	12/13/2016 10:40:00 AM	12/20/2016 4:09:00 PM	C	96.5	MG_L		2.0	1.70		
ERH143	AZ47496	1	ALKALINITY, BICARBONATE	12/13/2016 10:40:00 AM	12/20/2016 4:09:00 PM	C	96.5	MG_L		2.0	1.70		
ERH143	AZ47496	1	ALKALINITY, CARBONATE	12/13/2016 10:40:00 AM	12/20/2016 4:09:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH145	AZ47497	1	ALKALINITY, AS CaCO3	12/13/2016 10:50:00 AM	12/20/2016 4:16:00 PM	C	53.2	MG_L		2.0	1.70		
ERH145	AZ47497	1	ALKALINITY, BICARBONATE	12/13/2016 10:50:00 AM	12/20/2016 4:16:00 PM	C	53.2	MG_L		2.0	1.70		
ERH145	AZ47497	1	ALKALINITY, CARBONATE	12/13/2016 10:50:00 AM	12/20/2016 4:16:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH146	AZ47498	1	ALKALINITY, AS CaCO3	12/12/2016 4:55:00 PM	12/20/2016 4:21:00 PM	C	67.4	MG_L		2.0	1.70		
ERH146	AZ47498	1	ALKALINITY, BICARBONATE	12/12/2016 4:55:00 PM	12/20/2016 4:21:00 PM	C	67.4	MG_L		2.0	1.70		
ERH146	AZ47498	1	ALKALINITY, CARBONATE	12/12/2016 4:55:00 PM	12/20/2016 4:21:00 PM	C	1.70	MG_L	U	2.0	1.70		U
METHOD: 300.0													
ERH139	AZ47494	10	CHLORIDE	12/12/2016 1:30:00 PM	12/20/2016 12:59:00 PM	C	390	MG_L		10.0	2.00		
ERH139	AZ47494	2	NITRATE	12/12/2016 1:30:00 PM	12/14/2016 3:08:00 PM	C	2.8	MG_L		1.0	0.36	J	h
ERH139	AZ47494	2	SULFATE	12/12/2016 1:30:00 PM	12/14/2016 3:08:00 PM	C	85.4	MG_L		2.0	0.40		
ERH136	AZ47495	5	CHLORIDE	12/12/2016 2:45:00 PM	12/20/2016 1:12:00 PM	C	149	MG_L		5.0	1.00		
ERH136	AZ47495	1	NITRATE	12/12/2016 2:45:00 PM	12/14/2016 3:21:00 PM	C	4.3	MG_L		0.5	0.18	J	h
ERH136	AZ47495	1	SULFATE	12/12/2016 2:45:00 PM	12/14/2016 3:21:00 PM	C	48.4	MG_L		1.0	0.20		
ERH143	AZ47496	1	CHLORIDE	12/13/2016 10:40:00 AM	12/14/2016 3:47:00 PM	C	38.3	MG_L		1.0	0.20		
ERH143	AZ47496	1	NITRATE	12/13/2016 10:40:00 AM	12/14/2016 3:47:00 PM	C	0.44	MG_L	J	0.5	0.18	J	
ERH143	AZ47496	1	SULFATE	12/13/2016 10:40:00 AM	12/14/2016 3:47:00 PM	C	4.4	MG_L		1.0	0.20		

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 300.0													
ERH145	AZ47497	2	CHLORIDE	12/13/2016 10:50:00 AM	12/20/2016 1:25:00 PM	C	90.4	MG_L		2.0	0.40		
ERH145	AZ47497	1	NITRATE	12/13/2016 10:50:00 AM	12/14/2016 3:34:00 PM	C	0.81	MG_L		0.5	0.18		
ERH145	AZ47497	1	SULFATE	12/13/2016 10:50:00 AM	12/14/2016 3:34:00 PM	C	24.9	MG_L		1.0	0.20		
ERH146	AZ47498	2	CHLORIDE	12/12/2016 4:55:00 PM	12/20/2016 1:38:00 PM	C	49.2	MG_L		2.0	0.40		
ERH146	AZ47498	1	NITRATE	12/12/2016 4:55:00 PM	12/14/2016 4:00:00 PM	C	2.2	MG_L		0.5	0.18		
ERH146	AZ47498	1	SULFATE	12/12/2016 4:55:00 PM	12/14/2016 4:00:00 PM	C	9.1	MG_L		1.0	0.20		
METHOD: 3500 FE B													
ERH139	AZ47494	1	IRON, FERROUS	12/12/2016 1:30:00 PM	12/14/2016 4:10:00 PM	C	0.32	MG_L	U	1.0	0.32		U
ERH136	AZ47495	1	IRON, FERROUS	12/12/2016 2:45:00 PM	12/14/2016 4:11:00 PM	C	0.32	MG_L	U	1.0	0.32		U
ERH143	AZ47496	1	IRON, FERROUS	12/13/2016 10:40:00 AM	12/14/2016 4:12:00 PM	C	0.55	MG_L	J	1.0	0.32		J
ERH145	AZ47497	1	IRON, FERROUS	12/13/2016 10:50:00 AM	12/14/2016 4:13:00 PM	C	4.7	MG_L		1.0	0.32		
ERH146	AZ47498	1	IRON, FERROUS	12/12/2016 4:55:00 PM	12/14/2016 4:14:00 PM	C	0.32	MG_L	U	1.0	0.32		U
METHOD: 8011													
ERH134	AZ47493	1	1,2-DIBROMOETHANE	12/12/2016 8:00:00 AM	12/19/2016 6:41:00 PM	C	0.020	UG_L	U	0.02	0.020		U
ERH146	AZ47498	1	1,2-DIBROMOETHANE	12/12/2016 4:55:00 PM	12/19/2016 7:01:00 PM	C	0.020	UG_L	U	0.02	0.020		U
METHOD: 8015B_E													
ERH139	AZ47494	1	TPH-DIESEL RANGE	12/12/2016 1:30:00 PM	12/20/2016 8:08:00 PM	C	25.00	UG_L	U	40.0	25.00		U
ERH139	AZ47494	1	TPH-OIL RANGE	12/12/2016 1:30:00 PM	12/20/2016 8:08:00 PM	C	40.00	UG_L	U	40.0	40.00		U
ERH136	AZ47495	1	TPH-DIESEL RANGE	12/12/2016 2:45:00 PM	12/20/2016 8:28:00 PM	C	25.00	UG_L	U	40.0	25.00		U
ERH136	AZ47495	1	TPH-OIL RANGE	12/12/2016 2:45:00 PM	12/20/2016 8:28:00 PM	C	40.00	UG_L	U	40.0	40.00		U
ERH143	AZ47496	1	TPH-DIESEL RANGE	12/13/2016 10:40:00 AM	12/20/2016 8:48:00 PM	C		UG_L	T6	40.0	96		U f
ERH143	AZ47496	1	TPH-OIL RANGE	12/13/2016 10:40:00 AM	12/20/2016 8:48:00 PM	C	40.00	UG_L	U	40.0	40.00		U
ERH145	AZ47497	1	TPH-DIESEL RANGE	12/13/2016 10:50:00 AM	12/20/2016 9:08:00 PM	C	25.00	UG_L	U	40.0	25.00		U
ERH145	AZ47497	1	TPH-OIL RANGE	12/13/2016 10:50:00 AM	12/20/2016 9:08:00 PM	C	40.00	UG_L	U	40.0	40.00		U
ERH146	AZ47498	1	TPH-DIESEL RANGE	12/12/2016 4:55:00 PM	12/20/2016 9:29:00 PM	C	25.00	UG_L	U	40.0	25.00		U
ERH146	AZ47498	1	TPH-OIL RANGE	12/12/2016 4:55:00 PM	12/20/2016 9:29:00 PM	C	40.00	UG_L	U	40.0	40.00		U
METHOD: 8260B													
ERH134	AZ47493	1	1,2-DICHLOROETHANE	12/12/2016 8:00:00 AM	12/18/2016 8:26:00 PM	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
METHOD: 8260B													
ERH134	AZ47493	1	BENZENE	12/12/2016 8:00:00 AM	12/18/2016 8:26:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH134	AZ47493	1	ETHYLBENZENE	12/12/2016 8:00:00 AM	12/18/2016 8:26:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH134	AZ47493	1	TOLUENE	12/12/2016 8:00:00 AM	12/18/2016 8:26:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH134	AZ47493	1	TPH-GASOLINE RANGE C6-C10	12/12/2016 8:00:00 AM	12/18/2016 8:25:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH134	AZ47493	1	XYLENES, TOTAL	12/12/2016 8:00:00 AM	12/18/2016 8:26:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH139	AZ47494	1	BENZENE	12/12/2016 1:30:00 PM	12/18/2016 10:44:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH139	AZ47494	1	ETHYLBENZENE	12/12/2016 1:30:00 PM	12/18/2016 10:44:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH139	AZ47494	1	TOLUENE	12/12/2016 1:30:00 PM	12/18/2016 10:44:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH139	AZ47494	1	TPH-GASOLINE RANGE C6-C10	12/12/2016 1:30:00 PM	12/18/2016 10:45:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH139	AZ47494	1	XYLENES, TOTAL	12/12/2016 1:30:00 PM	12/18/2016 10:44:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH136	AZ47495	1	BENZENE	12/12/2016 2:45:00 PM	12/18/2016 11:13:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH136	AZ47495	1	ETHYLBENZENE	12/12/2016 2:45:00 PM	12/18/2016 11:13:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH136	AZ47495	1	TOLUENE	12/12/2016 2:45:00 PM	12/18/2016 11:13:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH136	AZ47495	1	TPH-GASOLINE RANGE C6-C10	12/12/2016 2:45:00 PM	12/18/2016 11:12:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH136	AZ47495	1	XYLENES, TOTAL	12/12/2016 2:45:00 PM	12/18/2016 11:13:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH143	AZ47496	1	BENZENE	12/13/2016 10:40:00 AM	12/18/2016 11:40:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH143	AZ47496	1	ETHYLBENZENE	12/13/2016 10:40:00 AM	12/18/2016 11:40:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH143	AZ47496	1	TOLUENE	12/13/2016 10:40:00 AM	12/18/2016 11:40:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH143	AZ47496	1	TPH-GASOLINE RANGE C6-C10	12/13/2016 10:40:00 AM	12/18/2016 11:41:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH143	AZ47496	1	XYLENES, TOTAL	12/13/2016 10:40:00 AM	12/18/2016 11:40:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH145	AZ47497	1	BENZENE	12/13/2016 10:50:00 AM	12/19/2016 12:08:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH145	AZ47497	1	ETHYLBENZENE	12/13/2016 10:50:00 AM	12/19/2016 12:08:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH145	AZ47497	1	TOLUENE	12/13/2016 10:50:00 AM	12/19/2016 12:08:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH145	AZ47497	1	TPH-GASOLINE RANGE C6-C10	12/13/2016 10:50:00 AM	12/19/2016 12:09:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH145	AZ47497	1	XYLENES, TOTAL	12/13/2016 10:50:00 AM	12/19/2016 12:08:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH146	AZ47498	1	1,2-DICHLOROETHANE	12/12/2016 4:55:00 PM	12/19/2016 12:36:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH146	AZ47498	1	BENZENE	12/12/2016 4:55:00 PM	12/19/2016 12:36:00 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
METHOD: 8260B													
ERH146	AZ47498	1	ETHYLBENZENE	12/12/2016 4:55:00 PM	12/19/2016 12:36:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH146	AZ47498	1	TOLUENE	12/12/2016 4:55:00 PM	12/19/2016 12:36:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH146	AZ47498	1	TPH-GASOLINE RANGE C6-C10	12/12/2016 4:55:00 PM	12/19/2016 12:37:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH146	AZ47498	1	XYLENES, TOTAL	12/12/2016 4:55:00 PM	12/19/2016 12:36:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
METHOD: 8270D													
ERH139	AZ47494	1	2-(2-METHOXYETHOXY)-ETHANOL	12/12/2016 1:30:00 PM	12/20/2016 7:15:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH139	AZ47494	1	PHENOL	12/12/2016 1:30:00 PM	12/21/2016 12:35:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH136	AZ47495	1	2-(2-METHOXYETHOXY)-ETHANOL	12/12/2016 2:45:00 PM	12/20/2016 7:45:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH136	AZ47495	1	PHENOL	12/12/2016 2:45:00 PM	12/21/2016 1:05:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH143	AZ47496	1	2-(2-METHOXYETHOXY)-ETHANOL	12/13/2016 10:40:00 AM	12/20/2016 8:15:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH143	AZ47496	1	PHENOL	12/13/2016 10:40:00 AM	12/21/2016 1:35:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH145	AZ47497	1	2-(2-METHOXYETHOXY)-ETHANOL	12/13/2016 10:50:00 AM	12/20/2016 8:45:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH145	AZ47497	1	PHENOL	12/13/2016 10:50:00 AM	12/21/2016 3:05:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH146	AZ47498	1	2-(2-METHOXYETHOXY)-ETHANOL	12/12/2016 4:55:00 PM	12/20/2016 9:15:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH146	AZ47498	1	PHENOL	12/12/2016 4:55:00 PM	12/21/2016 2:35:00 PM	C	1.1	UG_L	J	5.0	4.00	J	
METHOD: 8270D_SIM													
ERH139	AZ47494	1	1-METHYLNAPHTHALENE	12/12/2016 1:30:00 PM	12/20/2016 7:05:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH139	AZ47494	1	2-METHYLNAPHTHALENE	12/12/2016 1:30:00 PM	12/20/2016 7:05:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH139	AZ47494	1	NAPHTHALENE	12/12/2016 1:30:00 PM	12/20/2016 7:05:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH136	AZ47495	1	1-METHYLNAPHTHALENE	12/12/2016 2:45:00 PM	12/21/2016 12:15:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH136	AZ47495	1	2-METHYLNAPHTHALENE	12/12/2016 2:45:00 PM	12/21/2016 12:15:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH136	AZ47495	1	NAPHTHALENE	12/12/2016 2:45:00 PM	12/21/2016 12:15:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH143	AZ47496	1	1-METHYLNAPHTHALENE	12/13/2016 10:40:00 AM	12/20/2016 8:12:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH143	AZ47496	1	2-METHYLNAPHTHALENE	12/13/2016 10:40:00 AM	12/20/2016 8:12:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH143	AZ47496	1	NAPHTHALENE	12/13/2016 10:40:00 AM	12/20/2016 8:12:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH145	AZ47497	1	1-METHYLNAPHTHALENE	12/13/2016 10:50:00 AM	12/20/2016 8:45:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH145	AZ47497	1	2-METHYLNAPHTHALENE	12/13/2016 10:50:00 AM	12/20/2016 8:45:00 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
METHOD: 8270D_SIM													
ERH145	AZ47497	1	NAPHTHALENE	12/13/2016 10:50:00 AM	12/20/2016 8:45:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH146	AZ47498	1	1-METHYLNAPHTHALENE	12/12/2016 4:55:00 PM	12/20/2016 9:18:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH146	AZ47498	1	2-METHYLNAPHTHALENE	12/12/2016 4:55:00 PM	12/20/2016 9:18:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH146	AZ47498	1	NAPHTHALENE	12/12/2016 4:55:00 PM	12/20/2016 9:18:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
METHOD: RSK-175													
ERH134	AZ47493	1	METHANE	12/12/2016 8:00:00 AM	12/19/2016 9:23:00 AM	C	1.00	UG_L	U	5.0	1.00	U	
ERH139	AZ47494	1	METHANE	12/12/2016 1:30:00 PM	12/19/2016 9:30:00 AM	C	1.00	UG_L	U	5.0	1.00	U	
ERH136	AZ47495	1	METHANE	12/12/2016 2:45:00 PM	12/19/2016 9:37:00 AM	C	1.00	UG_L	U	5.0	1.00	U	
ERH143	AZ47496	1	METHANE	12/13/2016 10:40:00 AM	12/19/2016 9:43:00 AM	C	860	UG_L		5.0	1.00		
ERH145	AZ47497	1	METHANE	12/13/2016 10:50:00 AM	12/19/2016 9:55:00 AM	C	1.00	UG_L	U	5.0	1.00	U	
ERH146	AZ47498	1	METHANE	12/12/2016 4:55:00 PM	12/19/2016 10:01:00 AM	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 0053

LDC Report Date: January 23, 2017

Parameters: Volatiles

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81776

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH151	AZ47656	Water	12/14/16
ERH142	AZ47657	Water	12/13/16
ERH147	AZ47658	Water	12/14/16
ERH148	AZ47659	Water	12/14/16
ERH152	AZ47660	Water	12/14/16
ERH149	AZ47661	Water	12/14/16
ERH150	AZ47662	Water	12/14/16
ERH138	AZ47663	Water	12/13/16
ERH144	AZ47664	Water	12/13/16
ERH140	AZ47665	Water	12/13/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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

Samples ERH151 and ERH142 were identified as trip blanks. No contaminants were found.

Sample ERH149 was identified as an equipment blank. No contaminants were found.

Sample ERH150 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH147 and ERH148 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Laboratory Blank Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Field Blank Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

LDC #: 37870C1

VALIDATION COMPLETENESS WORKSHEET

SDG #: 81776

Level C

Laboratory: APPL, Inc.

Date: 1/13/17

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: GC/MS Volatiles (BTEX) (EPA SW 846 Method 8260B)
+ 1,2 - Dichloroethane

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	% PSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration / closing CV	A	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 1, 2 EB = 6 FB = 7
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LC>
X.	Field duplicates	ND	D = 3, 4
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	ERH151 TB	AZ47656	Water	12/14/16
2	ERH152 ⁴² F7 TB + DCA	AZ47657	Water	12/13/16
3	ERH147 D	AZ47658	Water	12/14/16
4	ERH148 P	AZ47659	Water	12/14/16
5	ERH152	AZ47660	Water	12/14/16
6	ERH149 EB	AZ47661	Water	12/14/16
7	ERH150 FB	AZ47662	Water	12/14/16
8	ERH138	AZ47663	Water	12/13/16
9	ERH144	AZ47664	Water	12/13/16
10	ERH140	AZ47665	Water	12/13/16
11				
12	161218 AL			
13				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 24, 2017

Parameters: Phenol

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81776

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH147	AZ47658	Water	12/14/16
ERH148	AZ47659	Water	12/14/16
ERH152	AZ47660	Water	12/14/16
ERH149	AZ47661	Water	12/14/16
ERH150	AZ47662	Water	12/14/16
ERH138	AZ47663	Water	12/13/16
ERH144	AZ47664	Water	12/13/16
ERH140	AZ47665	Water	12/13/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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%.

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% 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 ERH149 was identified as an equipment blank. No contaminants were found.

Sample ERH150 was identified as a field blank. No contaminants were found.

VII. Surrogates

Surrogates were added to all samples as required by the method. Surrogate recoveries (%R) were not within QC limits for sample ERH144. Using professional judgment, no data were qualified when one acid 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH147 and ERH148 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Red Hill Bulk Storage Facility, CTO 0053
Phenol - Data Qualification Summary - SDG 81776

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 0053
Phenol - Laboratory Blank Data Qualification Summary - SDG 81776

No Sample Data Qualified in this SDG

Red Hill Bulk Storage Facility, CTO 0053
Phenol - Field Blank Data Qualification Summary - SDG 81776

No Sample Data Qualified in this SDG

LDC #: 37870C2a
 SDG #: 81776
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C

Date: 1/13/17

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	A	
III.	Initial calibration/ICV	A / Δ	% PSD = 15 ICV ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	EB = 4 FB = 5
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	CS
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	ERH147 D	AZ47658	Water	12/14/16
2	ERH148 D	AZ47659	Water	12/14/16
3	ERH152	AZ47660	Water	12/14/16
4	ERH149 EB	AZ47661	Water	12/14/16
5	ERH150 FB	AZ47662	Water	12/14/16
6	ERH138	AZ47663	Water	12/13/16
7	ERH144	AZ47664	Water	12/13/16
8	ERH140	AZ47665	Water	12/13/16
9				
10				
11	161219A			
12				
13				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 24, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81776

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH147	AZ47658	Water	12/14/16
ERH148	AZ47659	Water	12/14/16
ERH152	AZ47660	Water	12/14/16
ERH149	AZ47661	Water	12/14/16
ERH150	AZ47662	Water	12/14/16
ERH138	AZ47663	Water	12/13/16
ERH144	AZ47664	Water	12/13/16
ERH140	AZ47665	Water	12/13/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 ERH149 was identified as an equipment blank. No contaminants were found.

Sample ERH150 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH147 and ERH148 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification
Summary - SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -
SDG 81776**

No Sample Data Qualified in this SDG

LDC #: 37870C2b
 SDG #: 81776
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C

Date: 1/13/17
 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	Δ	
III.	Initial calibration/ICV	A / Δ	% RSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration / closing cov	Δ	COV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	EB = 4 FB = 5
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	CS
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 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	ERH147 D	AZ47658	Water	12/14/16
2	ERH148 D	AZ47659	Water	12/14/16
3	ERH152	AZ47660	Water	12/14/16
4	ERH149 EB	AZ47661	Water	12/14/16
5	ERH150 FB	AZ47662	Water	12/14/16
6	ERH138	AZ47663	Water	12/13/16
7 ⁺	ERH144	AZ47664	Water	12/13/16
8 ⁻	ERH140	AZ47665	Water	12/13/16
9				
10				
11				
12				
13				

TTT, W, S only

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 24, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81776

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH147	AZ47658	Water	12/14/16
ERH148	AZ47659	Water	12/14/16
ERH152	AZ47660	Water	12/14/16
ERH149	AZ47661	Water	12/14/16
ERH150	AZ47662	Water	12/14/16
ERH138	AZ47663	Water	12/13/16
ERH144	AZ47664	Water	12/13/16
ERH140	AZ47665	Water	12/13/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% 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%.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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 ERH149 was identified as an equipment blank. No contaminants were found.

Sample ERH150 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH147 and ERH148 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81776**

No Sample Data Qualified in this SDG

LDC #: 37870C2c
 SDG #: 81776
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C

Date: 1/13/17

Page: 1 of 1

Reviewer: PK

2nd Reviewer: PK

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

Modified F7

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 ICV = 20
IV.	Continuing calibration / <i>closing CV</i>	Δ	CV = 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	EB = 4 FB = 5
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LC
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	N	

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	ERH147 D	AZ47658	Water	12/14/16
2	ERH148 P	AZ47659	Water	12/14/16
3	ERH152	AZ47660	Water	12/14/16
4	ERH149 EB	AZ47661	Water	12/14/16
5	ERH150 FB	AZ47662	Water	12/14/16
6	ERH138	AZ47663	Water	12/13/16
7	ERH144	AZ47664	Water	12/13/16
8	ERH140	AZ47665	Water	12/13/16
9				
10				
11	161219A			
12				
13				

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 24, 2017

Parameters: Wet Chemistry

Validation Level: Level C

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81776

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH147	AZ47658	Water	12/14/16
ERH152	AZ47660	Water	12/14/16
ERH138	AZ47663	Water	12/13/16
ERH144	AZ47664	Water	12/13/16
ERH140	AZ47665	Water	12/13/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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

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. 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	Associated Samples
PB (prep blank)	Alkalinity	1.6 mg/L	All samples in SDG 81776

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) were analyzed as required by the methods. Percent recoveries (%R) 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. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Field Blank Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

LDC #: 37870C6

VALIDATION COMPLETENESS WORKSHEET

Date: 11/18/17

SDG #: 81776

Level C

Page: 1 of 1

Laboratory: APPL Labs

Reviewer: SD

2nd Reviewer: KE

METHOD: (Analyte) Alkalinity (SM2320B), Chloride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B)

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	12/13-14/16
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	SW	
V.	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	CS
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	ERH147	AZ47658	Water	12/14/16
2	ERH152	AZ47660	Water	12/14/16
3	ERH138	AZ47663	Water	12/13/16
4	ERH144	AZ47664	Water	12/13/16
5	ERH140	AZ47665	Water	12/13/16
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes:

VALIDATION FINDINGS WORKSHEET

Blanks

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)		No Qualifiers									
Alkalinity	1.6		8										

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 0053

LDC Report Date: January 24, 2017

Parameters: Total Petroleum Hydrocarbons as Gasoline

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81776

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH151	AZ47656	Water	12/14/16
ERH142	AZ47657	Water	12/13/16
ERH147	AZ47658	Water	12/14/16
ERH148	AZ47659	Water	12/14/16
ERH152	AZ47660	Water	12/14/16
ERH149	AZ47661	Water	12/14/16
ERH150	AZ47662	Water	12/14/16
ERH138	AZ47663	Water	12/13/16
ERH144	AZ47664	Water	12/13/16
ERH140	AZ47665	Water	12/13/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 Gasoline 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 ERH151 and ERH142 were identified as trip blanks. No contaminants were found.

Sample ERH149 was identified as an equipment blank. No contaminants were found.

Sample ERH150 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH147 and ERH148 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG
81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification
Summary - SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification
Summary - SDG 81776**

No Sample Data Qualified in this SDG

LDC #: 37870C7
 SDG #: 81776
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C

Date: 1/13/17

Page: 1 of 1

Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC/MS TPH as Gasoline (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	1 ² ICV ≤ 20
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1, 2 EB = 6 FB = 7
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCY
X.	Field duplicates	ND	D = 3, 4
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	ERH151 TB	AZ47656	Water	12/14/16
2	ERH152 ⁴² TB	AZ47657	Water	12/13/16
3	ERH147 D	AZ47658	Water	12/14/16
4	ERH148 P	AZ47659	Water	12/14/16
5	ERH152	AZ47660	Water	12/14/16
6	ERH149 EB	AZ47661	Water	12/14/16
7	ERH150 FB	AZ47662	Water	12/14/16
8	ERH138	AZ47663	Water	12/13/16
9	ERH144	AZ47664	Water	12/13/16
10	ERH140	AZ47665	Water	12/13/16
11				
12	161218AL			
13				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 24, 2017

Parameters: Total Petroleum Hydrocarbons as Extractables

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81776

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH147	AZ47658	Water	12/14/16
ERH148	AZ47659	Water	12/14/16
ERH152	AZ47660	Water	12/14/16
ERH149	AZ47661	Water	12/14/16
ERH150	AZ47662	Water	12/14/16
ERH138	AZ47663	Water	12/13/16
ERH144	AZ47664	Water	12/13/16
ERH140	AZ47665	Water	12/13/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

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 ERH149 was identified as an equipment blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH149	12/14/16	Diesel (C10-C24)	25 ug/L	ERH147 ERH148

Sample ERH150 was identified as a field blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH150	12/14/16	Diesel (C10-C24)	26 ug/L	ERH149

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

Sample	Compound	Reported Concentration	Modified Final Concentration
ERH147	Diesel (C10-C24)	58 ug/L	58U ug/L
ERH148	Diesel (C10-C24)	57 ug/L	57U ug/L
ERH149	Diesel (C10-C24)	25 ug/L	25U ug/L

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH147 and ERH148 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)
	ERH147	ERH148	
Diesel (C10-C24)	58	57	2 (≤50)
Oil (C24-C40)	39	46	16 (≤50)

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.

Due to equipment and field blank contamination, data were qualified as not detected in three samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -
SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data
Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification
Summary - SDG 81776**

Sample	Compound	Modified Final Concentration	A or P	Code
ERH147	Diesel (C10-C24)	58U ug/L	A	F
ERH148	Diesel (C10-C24)	57U ug/L	A	F
ERH149	Diesel (C10-C24)	25U ug/L	A	F

LDC #: 37870C8

VALIDATION COMPLETENESS WORKSHEET

Date: 1/13/17

SDG #: 81776

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 / ICV ≤ 20
III.	Continuing calibration	Δ	CCV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	SW	EB = 4 FB = 5
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LC5
IX.	Field duplicates	SW	D = 1, 2
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	ERH147 EB D	AZ47658	Water	12/14/16
2	ERH148 I D	AZ47659	Water	12/14/16
3	ERH152	AZ47660	Water	12/14/16
4	ERH149 EB	AZ47661	Water	12/14/16
5	ERH150 FB	AZ47662	Water	12/14/16
6	ERH138	AZ47663	Water	12/13/16
7	ERH144	AZ47664	Water	12/13/16
8	ERH140	AZ47665	Water	12/13/16
9				
10				
11				
12				

Notes:

161219A				

LDC #: 37870 Cx

VALIDATION FINDINGS WORKSHEET Field Blanks

Page: 1 of 1

Reviewer: FT
2nd Reviewer: KR

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: 12/14/16

Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank
Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other:

Code = F

4 = EB
5 = FB

Associated Samples: 4:1 - 23 5:4

Compound	Blank ID	Blank ID	Sample Identification										
			1	2	3	4	5	6	7	8			
Diesel (C10-C14)	4	5	584	574	564	254							
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										
			1	2	3	4	5	6	7	8			
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".

VALIDATION FINDINGS WORKSHEET
Field Duplicates

METHOD: GC HPLC

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)
	1	2		
<u>Diesel (C10-C24)</u>	<u>58</u>	<u>57</u>	<u>2</u>	/
<u>Oil (C24-C40)</u>	<u>39</u>	<u>46</u>	<u>16</u>	

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

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

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

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 23, 2017

Parameters: Ethylene Dibromide

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81776

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH142	AZ47657	Water	12/13/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% for all compounds.

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 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 ERH142 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Laboratory Blank Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Field Blank Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

LDC #: 37870C10

VALIDATION COMPLETENESS WORKSHEET

SDG #: 81776

Level C

Laboratory: APPL, Inc.

Date: 1/13/17

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: GC Ethylene Dibromide (EPA SW 846 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	% RSD / ICV ≤ 20
III.	Continuing calibration	A	
IV.	Laboratory Blanks	A	F1
V.	Field blanks	ND	TB = X 1
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	N	QC sample
VIII.	Laboratory control samples	A	LCS
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	ERH162 ⁴² TB	AZ47657	Water	12/13/16
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Notes:

161219A				

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

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 24, 2017

Parameters: Methane

Validation Level: Level C

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81776

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH151	AZ47656	Water	12/14/16
ERH142	AZ47657	Water	12/13/16
ERH147	AZ47658	Water	12/14/16
ERH152	AZ47660	Water	12/14/16
ERH138	AZ47663	Water	12/13/16
ERH144	AZ47664	Water	12/13/16
ERH140	AZ47665	Water	12/13/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% with the following exceptions:

Date	Standard	Compound	%D	Associated Samples	Flag	A or P
12/17/16	CCV	Methane	22	All samples in SDG 81776	J (all detects) UJ (all non-detects)	A

IV. Laboratory Blanks

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

V. Field Blanks

Samples ERH151 and ERH142 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) were analyzed as required by the method. Percent recoveries (%R) 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.

Due to continuing calibration %D, data were qualified as estimated in seven samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Data Qualification Summary - SDG 81776**

Sample	Compound	Flag	A or P	Reason (Code)
ERH151 ERH142 ERH147 ERH152 ERH138 ERH144 ERH140	Methane	J (all detects) UJ (all non-detects)	A	Continuing calibration (%D) (C)

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Laboratory Blank Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Field Blank Data Qualification Summary - SDG 81776**

No Sample Data Qualified in this SDG

LDC #: 37870C51

VALIDATION COMPLETENESS WORKSHEET

Date: 1/13/17

SDG #: 81776

Level C

Page: 1 of 1

Laboratory: APPL Labs

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	1	
II.	Initial calibration/ICV	A, A	1, 2 ICV ≤ 20
III.	Continuing calibration	SW	CV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	TB = 1, 2
VI.	Matrix spike/Matrix spike duplicates	N	CS
VII.	Laboratory control samples	A	ICS
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	ERH151 TB	AZ47656	Water	12/14/16
2	ERH152 ⁴² TB	AZ47657	Water	12/13/16
3	ERH147	AZ47658	Water	12/14/16
4	ERH152	AZ47660	Water	12/14/16
5	ERH138	AZ47663	Water	12/13/16
6 ⁺	ERH144	AZ47664	Water	12/13/16
7 ⁻	ERH140	AZ47665	Water	12/13/16
8				
9				
10				
11				
12				
13				

Notes:

161217A				

**Red Hill Bulk Storage Facility, CTO 0053 - SDG 81776
LDC 37870**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 2320B													
ERH147	AZ47658	1	ALKALINITY, AS CaCO3	12/14/2016 9:30:00 AM	12/20/2016 6:25:00 PM	C	234	MG_L		2.0	1.70		
ERH147	AZ47658	1	ALKALINITY, BICARBONATE	12/14/2016 9:30:00 AM	12/20/2016 6:25:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH147	AZ47658	1	ALKALINITY, CARBONATE	12/14/2016 9:30:00 AM	12/20/2016 6:25:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH152	AZ47660	1	ALKALINITY, AS CaCO3	12/14/2016 10:35:00 AM	12/20/2016 6:28:00 PM	C	289	MG_L		2.0	1.70		
ERH152	AZ47660	1	ALKALINITY, BICARBONATE	12/14/2016 10:35:00 AM	12/20/2016 6:28:00 PM	C	289	MG_L		2.0	1.70		
ERH152	AZ47660	1	ALKALINITY, CARBONATE	12/14/2016 10:35:00 AM	12/20/2016 6:28:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH138	AZ47663	1	ALKALINITY, AS CaCO3	12/13/2016 2:30:00 PM	12/20/2016 6:42:00 PM	C	76.7	MG_L		2.0	1.70		
ERH138	AZ47663	1	ALKALINITY, BICARBONATE	12/13/2016 2:30:00 PM	12/20/2016 6:42:00 PM	C	76.7	MG_L		2.0	1.70		
ERH138	AZ47663	1	ALKALINITY, CARBONATE	12/13/2016 2:30:00 PM	12/20/2016 6:42:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH144	AZ47664	1	ALKALINITY, AS CaCO3	12/13/2016 2:35:00 PM	12/20/2016 6:47:00 PM	C	195	MG_L		2.0	1.70		
ERH144	AZ47664	1	ALKALINITY, BICARBONATE	12/13/2016 2:35:00 PM	12/20/2016 6:47:00 PM	C	195	MG_L		2.0	1.70		
ERH144	AZ47664	1	ALKALINITY, CARBONATE	12/13/2016 2:35:00 PM	12/20/2016 6:47:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH140	AZ47665	1	ALKALINITY, AS CaCO3	12/13/2016 5:00:00 PM	12/20/2016 6:58:00 PM	C	121	MG_L		2.0	1.70		
ERH140	AZ47665	1	ALKALINITY, BICARBONATE	12/13/2016 5:00:00 PM	12/20/2016 6:58:00 PM	C	121	MG_L		2.0	1.70		
ERH140	AZ47665	1	ALKALINITY, CARBONATE	12/13/2016 5:00:00 PM	12/20/2016 6:58:00 PM	C	1.70	MG_L	U	2.0	1.70		U
METHOD: 300.0													
ERH147	AZ47658	20	CHLORIDE	12/14/2016 9:30:00 AM	12/20/2016 2:42:00 PM	C	649	MG_L		20.0	4.00		
ERH147	AZ47658	5	NITRATE	12/14/2016 9:30:00 AM	12/15/2016 2:03:00 PM	C	10.1	MG_L		2.5	0.90		
ERH147	AZ47658	5	SULFATE	12/14/2016 9:30:00 AM	12/15/2016 2:03:00 PM	C	78.0	MG_L		5.0	1.00		
ERH152	AZ47660	1	CHLORIDE	12/14/2016 10:35:00 AM	12/15/2016 3:08:00 PM	C	45.0	MG_L		1.0	0.20		
ERH152	AZ47660	1	NITRATE	12/14/2016 10:35:00 AM	12/15/2016 3:08:00 PM	C	5.8	MG_L		0.5	0.18		
ERH152	AZ47660	1	SULFATE	12/14/2016 10:35:00 AM	12/15/2016 3:08:00 PM	C	44.1	MG_L		1.0	0.20		
ERH138	AZ47663	2	CHLORIDE	12/13/2016 2:30:00 PM	12/20/2016 2:55:00 PM	C	76.3	MG_L		2.0	0.40		
ERH138	AZ47663	1	NITRATE	12/13/2016 2:30:00 PM	12/15/2016 1:24:00 PM	C	2.4	MG_L		0.5	0.18		
ERH138	AZ47663	1	SULFATE	12/13/2016 2:30:00 PM	12/15/2016 1:24:00 PM	C	9.8	MG_L		1.0	0.20		

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 300.0													
ERH144	AZ47664	1	CHLORIDE	12/13/2016 2:35:00 PM	12/15/2016 1:37:00 PM	C	37.5	MG_L		1.0	0.20		
ERH144	AZ47664	1	NITRATE	12/13/2016 2:35:00 PM	12/15/2016 1:37:00 PM	C	0.43	MG_L	J	0.5	0.18	J	
ERH144	AZ47664	1	SULFATE	12/13/2016 2:35:00 PM	12/15/2016 1:37:00 PM	C	1.2	MG_L		1.0	0.20		
ERH140	AZ47665	20	CHLORIDE	12/13/2016 5:00:00 PM	12/20/2016 3:08:00 PM	C	382	MG_L		20.0	4.00		
ERH140	AZ47665	2	NITRATE	12/13/2016 5:00:00 PM	12/15/2016 1:50:00 PM	C	3.9	MG_L		1.0	0.36		
ERH140	AZ47665	2	SULFATE	12/13/2016 5:00:00 PM	12/15/2016 1:50:00 PM	C	68.5	MG_L		2.0	0.40		
METHOD: 3500_FE_B													
ERH147	AZ47658	1	IRON, FERROUS	12/14/2016 9:30:00 AM	12/15/2016 3:49:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
ERH152	AZ47660	1	IRON, FERROUS	12/14/2016 10:35:00 AM	12/15/2016 3:50:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
ERH138	AZ47663	1	IRON, FERROUS	12/13/2016 2:30:00 PM	12/15/2016 3:51:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
ERH144	AZ47664	1	IRON, FERROUS	12/13/2016 2:35:00 PM	12/15/2016 3:52:00 PM	C	2.5	MG_L		1.0	0.32		
ERH140	AZ47665	1	IRON, FERROUS	12/13/2016 5:00:00 PM	12/15/2016 3:53:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
METHOD: 8011													
ERH142	AZ47657	1	1,2-DIBROMOETHANE	12/13/2016 7:00:00 AM	12/19/2016 7:22:00 PM	C	0.020	UG_L	U	0.02	0.020	U	
METHOD: 8015B_E													
ERH147	AZ47658	1	TPH-DIESEL RANGE	12/14/2016 9:30:00 AM	12/20/2016 9:49:00 PM	C		UG_L	T4I	40.0	58	U	f
ERH147	AZ47658	1	TPH-OIL RANGE	12/14/2016 9:30:00 AM	12/20/2016 9:49:00 PM	C	39	UG_L	J	40.0	40.00	J	
ERH148	AZ47659	1	TPH-DIESEL RANGE	12/14/2016 9:30:00 AM	12/20/2016 10:09:00 PM	C		UG_L	T4I	40.0	57	U	f
ERH148	AZ47659	1	TPH-OIL RANGE	12/14/2016 9:30:00 AM	12/20/2016 10:09:00 PM	C	46	UG_L		40.0	40.00		
ERH152	AZ47660	1	TPH-DIESEL RANGE	12/14/2016 10:35:00 AM	12/20/2016 10:29:00 PM	C	56	UG_L	T3M	40.0	25.00		
ERH152	AZ47660	1	TPH-OIL RANGE	12/14/2016 10:35:00 AM	12/20/2016 10:29:00 PM	C	49	UG_L		40.0	40.00		
ERH149	AZ47661	1	TPH-DIESEL RANGE	12/14/2016 11:50:00 AM	12/20/2016 10:49:00 PM	C		UG_L	JT4I	40.0	25.00	U	f
ERH149	AZ47661	1	TPH-OIL RANGE	12/14/2016 11:50:00 AM	12/20/2016 10:49:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH150	AZ47662	1	TPH-DIESEL RANGE	12/14/2016 12:10:00 PM	12/20/2016 11:09:00 PM	C	26	UG_L	JT4I	40.0	25.00	J	
ERH150	AZ47662	1	TPH-OIL RANGE	12/14/2016 12:10:00 PM	12/20/2016 11:09:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH138	AZ47663	1	TPH-DIESEL RANGE	12/13/2016 2:30:00 PM	12/21/2016 12:09:00 AM	C	25.00	UG_L	U	40.0	25.00	U	
ERH138	AZ47663	1	TPH-OIL RANGE	12/13/2016 2:30:00 PM	12/21/2016 12:09:00 AM	C	40.00	UG_L	U	40.0	40.00	U	
ERH144	AZ47664	1	TPH-DIESEL RANGE	12/13/2016 2:35:00 PM	12/21/2016 12:29:00 AM	C	1300	UG_L	T6	40.0	25.00		

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8015B E													
ERH144	AZ47664	1	TPH-OIL RANGE	12/13/2016 2:35:00 PM	12/21/2016 12:29:00 AM	C	40.00	UG_L	U	40.0	40.00	U	
ERH140	AZ47665	1	TPH-DIESEL RANGE	12/13/2016 5:00:00 PM	12/21/2016 12:49:00 AM	C	25.00	UG_L	U	40.0	25.00	U	
ERH140	AZ47665	1	TPH-OIL RANGE	12/13/2016 5:00:00 PM	12/21/2016 12:49:00 AM	C	40.00	UG_L	U	40.0	40.00	U	
METHOD: 8260B													
ERH151	AZ47656	1	BENZENE	12/14/2016 6:20:00 AM	12/18/2016 8:53:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH151	AZ47656	1	ETHYLBENZENE	12/14/2016 6:20:00 AM	12/18/2016 8:53:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH151	AZ47656	1	TOLUENE	12/14/2016 6:20:00 AM	12/18/2016 8:53:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH151	AZ47656	1	TPH-GASOLINE RANGE C6-C10	12/14/2016 6:20:00 AM	12/18/2016 8:54:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH151	AZ47656	1	XYLENES, TOTAL	12/14/2016 6:20:00 AM	12/18/2016 8:53:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH142	AZ47657	1	1,2-DICHLOROETHANE	12/13/2016 7:00:00 AM	12/18/2016 9:22:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH142	AZ47657	1	BENZENE	12/13/2016 7:00:00 AM	12/18/2016 9:22:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH142	AZ47657	1	ETHYLBENZENE	12/13/2016 7:00:00 AM	12/18/2016 9:22:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH142	AZ47657	1	TOLUENE	12/13/2016 7:00:00 AM	12/18/2016 9:22:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH142	AZ47657	1	TPH-GASOLINE RANGE C6-C10	12/13/2016 7:00:00 AM	12/18/2016 9:21:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH142	AZ47657	1	XYLENES, TOTAL	12/13/2016 7:00:00 AM	12/18/2016 9:22:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH147	AZ47658	1	BENZENE	12/14/2016 9:30:00 AM	12/19/2016 1:04:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH147	AZ47658	1	ETHYLBENZENE	12/14/2016 9:30:00 AM	12/19/2016 1:04:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH147	AZ47658	1	TOLUENE	12/14/2016 9:30:00 AM	12/19/2016 1:04:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH147	AZ47658	1	TPH-GASOLINE RANGE C6-C10	12/14/2016 9:30:00 AM	12/19/2016 1:05:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH147	AZ47658	1	XYLENES, TOTAL	12/14/2016 9:30:00 AM	12/19/2016 1:04:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH148	AZ47659	1	BENZENE	12/14/2016 9:30:00 AM	12/19/2016 1:32:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH148	AZ47659	1	ETHYLBENZENE	12/14/2016 9:30:00 AM	12/19/2016 1:32:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH148	AZ47659	1	TOLUENE	12/14/2016 9:30:00 AM	12/19/2016 1:32:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH148	AZ47659	1	TPH-GASOLINE RANGE C6-C10	12/14/2016 9:30:00 AM	12/19/2016 1:33:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH148	AZ47659	1	XYLENES, TOTAL	12/14/2016 9:30:00 AM	12/19/2016 1:32:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH152	AZ47660	1	BENZENE	12/14/2016 10:35:00 AM	12/19/2016 2:00:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH152	AZ47660	1	ETHYLBENZENE	12/14/2016 10:35:00 AM	12/19/2016 2:00:00 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
METHOD: 8260B													
ERH152	AZ47660	1	TOLUENE	12/14/2016 10:35:00 AM	12/19/2016 2:00:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH152	AZ47660	1	TPH-GASOLINE RANGE C6-C10	12/14/2016 10:35:00 AM	12/19/2016 2:01:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH152	AZ47660	1	XYLENES, TOTAL	12/14/2016 10:35:00 AM	12/19/2016 2:00:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH149	AZ47661	1	BENZENE	12/14/2016 11:50:00 AM	12/19/2016 2:28:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH149	AZ47661	1	ETHYLBENZENE	12/14/2016 11:50:00 AM	12/19/2016 2:28:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH149	AZ47661	1	TOLUENE	12/14/2016 11:50:00 AM	12/19/2016 2:28:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH149	AZ47661	1	TPH-GASOLINE RANGE C6-C10	12/14/2016 11:50:00 AM	12/19/2016 2:29:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH149	AZ47661	1	XYLENES, TOTAL	12/14/2016 11:50:00 AM	12/19/2016 2:28:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH150	AZ47662	1	BENZENE	12/14/2016 12:10:00 PM	12/19/2016 2:57:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH150	AZ47662	1	ETHYLBENZENE	12/14/2016 12:10:00 PM	12/19/2016 2:57:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH150	AZ47662	1	TOLUENE	12/14/2016 12:10:00 PM	12/19/2016 2:57:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH150	AZ47662	1	TPH-GASOLINE RANGE C6-C10	12/14/2016 12:10:00 PM	12/19/2016 2:56:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH150	AZ47662	1	XYLENES, TOTAL	12/14/2016 12:10:00 PM	12/19/2016 2:57:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH138	AZ47663	1	BENZENE	12/13/2016 2:30:00 PM	12/19/2016 3:24:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH138	AZ47663	1	ETHYLBENZENE	12/13/2016 2:30:00 PM	12/19/2016 3:24:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH138	AZ47663	1	TOLUENE	12/13/2016 2:30:00 PM	12/19/2016 3:24:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH138	AZ47663	1	TPH-GASOLINE RANGE C6-C10	12/13/2016 2:30:00 PM	12/19/2016 3:25:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH138	AZ47663	1	XYLENES, TOTAL	12/13/2016 2:30:00 PM	12/19/2016 3:24:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH144	AZ47664	1	BENZENE	12/13/2016 2:35:00 PM	12/19/2016 3:52:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH144	AZ47664	1	ETHYLBENZENE	12/13/2016 2:35:00 PM	12/19/2016 3:52:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH144	AZ47664	1	TOLUENE	12/13/2016 2:35:00 PM	12/19/2016 3:52:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH144	AZ47664	1	TPH-GASOLINE RANGE C6-C10	12/13/2016 2:35:00 PM	12/19/2016 3:53:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH144	AZ47664	1	XYLENES, TOTAL	12/13/2016 2:35:00 PM	12/19/2016 3:52:00 AM	C	0.19	UG_L	J	2.0	0.30	J	
ERH140	AZ47665	1	BENZENE	12/13/2016 5:00:00 PM	12/19/2016 4:21:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH140	AZ47665	1	ETHYLBENZENE	12/13/2016 5:00:00 PM	12/19/2016 4:21:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH140	AZ47665	1	TOLUENE	12/13/2016 5:00:00 PM	12/19/2016 4:21:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH140	AZ47665	1	TPH-GASOLINE RANGE C6-C10	12/13/2016 5:00:00 PM	12/19/2016 4:20:00 AM	C	18.0	UG_L	U	20	18.0	U	

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8260B													
ERH140	AZ47665	1	XYLENES, TOTAL	12/13/2016 5:00:00 PM	12/19/2016 4:21:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
METHOD: 8270D													
ERH147	AZ47658	1	2-(2-METHOXYETHOXY)-ETHANOL	12/14/2016 9:30:00 AM	12/20/2016 9:45:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH147	AZ47658	1	PHENOL	12/14/2016 9:30:00 AM	12/21/2016 3:35:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH148	AZ47659	1	2-(2-METHOXYETHOXY)-ETHANOL	12/14/2016 9:30:00 AM	12/20/2016 10:15:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH148	AZ47659	1	PHENOL	12/14/2016 9:30:00 AM	12/21/2016 4:05:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH152	AZ47660	1	2-(2-METHOXYETHOXY)-ETHANOL	12/14/2016 10:35:00 AM	12/20/2016 10:45:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH152	AZ47660	1	PHENOL	12/14/2016 10:35:00 AM	12/21/2016 5:06:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH149	AZ47661	1	2-(2-METHOXYETHOXY)-ETHANOL	12/14/2016 11:50:00 AM	12/20/2016 11:15:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH149	AZ47661	1	PHENOL	12/14/2016 11:50:00 AM	12/21/2016 5:36:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH150	AZ47662	1	2-(2-METHOXYETHOXY)-ETHANOL	12/14/2016 12:10:00 PM	12/20/2016 11:45:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH150	AZ47662	1	PHENOL	12/14/2016 12:10:00 PM	12/21/2016 6:06:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH138	AZ47663	1	2-(2-METHOXYETHOXY)-ETHANOL	12/13/2016 2:30:00 PM	12/21/2016 12:15:00 AM	C	80.0	UG_L	U	100	80.0	U	
ERH138	AZ47663	1	PHENOL	12/13/2016 2:30:00 PM	12/21/2016 6:35:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH144	AZ47664	1	2-(2-METHOXYETHOXY)-ETHANOL	12/13/2016 2:35:00 PM	12/21/2016 12:45:00 AM	C	80.0	UG_L	U	100	80.0	U	
ERH144	AZ47664	1	PHENOL	12/13/2016 2:35:00 PM	12/21/2016 7:06:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH140	AZ47665	1	2-(2-METHOXYETHOXY)-ETHANOL	12/13/2016 5:00:00 PM	12/21/2016 1:15:00 AM	C	80.0	UG_L	U	100	80.0	U	
ERH140	AZ47665	1	PHENOL	12/13/2016 5:00:00 PM	12/21/2016 7:36:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
METHOD: 8270D_SIM													
ERH147	AZ47658	1	1-METHYLNAPHTHALENE	12/14/2016 9:30:00 AM	12/20/2016 9:51:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH147	AZ47658	1	2-METHYLNAPHTHALENE	12/14/2016 9:30:00 AM	12/20/2016 9:51:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH147	AZ47658	1	NAPHTHALENE	12/14/2016 9:30:00 AM	12/20/2016 9:51:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH148	AZ47659	1	1-METHYLNAPHTHALENE	12/14/2016 9:30:00 AM	12/20/2016 10:24:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH148	AZ47659	1	2-METHYLNAPHTHALENE	12/14/2016 9:30:00 AM	12/20/2016 10:24:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH148	AZ47659	1	NAPHTHALENE	12/14/2016 9:30:00 AM	12/20/2016 10:24:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH152	AZ47660	1	1-METHYLNAPHTHALENE	12/14/2016 10:35:00 AM	12/20/2016 10:58:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH152	AZ47660	1	2-METHYLNAPHTHALENE	12/14/2016 10:35:00 AM	12/20/2016 10:58:00 PM	C	0.10	UG_L	U	0.2	0.10	U	

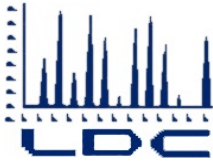
EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8270D_SIM													
ERH152	AZ47660	1	NAPHTHALENE	12/14/2016 10:35:00 AM	12/20/2016 10:58:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH149	AZ47661	1	1-METHYLNAPHTHALENE	12/14/2016 11:50:00 AM	12/20/2016 11:31:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH149	AZ47661	1	2-METHYLNAPHTHALENE	12/14/2016 11:50:00 AM	12/20/2016 11:31:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH149	AZ47661	1	NAPHTHALENE	12/14/2016 11:50:00 AM	12/20/2016 11:31:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH150	AZ47662	1	1-METHYLNAPHTHALENE	12/14/2016 12:10:00 PM	12/21/2016 12:04:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH150	AZ47662	1	2-METHYLNAPHTHALENE	12/14/2016 12:10:00 PM	12/21/2016 12:04:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH150	AZ47662	1	NAPHTHALENE	12/14/2016 12:10:00 PM	12/21/2016 12:04:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH138	AZ47663	1	1-METHYLNAPHTHALENE	12/13/2016 2:30:00 PM	12/21/2016 12:37:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH138	AZ47663	1	2-METHYLNAPHTHALENE	12/13/2016 2:30:00 PM	12/21/2016 12:37:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH138	AZ47663	1	NAPHTHALENE	12/13/2016 2:30:00 PM	12/21/2016 12:37:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH144	AZ47664	1	1-METHYLNAPHTHALENE	12/13/2016 2:35:00 PM	12/21/2016 1:10:00 AM	C	17	UG_L		0.2	0.10		
ERH144	AZ47664	1	2-METHYLNAPHTHALENE	12/13/2016 2:35:00 PM	12/21/2016 1:10:00 AM	C	11	UG_L		0.2	0.10		
ERH144	AZ47664	1	NAPHTHALENE	12/13/2016 2:35:00 PM	12/21/2016 1:10:00 AM	C	40	UG_L		0.2	0.10		
ERH140	AZ47665	1	1-METHYLNAPHTHALENE	12/13/2016 5:00:00 PM	12/21/2016 1:44:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH140	AZ47665	1	2-METHYLNAPHTHALENE	12/13/2016 5:00:00 PM	12/21/2016 1:44:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH140	AZ47665	1	NAPHTHALENE	12/13/2016 5:00:00 PM	12/21/2016 1:44:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
METHOD: RSK-175													
ERH151	AZ47656	1	METHANE	12/14/2016 6:20:00 AM	12/17/2016 12:25:00 PM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH142	AZ47657	1	METHANE	12/13/2016 7:00:00 AM	12/17/2016 12:29:00 PM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH147	AZ47658	1	METHANE	12/14/2016 9:30:00 AM	12/17/2016 12:37:00 PM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH152	AZ47660	1	METHANE	12/14/2016 10:35:00 AM	12/17/2016 12:41:00 PM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH138	AZ47663	1	METHANE	12/13/2016 2:30:00 PM	12/17/2016 12:47:00 PM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH144	AZ47664	50	METHANE	12/13/2016 2:35:00 PM	12/17/2016 1:07:00 PM	C	16000	UG_L		250.0	50.00	J	c
ERH140	AZ47665	1	METHANE	12/13/2016 5:00:00 PM	12/17/2016 1:04:00 PM	C	1.00	UG_L	U	5.0	1.00	UJ	c

The attached zipped file contains one file:

<u>File</u>	<u>Format</u>	<u>Description</u>
1) Readme_RedHill_012717.docx	MS Word 2007	A "Readme" file (this document).
	MS Excel 2007	<u>A spreadsheet for the following SDGs:</u>
2) 81734_RH_COPC_dva.xlsx		81734 37870A
3) 81760_RH_COPC_dva.xlsx		81760 37870B
4) 81776_RH_COPC_dva.xlsx		81776 37870C

No discrepancies were observed between the hardcopy data packages and the electronic data deliverables during verification.

Please contact Stella Cuenco or Judy Ecklund at (760) 827-1100 if you have any questions regarding this electronic data submittal.



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 Thach

February 8, 2017

SUBJECT: Revised Red Hill Bulk Storage Facility, CTO 0053, Data Validation

Dear Ms. Thach,

Enclosed is the revised validation report for the fractions listed below. Please replace the previously submitted report with the enclosed revised report.

LDC Project #37870:

<u>SDG #</u>	<u>Fraction</u>
81734	2-(2-Methoxyethoxy)-ethanol, Wet Chemistry

- Revision A2c: Corrected receipt date for ERH155
- Revision A6: Corrected Nitrate as N to Nitrate

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

Sincerely,

Stella Cuenco
Operations Manager/Senior Chemist

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 7, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81734

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH137	AZ47343	Water	12/12/16
ERH141**	AZ47344**	Water	12/12/16
ERH135**	AZ47345**	Water	12/12/16
ERH155	AZ47431	Water	11/18/16*
ERH135MS	AZ47345MS	Water	12/12/16
ERH135MSD	AZ47345MSD	Water	12/12/16

*Indicates collection date is the receipt date

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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, r² 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) 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%.

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 and MS/MSD percent recoveries were within QC limits. Additionally, all 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 with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
ERH135MS/MSD (ERH135**)	2-(2-Methoxyethoxy)-ethanol	31.8 (≤20)	NA	-

IX. Laboratory Control Samples/Reference Material

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

Reference materials (RM) were analyzed as required by the method. The results were within QC limits with the following exceptions:

Compound	ERH155		RPD (Limits)
	True Value	Laboratory Result	
2-(2-Methoxyethoxy)-ethanol	1000	700	35 (≤100)

X. Field Duplicates

Samples ERH137 and ERH135** 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81734**

No Sample Data Qualified in this SDG

LDC #: 37870A2c
 SDG #: 81734
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 1/16/17
 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 / SW	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ Δ	% PSD \leq 15 ICV \leq 20
IV.	Continuing calibration / closing CV	Δ	CV \leq 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples / RM	Δ / Δ	ICV
X.	Field duplicates	ND	D = 1, 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	SW / Δ	RTA = 4

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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH137 D	AZ47343	Water	12/12/16
2	ERH141**	AZ47344**	Water	12/12/16
3	ERH135** D	AZ47345**	Water	12/12/16
4	ERH155 PT	AZ47431	Water	12/12/16
5	ERH135MS	AZ47345MS	Water	11/18 * 12/12/16
6	ERH135MSD	AZ47345MSD	Water	12/12/16
7				
8				
9				

Notes: * Receipt date

161219A					

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/	X		
Was cooler temperature criteria met?	/			
II. GC/MS instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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) 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?		/		
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) < 20% ?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed 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 completeness worksheet.		/		
VI. Field blanks				
Were field blanks were identified in this SDG?		/		
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
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 ?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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 checked="" type="checkbox"/>	<input type="checkbox"/>	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
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"/>	
X. Field duplicates				
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 type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
XI. Internal standards				
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"/>	
XII. Compound quantitation				
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"/>	
XIII. Target compound identification				
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"/>	
XIV. System performance				
System performance was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37870A2c

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GCMS 8270C

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 400 std)	Recalculated (RRF400 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	12/20/2016	2-(2-Methoxyethoxy) Ethanol	0.2253	0.2253	0.2214	0.2214	9.90	9.90
	Yoda								

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, A_{is} = Area of associated internal standard
 C_x = Concentration of compound, 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	1220Y011	12/20/16	2-(2-ME)-E (1st IS)	0.2144	0.2388	0.2388	11	11
			(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 #: 37870A2C

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

Page: 1 of 1

Reviewer: FT

2nd reviewer: PK

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: surrogate not added see phenol analysis

	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					

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 #: 37870A2c

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

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

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = $|MSC - MSC| * 2 / (MSC + MSDC)$

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: 5 + 6

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol											
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene											
Pentachlorophenol											
Pyrene											
2-(2-ME)-E	80.0	80.0	ND	52.9	38.4	66.1	66.1	48.0	48.0	31.8	31.8

Comments: Refer to Matrix Spike/Matrix Spike 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
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 161219A led

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										
2-(2-ME)-Ethanol	80.0	NA	43.5	NA	54.4	54.4	NA			

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 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_x = Area of the characteristic ion (EICP) for the compound to be measured
- A_s = Area of the characteristic ion (EICP) for the specific internal standard
- I_s = Amount of internal standard added in nanograms (ng)
- V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).
- V_i = Volume of extract injected in microliters (ul)
- V_t = 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. 161219A W3 2-(2-ME)E

$$\text{Conc.} = \frac{44294 (40)}{189835 (0.2144)}$$

43.5 ug/L

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification

LDC #: 37870Ade

VALIDATION FINDINGS WORKSHEET
Reference Material = ERH155

Page: 1 of 1
Reviewer: FE7
2nd reviewer: KH

METHOD: GC/MS 22MEE (EPA SW 846 Method 8270D Modified)

Compound	SampleID : ERH155		RPD = 100
	True Value	Laboratory Result	
2-(2-Methoxyethoxy)-Ethanol	1000	700	35

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 7, 2017

Parameters: Wet Chemistry

Validation Level: Level D

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81734

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH141	AZ47344	Water	12/12/16
ERH135	AZ47345	Water	12/12/16
ERH135MS	AZ47345MS	Water	12/12/16
ERH135MSD	AZ47345MSD	Water	12/12/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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

All sample results were subjected to Level D data validation, which is comprised of the quality control (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
ERH141	Nitrate	172.02 hours	48 hours	J (all detects)	P
ERH135	Nitrate	179.00 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	Associated Samples
PB (prep blank)	Alkalinity	1.5 mg/L	All samples in SDG 81734

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 with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
ERH135MS/MSD (ERH135)	Chloride	114 (90-110)	114 (90-110)	J (all detects)	A
ERH135MS/MSD (ERH135)	Nitrate/Nitrite as N	-	87.2 (90-110)	J (all detects)	A

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) were analyzed as required by the methods. Percent recoveries (%R) 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.

XI. Overall Assessment of Data

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

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

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Data Qualification Summary - SDG 81734**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH141 ERH135	Nitrate	J (all detects)	P	Technical holding time (H)
ERH135	Chloride Nitrate/Nitrite as N	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (%R) (Q)

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Field Blank Data Qualification Summary - SDG 81734**

No Sample Data Qualified in this SDG

LDC #: 37870A6
 SDG #: 81734
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET

Level D

Date: 11/18/16
 Page: 1 of 1
 Reviewer: SD
 2nd Reviewer: PK

METHOD: (Analyte) Alkalinity (SM2320B), Chloride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B)
 Nitrate/Nitrite-N (EPA Method 353.2)

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	SW	12/12/16
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	MS/D = (3,4)
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Sample result verification	A	
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	ERH141	AZ47344	Water	12/12/16
2	ERH135	AZ47345	Water	12/12/16
3	ERH135MS	AZ47345MS	Water	12/12/16
4	ERH135MSD	AZ47345MSD	Water	12/12/16
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes: _____

Method: Inorganics (EPA Method See Cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.		/		
II. Calibration				
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)			/	
III. Blanks				
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.		/		
IV. Matrix spike/Matrix spike duplicates and Duplicates				
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.	/			
V. Laboratory control samples				
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?	/			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?			/	
Were the performance evaluation (PE) samples within the acceptance limits?			/	

LDC #: 37870A

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: SD
 2nd Reviewer: PK

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

LDC #: 378104

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Page: 1 of 1
 Reviewer: JD
 2nd reviewer: KH

All circled methods are applicable to each sample.

Sample ID	Parameter
1-2	pH TDS <u>Cl</u> <u>F</u> <u>NO₃</u> <u>NO₂</u> <u>SO₄</u> O-PO ₄ <u>Alk</u> CN NH ₃ TKN TOC Cr6+ ClO ₄ <u>NO₃(NO₂-N)</u> <u>Fe⁺²</u>
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
BC34	pH TDS <u>Cl</u> <u>F</u> <u>NO₃</u> <u>NO₂</u> <u>SO₄</u> O-PO ₄ <u>Alk</u> CN NH ₃ TKN TOC Cr6+ ClO ₄ <u>NO₃(NO₂-N)</u> <u>Fe⁺²</u>
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
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	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄

Comments: _____

VALIDATION FINDINGS WORKSHEET

Blanks

METHOD: Inorganics, Method See Cover

Conc. units: mg/L

Associated Samples: All (S)

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB	ICB/CCB (mg/L)		No Qualifiers									
Alkalinity	1.5		7.5										

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

LDC #: 37870A6

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

Page: 1 of 1
 Reviewer: JD
 2nd Reviewer: KK

Method: Inorganics, Method See Cover

The correlation coefficient (r) for the calibration of Fe⁺² was recalculated. Calibration date: 12/13/16

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 ²	r or r ²	
Initial calibration	Fe ⁺²	s1	0.0	0	0.9998278	0.9998278	Y
		s2	1	0.101			
		s3	2	0.201			
		s4	4	0.403			
		s5	5	0.512			
		s6	10	0.999			
ICV 12:41 Calibration verification	Fe ⁺²	<u>Found</u> 3.0 mg/L	<u>True</u> 3 mg/L		100%R	100%R	Y
ICV 12:37 Calibration verification	Cl	18.18 mg/L	20 mg/L		90.9%R	91.1%R	Y*
ICV 16:35 Calibration verification	NO ₃ -N	2.35 mg/L	2.5 mg/L		94.0%R	94.2%R	Y*

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

*Rounding

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

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	
LCS	Laboratory control sample	Alkalinity	244.3mg/L	250mg/L	97.7%R	97.6%R	Y*
MS 14.24	Matrix spike sample	Fe ⁺²	(SSR-SR) 2957mg/L	3mg/L	98.6%R	98.4%R	Y*
MSD 22.02	Duplicate sample	NO ₃	5.13mg/L	5.14mg/L	0.19%RPD	0.44%RPD	Y*

Comments: *Rounding

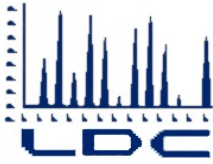
**Red Hill Bulk Storage Facility, CTO 0053 - SDG 81734
LDC 37870**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 2320B													
ERH141	AZ47344	1	ALKALINITY, AS CaCO3	12/12/2016 10:50:00 AM	12/19/2016 5:19:00 PM	D	59.1	MG_L		2.0	1.70		
ERH141	AZ47344	1	ALKALINITY, BICARBONATE	12/12/2016 10:50:00 AM	12/19/2016 5:19:00 PM	D	59.1	MG_L		2.0	1.70		
ERH141	AZ47344	1	ALKALINITY, CARBONATE	12/12/2016 10:50:00 AM	12/19/2016 5:19:00 PM	D	1.70	MG_L	U	2.0	1.70		U
ERH135	AZ47345	1	ALKALINITY, AS CaCO3	12/12/2016 10:20:00 AM	12/19/2016 5:24:00 PM	D	61.9	MG_L		2.0	1.70		
ERH135	AZ47345	1	ALKALINITY, BICARBONATE	12/12/2016 10:20:00 AM	12/19/2016 5:24:00 PM	D	61.9	MG_L		2.0	1.70		
ERH135	AZ47345	1	ALKALINITY, CARBONATE	12/12/2016 10:20:00 AM	12/19/2016 5:24:00 PM	D	1.70	MG_L	U	2.0	1.70		U
METHOD: 300.0													
ERH141	AZ47344	5	CHLORIDE	12/12/2016 10:50:00 AM	12/19/2016 4:36:00 PM	D	171	MG_L	D	5.0	1.00		
ERH141	AZ47344	1	NITRATE	12/12/2016 10:50:00 AM	12/19/2016 2:51:00 PM	D	2.2	MG_L		0.5	0.18	J	h
ERH141	AZ47344	5	SULFATE	12/12/2016 10:50:00 AM	12/19/2016 4:36:00 PM	D	78.7	MG_L	D	5.0	1.00		
ERH135	AZ47345	2	CHLORIDE	12/12/2016 10:20:00 AM	12/19/2016 9:23:00 PM	D	85.3	MG_L		2.0	0.40	J	q
ERH135	AZ47345	1	NITRATE	12/12/2016 10:20:00 AM	12/19/2016 9:10:00 PM	D	2.5	MG_L		0.5	0.18	J	h
ERH135	AZ47345	1	SULFATE	12/12/2016 10:20:00 AM	12/19/2016 9:10:00 PM	D	14.9	MG_L		1.0	0.20		
METHOD: 3500_FE_B													
ERH141	AZ47344	1	IRON, FERROUS	12/12/2016 10:50:00 AM	12/13/2016 2:22:00 PM	D	0.32	MG_L	U	1.0	0.32		U
ERH135	AZ47345	1	IRON, FERROUS	12/12/2016 10:20:00 AM	12/13/2016 2:23:00 PM	D	0.32	MG_L	U	1.0	0.32		U
METHOD: 353.2													
ERH141	AZ47344	1	NITRATE-NITRITE AS NITROGEN	12/12/2016 10:50:00 AM	12/20/2016 5:28:00 PM	D	0.33	MG_L		0.10	0.100		
ERH135	AZ47345	1	NITRATE-NITRITE AS NITROGEN	12/12/2016 10:20:00 AM	12/20/2016 5:30:00 PM	D	0.40	MG_L		0.10	0.100	J	q
METHOD: 8011													
ERH141	AZ47344	1	1,2-DIBROMOETHANE	12/12/2016 10:50:00 AM	12/20/2016 3:09:00 PM	D	0.020	UG_L	U	0.02	0.020		U
METHOD: 8015B_E													
ERH137	AZ47343	1	TPH-DIESEL RANGE	12/12/2016 10:20:00 AM	12/19/2016 11:53:00 AM	C	25.00	UG_L	U	40.0	25.00		U
ERH137	AZ47343	1	TPH-OIL RANGE	12/12/2016 10:20:00 AM	12/19/2016 11:53:00 AM	C	40.00	UG_L	U	40.0	40.00		U
ERH141	AZ47344	1	TPH-DIESEL RANGE	12/12/2016 10:50:00 AM	12/19/2016 12:14:00 PM	D	27	UG_L	JT3I	40.0	25.00		J
ERH141	AZ47344	1	TPH-OIL RANGE	12/12/2016 10:50:00 AM	12/19/2016 12:14:00 PM	D	29	UG_L	J	40.0	40.00		J
ERH135	AZ47345	1	TPH-DIESEL RANGE	12/12/2016 10:20:00 AM	12/19/2016 12:34:00 PM	D	14	UG_L	JT3I	40.0	25.00		J

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8015B_E													
ERH135	AZ47345	1	TPH-OIL RANGE	12/12/2016 10:20:00 AM	12/19/2016 12:34:00 PM	D	16	UG_L	J	40.0	40.00	J	
METHOD: 8260B													
ERH137	AZ47343	1	BENZENE	12/12/2016 10:20:00 AM	12/15/2016 7:21:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH137	AZ47343	1	ETHYLBENZENE	12/12/2016 10:20:00 AM	12/15/2016 7:21:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH137	AZ47343	1	TOLUENE	12/12/2016 10:20:00 AM	12/15/2016 7:21:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH137	AZ47343	1	TPH-GASOLINE RANGE C6-C10	12/12/2016 10:20:00 AM	12/15/2016 7:20:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH137	AZ47343	1	XYLENES, TOTAL	12/12/2016 10:20:00 AM	12/15/2016 7:21:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH141	AZ47344	1	1,2-DICHLOROETHANE	12/12/2016 10:50:00 AM	12/15/2016 7:49:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH141	AZ47344	1	BENZENE	12/12/2016 10:50:00 AM	12/15/2016 7:49:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH141	AZ47344	1	ETHYLBENZENE	12/12/2016 10:50:00 AM	12/15/2016 7:49:00 PM	D	0.50	UG_L	U	1.0	0.50	U	
ERH141	AZ47344	1	TOLUENE	12/12/2016 10:50:00 AM	12/15/2016 7:49:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH141	AZ47344	1	TPH-GASOLINE RANGE C6-C10	12/12/2016 10:50:00 AM	12/15/2016 7:48:00 PM	D	18.0	UG_L	U	20	18.0	U	
ERH141	AZ47344	1	XYLENES, TOTAL	12/12/2016 10:50:00 AM	12/15/2016 7:49:00 PM	D	0.30	UG_L	U	2.0	0.30	U	
ERH135	AZ47345	1	BENZENE	12/12/2016 10:20:00 AM	12/15/2016 8:17:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH135	AZ47345	1	ETHYLBENZENE	12/12/2016 10:20:00 AM	12/15/2016 8:17:00 PM	D	0.50	UG_L	U	1.0	0.50	U	
ERH135	AZ47345	1	TOLUENE	12/12/2016 10:20:00 AM	12/15/2016 8:17:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH135	AZ47345	1	TPH-GASOLINE RANGE C6-C10	12/12/2016 10:20:00 AM	12/15/2016 8:16:00 PM	D	18.0	UG_L	U	20	18.0	U	
ERH135	AZ47345	1	XYLENES, TOTAL	12/12/2016 10:20:00 AM	12/15/2016 8:17:00 PM	D	0.30	UG_L	U	2.0	0.30	U	
METHOD: 8270D													
ERH137	AZ47343	1	2-(2-METHOXYETHOXY)-ETHANOL	12/12/2016 10:20:00 AM	12/20/2016 4:14:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH137	AZ47343	1	PHENOL	12/12/2016 10:20:00 AM	12/16/2016 1:31:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH141	AZ47344	1	2-(2-METHOXYETHOXY)-ETHANOL	12/12/2016 10:50:00 AM	12/20/2016 4:45:00 PM	D	80.0	UG_L	U	100	80.0	U	
ERH141	AZ47344	1	PHENOL	12/12/2016 10:50:00 AM	12/16/2016 2:02:00 PM	D	4.00	UG_L	U	5.0	4.00	U	
ERH135	AZ47345	1	2-(2-METHOXYETHOXY)-ETHANOL	12/12/2016 10:20:00 AM	12/20/2016 5:15:00 PM	D	80.0	UG_L	U	100	80.0	U	
ERH135	AZ47345	1	PHENOL	12/12/2016 10:20:00 AM	12/16/2016 3:33:00 PM	D	4.00	UG_L	U	5.0	4.00	U	
ERH155	AZ47431	2	2-(2-METHOXYETHOXY)-ETHANOL	11/18/2016 10:00:00 AM	12/21/2016 2:15:00 AM	C	700	UG_L		200	160.0		
METHOD: 8270D_SIM													
ERH137	AZ47343	1	1-METHYLNAPHTHALENE	12/12/2016 10:20:00 AM	12/16/2016 1:20:00 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
METHOD: 8270D_SIM													
ERH137	AZ47343	1	2-METHYLNAPHTHALENE	12/12/2016 10:20:00 AM	12/16/2016 1:20:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH137	AZ47343	1	NAPHTHALENE	12/12/2016 10:20:00 AM	12/16/2016 1:20:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH141	AZ47344	1	1-METHYLNAPHTHALENE	12/12/2016 10:50:00 AM	12/16/2016 1:54:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH141	AZ47344	1	2-METHYLNAPHTHALENE	12/12/2016 10:50:00 AM	12/16/2016 1:54:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH141	AZ47344	1	NAPHTHALENE	12/12/2016 10:50:00 AM	12/16/2016 1:54:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH135	AZ47345	1	1-METHYLNAPHTHALENE	12/12/2016 10:20:00 AM	12/16/2016 4:41:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH135	AZ47345	1	2-METHYLNAPHTHALENE	12/12/2016 10:20:00 AM	12/16/2016 4:41:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH135	AZ47345	1	NAPHTHALENE	12/12/2016 10:20:00 AM	12/16/2016 4:41:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
METHOD: RSK-175													
ERH141	AZ47344	1	METHANE	12/12/2016 10:50:00 AM	12/17/2016 11:40:00 AM	D	1.00	UG_L	U	5.0	1.00	UJ	c
ERH135	AZ47345	1	METHANE	12/12/2016 10:20:00 AM	12/17/2016 11:43:00 AM	D	1.00	UG_L	U	5.0	1.00	UJ	c,q



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 Thach

January 31, 2017

SUBJECT: Red Hill Bulk Storage Facility, CTO 0053, Data Validation

Dear Ms. Thach,

Enclosed is the final validation report for the fractions listed below. This SDG was received on January 16, 2017. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #37933:

<u>SDG #</u>	<u>Fraction</u>
81842	Volatiles, Polynuclear Aromatic Hydrocarbons, Phenol, 2-(2-Methoxyethoxy)-ethanol, Wet Chemistry, TPH as Gasoline, TPH 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:

- Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i, August 2016
- Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i, Revision 01, November 2016
- Project Procedures Manual Naval Facilities Engineering Command, Environmental Restoration Program, NAVFAC Pacific, DON 2015
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

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

Sincerely,

Stella Cuenco
Operations Manager/Senior Chemist

EDD 90/10

LDC #37933 (AECOM-Honolulu, HI / Red Hill Bulk Storage Facility, CTO 0053)

LDC	SDG#	DATE REC'D	(3) DATE DUE	BTEX 1,2-DCA (8260B)		3 PAHs (8270D -SIM)		Phenol (8270D)		2,2-MEE (8270D-M)		TPH-G (8260B)		TPH-E (8015B)		EDB (8011)		Methane (175)		Alk. (2320B)		Cl, NO ₃ ,SO ₄ (300.0)		Fe II (3500-Fe B)													
				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	W	S		
Matrix: Water/Soil																																					
A	81842	01/16/17	02/06/17	3	0	2	0	2	0	2	0	3	0	2	0	3	0	2	0	1	0	1	0	1	0												
				</																																	

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

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 27, 2017

Parameters: Volatiles

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81842

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH156	AZ48082	Water	12/21/16
ERH157	AZ48083	Water	12/21/16
ERH158	AZ48084	Water	12/21/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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 ERH156 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH157 and ERH158 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Laboratory Blank Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Field Blank Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

LDC #: 37933A1
 SDG #: 81842
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 1/23/17
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC/MS Volatiles (BTEX) (EPA SW 846 Method 8260B)
 + 1,2 - DCA

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 IA	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ IA	% PSD = 15 ICV = 20
IV.	Continuing calibration / closing CCV	A	CCV = 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	CS
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	ERH156	AZ48082	Water	12/21/16
2	ERH157	AZ48083	Water	12/21/16
3	ERH158	AZ48084	Water	12/21/16
4				
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9				

Notes:

161228AL				

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

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 27, 2017

Parameters: Phenol

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81842

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH157	AZ48083	Water	12/21/16
ERH158	AZ48084	Water	12/21/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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%.

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% 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH157 and ERH158 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Laboratory Blank Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Field Blank Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

LDC #: 37933A2a
 SDG #: 81842
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C

Date: 1/23/17

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	A, Δ	% RSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20
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	LCS
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 = Rinstate
 FB = Field blank

D = Duplicate
 TB = Trip blank
 EB = Equipment blank

SB=Source blank
 OTHER:

	Client ID	Lab ID	Matrix	Date
1	ERH157	AZ48083	Water	12/21/16
2	ERH158	AZ48084	Water	12/21/16
3				
4				
5				
6				
7				
8				

Notes:

161227A				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 27, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81842

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH157	AZ48083	Water	12/21/16
ERH158	AZ48084	Water	12/21/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH157 and ERH158 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification
Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -
SDG 81842**

No Sample Data Qualified in this SDG

LDC #: 37933A2b
 SDG #: 81842
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 11/23/17
 Page: 1 of 1
 Reviewer: FJ
 2nd Reviewer: KK

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 IA	
II.	GC/MS Instrument performance check	Δ	≤ 15
III.	Initial calibration/ICV	A Δ	% RSD / ICV ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20
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
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 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	ERH157	AZ48083	Water	12/21/16
2	ERH158	AZ48084	Water	12/21/16
3				
4				
5				
6				
7				
8				

Notes:

TTT, W, S

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 27, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81842

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH157	AZ48083	Water	12/21/16
ERH158	AZ48084	Water	12/21/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% 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%.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

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

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 percent recoveries were within QC limits. Additionally, all 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH157 and ERH158 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81842**

No Sample Data Qualified in this SDG

LDC #: 37933A2c

VALIDATION COMPLETENESS WORKSHEET

Date: 1/23/17

SDG #: 81842

Level C

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-SIM) *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>/closing cal</i>	A	CV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	CS
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
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	ERH157	AZ48083	Water	12/21/16
2	ERH158	AZ48084	Water	12/21/16
3				
4				
5				
6				
7				
8				
9				

Notes:

161228A				

LDC #: 37933 A2C

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
		Surrogates were not added to all samples as required by the method. Using professional judgment, no data were qualified, since the LCS percent recoveries were within QC limits. Additionally, all 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 0053

LDC Report Date: January 27, 2017

Parameters: Wet Chemistry

Validation Level: Level C

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81842

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH157	AZ48083	Water	12/21/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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

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. 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	Associated Samples
PB (prep blank)	Alkalinity	1.6 mg/L	All samples in SDG 81842

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) were analyzed as required by the methods. Percent recoveries (%R) 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. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Field Blank Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

LDC #: 37933A6

VALIDATION COMPLETENESS WORKSHEET

Date: 12/21/17

SDG #: 81842

Level C

Page: 1 of 1

Laboratory: APPL Labs

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: (Analyte) Alkalinity (SM2320B), Chloride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B)

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	12/21/16
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	CS
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
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	ERH157	AZ48083	Water	12/21/16
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

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)		No Qualifiers												
Alkalinity	1.6		8													

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 0053
LDC Report Date: January 27, 2017
Parameters: Total Petroleum Hydrocarbons as Gasoline
Validation Level: Level C
Laboratory: APPL, Inc.
Sample Delivery Group (SDG): 81842

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH156	AZ48082	Water	12/21/16
ERH157	AZ48083	Water	12/21/16
ERH158	AZ48084	Water	12/21/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 Gasoline 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.

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 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 ERH156 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

Samples ERH157 and ERH158 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG
81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification
Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification
Summary - SDG 81842**

No Sample Data Qualified in this SDG

LDC #: 37933A7

VALIDATION COMPLETENESS WORKSHEET

Date: 1/23/17

SDG #: 81842

Level C

Page: 1 of 1

Laboratory: APPL, Inc.

Reviewer: [Signature]
2nd Reviewer: [Signature]

METHOD: GC/MS TPH as Gasoline (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, Δ	% RSD / ICV ≤ 70
IV.	Continuing calibration	Δ	CCV ≤ 70
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 1
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LOS 10
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
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	ERH156 TB	AZ48082	Water	12/21/16
2	ERH157 D	AZ48083	Water	12/21/16
3	ERH158 D	AZ48084	Water	12/21/16
4				
5				
6				
7				
8				
9				

Notes:

161228A L1				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 27, 2017

Parameters: Total Petroleum Hydrocarbons as Extractables

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81842

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH157	AZ48083	Water	12/21/16
ERH158	AZ48084	Water	12/21/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds.

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH157 and ERH158 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ng/L)		RPD (Limits)
	ERH157	ERH158	
Diesel (C10-C24)	25.00U	63	200 (≤50)

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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -
SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data
Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification
Summary - SDG 81842**

No Sample Data Qualified in this SDG

LDC #: 37933A8
 SDG #: 81842
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C

Date: 1/30/17
 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	% RSD / ICV ≤ 20
III.	Continuing calibration	A	CV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	Δ	
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	CS
IX.	Field duplicates	SW	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	ERH157	AZ48083	Water	12/21/16
2	ERH158	AZ48084	Water	12/21/16
3				
4				
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8				
9				
10				
11				
12				

Notes:

1	161227A				

LDC #: 37933AB

VALIDATION FINDINGS WORKSHEET Field Duplicates

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

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>ng/L</u>)		%RPD Limit (≤ <u>50</u> %)	Qualification (Parent only)
	1	2		
<u>Diesel (C10-C24)</u>	<u>25.004</u>	<u>63</u>	<u>200</u>	

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

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

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 27, 2017

Parameters: Ethylene Dibromide

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81842

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH156	AZ48082	Water	12/21/16
ERH157	AZ48083	Water	12/21/16
ERH158	AZ48084	Water	12/21/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

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 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 ERH156 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH157 and ERH158 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Laboratory Blank Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Field Blank Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

LDC #: 37933A10
 SDG #: 81842
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 1/23/17
 Page: 1 of 1
 Reviewer: *FR*
 2nd Reviewer: *KY*

METHOD: GC Ethylene Dibromide (EPA SW 846 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	ICV ≤ 20
III.	Continuing calibration	Δ	CV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	TB = 1
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	CS
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	ERH156 TB	AZ48082	Water	12/21/16
2	ERH157 D	AZ48083	Water	12/21/16
3	ERH158 D	AZ48084	Water	12/21/16
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Notes:

161228A /				

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

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: January 27, 2017

Parameters: Methane

Validation Level: Level C

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81842

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH157	AZ48083	Water	12/21/16
ERH156	AZ48082	Water	12/21/16

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 ERH156 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Laboratory Blank Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Field Blank Data Qualification Summary - SDG 81842**

No Sample Data Qualified in this SDG

LDC #: 37933A51

VALIDATION COMPLETENESS WORKSHEET

SDG #: 81842

Level C

Laboratory: APPL Labs

Date: 1/23/17

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	Δ Δ	ICV ± 20
III.	Continuing calibration	Δ	CCV ± 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 3
VI.	Matrix spike/Matrix spike duplicates	N	CS
VII.	Laboratory control samples	A	CS
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	ERH157	AZ48083	Water	12/21/16
2	ERH158 FT	AZ48084	Water	12/21/16
3	ERH156	AZ48082	↓	↓
4				
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8				
9				
10				
11				
12				
13				

Notes:

161224 Δ				

**Red Hill Bulk Storage Facility, CTO 003 - SDG 81842
LDC 37933**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 2320B													
ERH157	AZ48083	1	ALKALINITY, AS CaCO3	12/21/2016 9:45:00 AM	1/3/2017 1:40:00 PM	C	63.1	MG_L		2.0	1.70		
ERH157	AZ48083	1	ALKALINITY, BICARBONATE	12/21/2016 9:45:00 AM	1/3/2017 1:40:00 PM	C	63.1	MG_L		2.0	1.70		
ERH157	AZ48083	1	ALKALINITY, CARBONATE	12/21/2016 9:45:00 AM	1/3/2017 1:40:00 PM	C	1.70	MG_L	U	2.0	1.70		U
METHOD: 300.0													
ERH157	AZ48083	1	CHLORIDE	12/21/2016 9:45:00 AM	12/22/2016 5:40:00 PM	C	12.7	MG_L		1.0	0.20		
ERH157	AZ48083	1	NITRATE	12/21/2016 9:45:00 AM	12/22/2016 5:40:00 PM	C	16.1	MG_L		0.5	0.18		
ERH157	AZ48083	1	SULFATE	12/21/2016 9:45:00 AM	12/22/2016 5:40:00 PM	C	13.4	MG_L		1.0	0.20		
METHOD: 3500_FE_B													
ERH157	AZ48083	1	IRON, FERROUS	12/21/2016 9:45:00 AM	12/22/2016 4:35:00 PM	C	0.28	MG_L	J	1.0	0.32		J
METHOD: 8011													
ERH156	AZ48082	1	1,2-DIBROMOETHANE	12/21/2016 8:30:00 AM	12/28/2016 3:29:00 PM	C	0.020	UG_L	U	0.02	0.020		U
ERH157	AZ48083	1	1,2-DIBROMOETHANE	12/21/2016 9:45:00 AM	12/28/2016 3:50:00 PM	C	0.020	UG_L	U	0.02	0.020		U
ERH158	AZ48084	1	1,2-DIBROMOETHANE	12/21/2016 9:45:00 AM	12/28/2016 4:11:00 PM	C	0.020	UG_L	U	0.02	0.020		U
METHOD: 8015B_E													
ERH157	AZ48083	1	TPH-DIESEL RANGE	12/21/2016 9:45:00 AM	12/29/2016 7:41:00 PM	C	25.00	UG_L	U	40.0	25.00		U
ERH157	AZ48083	1	TPH-OIL RANGE	12/21/2016 9:45:00 AM	12/29/2016 7:41:00 PM	C	40.00	UG_L	U	40.0	40.00		U
ERH158	AZ48084	1	TPH-DIESEL RANGE	12/21/2016 9:45:00 AM	12/29/2016 8:01:00 PM	C	63	UG_L	T6	40.0	25.00		
ERH158	AZ48084	1	TPH-OIL RANGE	12/21/2016 9:45:00 AM	12/29/2016 8:01:00 PM	C	40.00	UG_L	U	40.0	40.00		U
METHOD: 8260B													
ERH156	AZ48082	1	1,2-DICHLOROETHANE	12/21/2016 8:30:00 AM	12/28/2016 3:39:00 PM	C	0.30	UG_L	U	1.0	0.30		U
ERH156	AZ48082	1	BENZENE	12/21/2016 8:30:00 AM	12/28/2016 3:39:00 PM	C	0.30	UG_L	U	1.0	0.30		U
ERH156	AZ48082	1	ETHYLBENZENE	12/21/2016 8:30:00 AM	12/28/2016 3:39:00 PM	C	0.50	UG_L	U	1.0	0.50		U
ERH156	AZ48082	1	TOLUENE	12/21/2016 8:30:00 AM	12/28/2016 3:39:00 PM	C	0.30	UG_L	U	1.0	0.30		U
ERH156	AZ48082	1	TPH-GASOLINE RANGE C6-C10	12/21/2016 8:30:00 AM	12/28/2016 3:40:00 PM	C	18.0	UG_L	U	20	18.0		U
ERH156	AZ48082	1	XYLENES, TOTAL	12/21/2016 8:30:00 AM	12/28/2016 3:39:00 PM	C	0.30	UG_L	U	2.0	0.30		U
ERH157	AZ48083	1	1,2-DICHLOROETHANE	12/21/2016 9:45:00 AM	12/28/2016 4:07:00 PM	C	0.30	UG_L	U	1.0	0.30		U
ERH157	AZ48083	1	BENZENE	12/21/2016 9:45:00 AM	12/28/2016 4:07:00 PM	C	0.30	UG_L	U	1.0	0.30		U

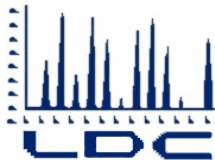
EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8260B													
ERH157	AZ48083	1	ETHYLBENZENE	12/21/2016 9:45:00 AM	12/28/2016 4:07:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH157	AZ48083	1	TOLUENE	12/21/2016 9:45:00 AM	12/28/2016 4:07:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH157	AZ48083	1	TPH-GASOLINE RANGE C6-C10	12/21/2016 9:45:00 AM	12/28/2016 4:08:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH157	AZ48083	1	XYLENES, TOTAL	12/21/2016 9:45:00 AM	12/28/2016 4:07:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH158	AZ48084	1	1,2-DICHLOROETHANE	12/21/2016 9:45:00 AM	12/28/2016 4:35:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH158	AZ48084	1	BENZENE	12/21/2016 9:45:00 AM	12/28/2016 4:35:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH158	AZ48084	1	ETHYLBENZENE	12/21/2016 9:45:00 AM	12/28/2016 4:35:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH158	AZ48084	1	TOLUENE	12/21/2016 9:45:00 AM	12/28/2016 4:35:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH158	AZ48084	1	TPH-GASOLINE RANGE C6-C10	12/21/2016 9:45:00 AM	12/28/2016 4:36:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH158	AZ48084	1	XYLENES, TOTAL	12/21/2016 9:45:00 AM	12/28/2016 4:35:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
METHOD: 8270D													
ERH157	AZ48083	1	2-(2-METHOXYETHOXY)-ETHANOL	12/21/2016 9:45:00 AM	12/28/2016 6:15:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH157	AZ48083	1	PHENOL	12/21/2016 9:45:00 AM	12/27/2016 7:13:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH158	AZ48084	1	2-(2-METHOXYETHOXY)-ETHANOL	12/21/2016 9:45:00 AM	12/28/2016 6:45:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH158	AZ48084	1	PHENOL	12/21/2016 9:45:00 AM	12/27/2016 7:43:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
METHOD: 8270D_SIM													
ERH157	AZ48083	1	1-METHYLNAPHTHALENE	12/21/2016 9:45:00 AM	12/27/2016 6:33:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH157	AZ48083	1	2-METHYLNAPHTHALENE	12/21/2016 9:45:00 AM	12/27/2016 6:33:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH157	AZ48083	1	NAPHTHALENE	12/21/2016 9:45:00 AM	12/27/2016 6:33:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH158	AZ48084	1	1-METHYLNAPHTHALENE	12/21/2016 9:45:00 AM	12/27/2016 7:07:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH158	AZ48084	1	2-METHYLNAPHTHALENE	12/21/2016 9:45:00 AM	12/27/2016 7:07:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH158	AZ48084	1	NAPHTHALENE	12/21/2016 9:45:00 AM	12/27/2016 7:07:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
METHOD: RSK-175													
ERH156	AZ48082	1	METHANE	12/21/2016 8:30:00 AM	12/24/2016 11:17:00 AM	C	1.00	UG_L	U	5.0	1.00	U	
ERH157	AZ48083	1	METHANE	12/21/2016 9:45:00 AM	12/24/2016 11:20:00 AM	C	1.00	UG_L	U	5.0	1.00	U	

The attached zipped file contains two files:

<u>File</u>	<u>Format</u>	<u>Description</u>
1) Readme_RedHill_013117.docx	MS Word 2007	A "Readme" file (this document).
2) 81842_RH_COPC_dva.xlsx	MS Excel 2007	<u>A spreadsheet for the following SDGs:</u> 81842 37933A

No discrepancies were observed between the hardcopy data packages and the electronic data deliverables during verification.

Please contact Stella Cuenco or Judy Ecklund at (760) 827-1100 if you have any questions regarding this electronic data submittal.



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AECOM
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ATTN: Ms. Margie Thach

February 9, 2017

**SUBJECT: Data Quality Assessment Report
December 2016
Investigation and Remediation of Releases and
Groundwater Protection and Evaluation
Red Hill Bulk Fuel Storage Facility
Joint Base Pearl Harbor-Hickam
Oahu, Hawaii
CTO 0053**

Dear Ms. Thach,

Enclosed is the Data Quality Assessment Report, December 2016, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, Oahu, Hawaii, CTO 0053

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,

Stella Cuenco
Operations Manager/Senior Chemist

DATA QUALITY ASSESSMENT REPORT

**DECEMBER 2016
INVESTIGATION AND REMEDIATION OF RELEASES
AND GROUNDWATER PROTECTION AND EVALUATION**

**RED HILL BULK FUEL STORAGE FACILITY
JOINT BASE PEARL HARBOR-HICKAM
OAHU, HAWAII**

CTO 0053

February 9, 2017

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GLOSSARY

ASTM	American Society for Testing and Materials
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes, total
COPC	Compounds of Potential Concern
CTO	Contract Task Order
DCA	1,2-Dichloroethane
DQAR	Data Quality Assessment Report
DOD	Department of Defense
DL	Detection Limit
EB	Equipment Blank
EDB	Ethylene Dibromide
FB	Field Blank
FD	Field Duplicate
LCS	Laboratory Control Sample
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
RM	Reference Material
RRF	Relative Response Factor
SDG	Sample Delivery Group
SGCU	Silica Gel Clean-Up
SIM	Selected Ion Monitoring
TB	Trip Blank
TPH	Total Petroleum Hydrocarbons
%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 investigation and remediation of petroleum product releases and protection and evaluation of groundwater were conducted on December 2016 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 23 environmental and quality control (QC) samples. The analyses were performed by the following methods:

Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), and 1,2-Dichloroethane (DCA) by Environmental Protection Agency (EPA) SW-846 Method 8260B

Phenol by EPA SW-846 Method 8270D

2-(2-Methoxyethoxy)-ethanol (MEE) by EPA SW-846 Method 8270D Modified

Polynuclear Aromatic Hydrocarbons (PAH) by EPA SW-846 Method 8270D-Selected Ion Monitoring (SIM) mode

Total Petroleum Hydrocarbons (TPH) as Gasoline by EPA SW-846 Method 8260B

TPH as Extractables by EPA SW-846 Method 8015B

Ethylene Dibromide (EDB) by EPA SW-846 Method 8011

Methane by Method RSK 175

Wet Chemistry:

Alkalinity by Standard Method 2320B

Chloride, Nitrate and Sulfate (Anions) by EPA Method 300.0

Ferrous Iron by Standard Method 3500 Fe B

Nitrate/Nitrite as Nitrogen by EPA Method 353.2

Analytical services were provided by APPL, Inc. whom performed analyses on the water samples. The samples were grouped into sample delivery groups (SDGs) as received by each 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 5.0 (DoD 2013)*.

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 11 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, laboratory control samples/ laboratory control sample duplicates (LCS/LCSD), laboratory duplicates (DUP), matrix spike/matrix spike duplicates (MS/MSD), equipment blanks (EB), field blanks (FB), trip blanks (TB) and field duplicates (FD).

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 5 times the concentration in any associated blank.
- 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):

$$RPD = (D1 - D2) / \{1/2(D1 + D2)\} \times 100$$

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. Non-aqueous LCSs are prepared using solid media approved by the American Society for Testing and Materials (ASTM) for their homogeneity. The LCS measures laboratory efficiency in recovering target analytes from either a solid or 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.

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, ambient blanks, field 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 all BTEX, DCA, TPH as gasoline, EDB, 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 all BTEX, MEE, phenol, PAH, TPH as gasoline and TPH as extractables.

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 all BTEX, phenol, PAH, MEE, TPH as gasoline, and TPH as extractables.

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 for contaminants.

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 BENZENE, TOLUENE, ETHYLBENZENE, XYLENES, TOTAL AND 1,2-DICHLOROETHANE

A total of 22 water samples were analyzed for BTEX and a total of 7 water samples were analyzed for DCA by EPA SW-846 Method 8260B. All BTEX and DCA data were assessed to be valid since none of the 95 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.

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 acceptance criteria of 0.05 in the initial and continuing calibrations.

The %RSDs met the acceptance criteria of 15 percent in the initial calibration. The %Ds in the continuing calibration verifications and closing continuing calibration verifications met the acceptance criteria of 20 and 50 percent, respectively.

The %Ds in the initial calibration verification were within the acceptance criteria of 20 percent.

2.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria.

2.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

2.1.4 LCS Samples

All LCS %Rs were within the acceptance criteria.

2.1.5 Internal Standards

All internal standard areas and retention times were within the acceptance criteria.

2.1.6 Field Duplicate Samples

No BTEX or DCA were detected in the field duplicate samples ERH137 and ERH135, samples ERH147 and ERH148, and samples ERH157 and ERH158.

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 compound identification 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, equipment blanks, field blanks and trip blanks 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 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 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 Trip Blanks

No contaminants were detected in the trip blanks for this analysis.

2.2.2.3 Equipment and Field Blanks

No contaminants were detected in the equipment and field 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. Target analytes detected below the LOQs flagged (J) by the laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

2.4 Completeness

The completeness level attained for BTEX and DCA 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 work plan.

3.0 PHENOL AND 2-(2-METHOXYETHOXY)-ETHANOL

A total of 18 water samples were analyzed for phenol by EPA SW-846 Method 8270D and 19 water samples were analyzed for MEE by EPA SW-846 Method 8270D Modified. All phenol and MEE data were assessed to be valid since none of the 37 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.

3.1 Precision and Accuracy

3.1.1 Instrument Calibration

The RRFs met the acceptance criteria of 0.05 in the initial and continuing calibrations.

The %RSDs met the acceptance criteria of 15 percent in the initial calibration. The %Ds in the continuing calibration verifications and closing continuing calibration verifications met the acceptance criteria of 20 and 50 percent, respectively.

The %Ds in the initial calibration verification were within the acceptance criteria of 20 percent.

3.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria for the phenol analysis.

3.1.3 MS/MSD Samples

All MS/MSD %Rs were within the acceptance criteria.

No data were qualified due to high ERH135MS/MSD RPD since the associated MEE result was non-detected.

3.1.4 LCS Samples/Reference Material

All LCS %Rs were within the acceptance criteria.

RPD for reference material sample ERH155 was within the acceptance criteria.

3.1.5 Internal Standards

All internal standard areas and retention times were within the acceptance criteria.

3.1.6 Field Duplicate Samples

No phenol or MEE were detected in the field duplicate samples ERH137 and ERH135, samples ERH147 and ERH148, and samples ERH157 and ERH158.

3.1.7 Proficiency Testing Samples

Proficiency testing (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, equipment blanks and field blanks were collected and analyzed to evaluate representativeness.

3.2.2.1 Method Blanks

No contaminants were detected in the method blanks for this analysis.

3.2.2.2 Equipment and Field Blanks

No contaminants were detected in the equipment 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. Target analytes detected below the LOQs flagged (J) by the laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

3.4 Completeness

The completeness level attained for phenol and 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.

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 18 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 54 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 acceptance criteria of 0.05 in the initial and continuing calibrations.

The %RSDs met the acceptance criteria of 15 percent in the initial calibration. The %Ds in the continuing calibration verifications and closing continuing calibration verifications met the acceptance criteria of 20 and 50 percent, respectively.

The %Ds in the initial calibration verification were within the acceptance criteria of 20 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 Samples

All LCS %Rs 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

No PAH were detected in the field duplicate samples ERH137 and ERH135, samples ERH147 and ERH148, and samples ERH157 and ERH158.

4.1.7 Proficiency Testing Samples

Proficiency testing (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, equipment blanks, and field blanks 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 Equipment and Field Blanks

No contaminants were detected in the equipment 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 TOTAL PETROLEUM HYDROCARBONS AS GASOLINE

A total of 22 water samples were analyzed for TPH as gasoline by EPA SW-846 Method 8260B. All TPH as gasoline data were assessed to be valid since none of the 22 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 coefficient of determination (r^2) was ≥ 0.990 in the initial calibration. The %Ds in the initial and continuing calibration verifications met the acceptance criteria of 20 percent.

5.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria.

5.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

5.1.4 LCS/LCSD Samples

All LCS/LCSD %Rs and RPDs were within the acceptance criteria.

5.1.5 Field Duplicate Samples

No TPH as gasoline was detected in the field duplicate samples ERH137 and ERH135, samples ERH147 and ERH148, and samples ERH157 and ERH158.

5.1.6 Proficiency Testing Samples

PT samples were not performed for the sampling event.

5.1.7 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, equipment blanks, field blanks and trip blanks 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 Trip Blanks

No contaminants were detected in the trip blanks for this analysis.

5.2.2.3 Equipment and Field Blanks

No contaminants were detected in the equipment 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 TPH as gasoline 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 TOTAL PETROLEUM HYDROCARBONS AS EXTRACTABLES

A total of 18 water samples were analyzed for diesel and oil by EPA SW-846 Method 8015B. All TPH as extractable data were assessed to be valid since none of the 36 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 %RSDs met the acceptance criteria of 20 percent in the initial calibration. The %Ds in the initial and continuing calibration verifications met the acceptance criteria of 20 percent.

6.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria.

6.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

6.1.4 LCS Samples

All LCS %Rs were within the acceptance criteria.

6.1.5 Field Duplicate Samples

The RPDs for diesel and/or oil were outside the acceptance criteria for field duplicate samples ERH137 and ERH135 and samples ERH157 and ERH158. Sample data were not qualified on the basis of field duplicate imprecision. The field duplicates are presented in detail in the data validation reports.

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, equipment blanks and field blanks 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 Equipment and Field Blanks

Diesel results in samples ERH143, ERH147, and ERH148 were qualified as non-detected (U) due to contamination in the equipment blank.

Diesel result in sample ERH149 was qualified as non-detected (U) due to contamination in the field blank.

6.3 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 analytes detected below the LOQs flagged (J) by the laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

6.4 Completeness

The completeness level attained for TPH as extractable 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 ETHYLENE DIBROMIDE

A total of 7 water samples were analyzed for EDB by EPA SW-846 Method 8011. All EDB data were assessed to be valid since none of the 7 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 acceptance criteria of 20 percent.

7.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria.

7.1.3 MS/MSD Samples

MS/MSDs were not performed for the water samples. Since the LCS %Rs met the acceptance criteria, the absence of MS/MSD samples was judged to have no impact on the data quality and no qualifications were made.

7.1.4 LCS Samples

All LCS %Rs were within the acceptance criteria.

7.1.5 Field Duplicate Samples

No EDB was detected in the field duplicate samples ERH157 and ERH158.

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. All holding times were met.

7.2.2 Blanks

Method blanks and trip blanks 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 Trip Blanks

No contaminants were detected in the trip blank for this analysis.

7.3 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.

7.4 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.

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 METHANE

A total of 17 water samples were analyzed for methane by EPA Method RSK 175. All methane data were assessed to be valid since none of the 17 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 coefficient of determination (r^2) was ≥ 0.990 in the initial calibration. The %Ds in the initial calibration verifications met the acceptance criteria of 20 percent.

As a result of continuing calibration verification %D outside of the acceptance criteria of 20 percent, the nine methane results were qualified as detected estimated (J) or non-detected estimated (UJ). Bias is indeterminate.

8.1.2 MS/MSD Samples

The methane result in sample ERH135 was qualified as detected estimated (J) as a result of high and low MS/MSD %R. Bias is indeterminate.

No data were qualified due to a high ERH135MS/MSD RPD since the associated methane result was non-detected.

8.1.3 LCS Samples

All LCS %Rs were within the acceptance criteria.

8.1.4 Field Duplicate Samples

Field duplicates were not collected for the analysis.

8.1.5 Proficiency Testing Samples

PT samples were not performed for the sampling event.

8.1.6 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 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 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 and LODs attained were below the specified LOQs. The comparability of the data is regarded as acceptable.

8.4 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.

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 WET CHEMISTRY

A total of 13 water samples were analyzed for alkalinity by Standard Method 2320B, anions by EPA Method 300.0, ferrous iron by Standard Method 3500 Fe B, and two water samples were analyzed for nitrate/nitrite as nitrogen by EPA Method 353.2. All wet chemistry data were assessed to be valid since none of the 93 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.

9.1 Precision and Accuracy

9.1.1 Instrument Calibration

The correlation coefficients in the initial calibrations and percent recoveries in the initial and continuing calibration verifications were within the acceptance criteria of ≥ 0.995 and 90-110 percent, respectively.

9.1.2 MS/MSD Samples

The chloride result in sample ERH135 was qualified as detected estimated (J) as a result of high MS/MSD %R. High MS/MSD %R indicates that the matrix may be introducing a high bias.

Nitrate/nitrite as nitrogen result in sample ERH135 was qualified as detected estimated (J) as a result of a low MSD %R. Low MS/MSD %R indicate that the matrix may be introducing a low bias.

9.1.3 LCS Samples

All LCS %Rs were within the acceptance criteria.

9.1.4 FD Samples

Field duplicates were not collected for the analysis.

9.1.5 Proficiency Testing Samples

PT samples were not performed for the sampling event.

9.1.6 Sample Result Verification

All sample results were found to be acceptable.

9.2 Representativeness

9.2.1 Holding Times

The evaluation of holding times to verify compliance with all wet chemistry methods was conducted. All water samples met the 28-day analysis holding time criteria for chloride, sulfate, nitrate/nitrite as nitrogen, the 14-day analysis holding time criteria for alkalinity, and the 7-day analysis holding time criteria for ferrous iron.

Due to holding time criteria exceedance, the nitrate results for samples ERH141, ERH135, ERH139 and ERH136 were qualified as detected estimated (J). The analysis holding time criteria is 48 hours.

9.2.2 Blanks

Method blanks were analyzed to evaluate representativeness.

9.2.2.1 Method Blanks

No data were qualified due to a low level alkalinity in method blanks.

9.3 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 analytes detected below the LOQs flagged (J) by the laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

9.4 Completeness

The completeness level attained for wet chemistry 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 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.

11.0 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.

11.1 Precision and Accuracy

Bias cannot be determined for associated methane results when continuing calibration verification %Ds are outside of the acceptance criteria or when MS/MSD %Rs are either high or low.

High MS/MSD %Rs indicates that the associated chloride results may be biased high for the associated samples.

Low MS/MSD %Rs indicates that the associated nitrate/nitrite as nitrogen results may be bias low for the associated samples.

Precision and accuracy were evaluated using data quality indicators such as calibration, surrogates, MS/MSD, LCS, 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.

11.2 Representativeness

All samples for each method and matrix were evaluated for holding time compliance. All holding times were met with the exception noted in Section 9.2.1. All samples were associated with a method blank in each individual SDG. The representativeness of the project data is considered acceptable after qualification for holding time.

11.3 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.

11.4 Completeness

Of the 335 total results reported, none of the results were rejected. The completeness for all SDGs is as follows:

Parameter	Total Analytes	No. of Rejects	% Completeness
BTEX and DCA	95	0	100
Phenol	18	0	100
MEE	19	0	100
PAHs	54	0	100
TPHG	22	0	100
TPHE	36	0	100
EDB	7	0	100
Methane	17	0	100
Wet chemistry	93	0	100
Total	361	0	100

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 Section 6.2.2.2.

11.5 Sensitivity

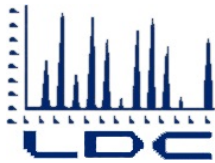
Sensitivity was achieved by the laboratory to support the PQOs. Calibration concentrations, DLs, LODs and LOQs met the project requirements and low level contamination in the method, equipment and field blanks did not affect sensitivity.

Table I. Validation Sample Table

SDG	Client Sample ID	Lab Sample ID	Matrix	QC Type	Sample Date	Validation Level	BTEX (8260B)	DCA (8260B)	Phenol (8270D)	MEE (8270D Mod)	PAH (8270D-SIM)	TPHG (8260B)	TPHE (8015B)	EDB (8011)	Methane (RSK175)
81734	ERH135	AZ47345	Water	FD1	12/12/2016	Level D	X		X	X	X	X	X		X
81734	ERH137	AZ47343	Water	FD1	12/12/2016	Level C	X		X	X	X	X	X		
81734	ERH141	AZ47344	Water		12/12/2016	Level D	X	X	X	X	X	X	X	X	X
81734	ERH155	AZ47431	Water	RM	11/18/2016	Level C				X					
81760	ERH134	AZ47493	Water	TB	12/12/2016	Level C	X	X				X		X	X
81760	ERH136	AZ47495	Water		12/12/2016	Level C	X		X	X	X	X	X		X
81760	ERH139	AZ47494	Water		12/12/2016	Level C	X		X	X	X	X	X		X
81760	ERH143	AZ47496	Water		12/13/2016	Level C	X		X	X	X	X	X		X
81760	ERH145	AZ47497	Water		12/13/2016	Level C	X		X	X	X	X	X		X
81760	ERH146	AZ47498	Water		12/12/2016	Level C	X	X	X	X	X	X	X	X	X
81776	ERH138	AZ47663	Water		12/13/2016	Level C	X		X	X	X	X	X		X
81776	ERH147	AZ47658	Water	FD2	12/14/2016	Level C	X		X	X	X	X	X		X
81776	ERH140	AZ47665	Water		12/13/2016	Level C	X		X	X	X	X	X		X
81776	ERH148	AZ47659	Water	FD2	12/14/2016	Level C	X		X	X	X	X	X		
81776	ERH142	AZ47657	Water	TB	12/13/2016	Level C	X	X				X		X	X
81776	ERH144	AZ47664	Water		12/13/2016	Level C	X		X	X	X	X	X		X
81776	ERH149	AZ47661	Water	EB	12/14/2016	Level C	X		X	X	X	X	X		
81776	ERH150	AZ47662	Water	FB	12/14/2016	Level C	X		X	X	X	X	X		
81776	ERH151	AZ47656	Water	TB	12/14/2016	Level C	X					X			X
81776	ERH152	AZ47660	Water		12/14/2016	Level C	X		X	X	X	X	X		X
81842	ERH156	AZ48082	Water	TB	12/21/2016	Level C	X	X				X		X	X
81842	ERH157	AZ48083	Water	FD3	12/21/2016	Level C	X	X	X	X	X	X	X	X	X
81842	ERH158	AZ48084	Water	FD3	12/21/2016	Level C	X	X	X	X	X	X	X	X	

Table I. Validation Sample Table

SDG	Client Sample ID	Lab Sample ID	Matrix	QC Type	Sample Date	Validation Level	Alkalinity (2320B)	Anions (300.0)	Fe II (3500 FeB)	NO ₃ /NO ₂ -N (353.2)
81734	ERH135	AZ47345	Water	FD1	12/12/2016	Level D	X	X	X	X
81734	ERH137	AZ47343	Water	FD1	12/12/2016	Level C	X	X	X	
81734	ERH141	AZ47344	Water		12/12/2016	Level D				X
81734	ERH155	AZ47431	Water	RM	11/18/2016	Level C				
81760	ERH134	AZ47493	Water	TB	12/12/2016	Level C				
81760	ERH136	AZ47495	Water		12/12/2016	Level C	X	X	X	
81760	ERH139	AZ47494	Water		12/12/2016	Level C	X	X	X	
81760	ERH143	AZ47496	Water		12/13/2016	Level C	X	X	X	
81760	ERH145	AZ47497	Water		12/13/2016	Level C	X	X	X	
81760	ERH146	AZ47498	Water		12/12/2016	Level C	X	X	X	
81776	ERH138	AZ47663	Water		12/13/2016	Level C	X	X	X	
81776	ERH147	AZ47658	Water	FD2	12/14/2016	Level C	X	X	X	
81776	ERH140	AZ47665	Water		12/13/2016	Level C	X	X	X	
81776	ERH148	AZ47659	Water	FD2	12/14/2016	Level C				
81776	ERH142	AZ47657	Water	TB	12/13/2016	Level C				
81776	ERH144	AZ47664	Water		12/13/2016	Level C	X	X	X	
81776	ERH149	AZ47661	Water	EB	12/14/2016	Level C				
81776	ERH150	AZ47662	Water	FB	12/14/2016	Level C				
81776	ERH151	AZ47656	Water	TB	12/14/2016	Level C				
81776	ERH152	AZ47660	Water		12/14/2016	Level C	X	X	X	
81842	ERH156	AZ48082	Water	TB	12/21/2016	Level C				
81842	ERH157	AZ48083	Water	FD3	12/21/2016	Level C	X	X	X	
81842	ERH158	AZ48084	Water	FD3	12/21/2016	Level C				



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 Thach

February 10, 2017

SUBJECT: Red Hill Bulk Storage Facility, CTO 0053, Data Validation

Dear Ms. Thach,

Enclosed is the final validation report for the fractions listed below. This SDG was received on January 27, 2017. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #37996:

<u>SDG #</u>	<u>Fraction</u>
81965	Volatiles, Phenol, Polynuclear Aromatic Hydrocarbons, 2-(2-Methoxyethoxy)-ethanol, Wet Chemistry, TPH as Gasoline, TPH 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:

- Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i, August 2016
- Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i, Revision 01, November 2016
- Project Procedures Manual Naval Facilities Engineering Command, Environmental Restoration Program, NAVFAC Pacific, DON 2015
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

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

Sincerely,

Stella Cuenco
Operations Manager/Senior Chemist

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 7, 2017

Parameters: Volatiles

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH162	AZ48867	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH163	AZ48869	Water	01/10/17
ERH167	AZ48870	Water	01/09/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH177	AZ48874	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH175	AZ48876	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH197	AZ48879	Water	01/09/17
ERH186	AZ48880	Water	01/10/17
ERH187	AZ48881	Water	01/10/17
ERH194	AZ48882	Water	01/10/17
ERH173	AZ48884	Water	01/10/17
ERH198	AZ48885	Water	01/10/17
ERH196	AZ48886	Water	01/09/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17
ERH169MS	AZ48872MS	Water	01/11/17
ERH169MSD	AZ48872MSD	Water	01/11/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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. 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 ERH163, ERH167, ERH177, ERH175, ERH194, ERH173, and ERH196 were identified as trip blanks. No contaminants were found.

Samples ERH197 and ERH198 were identified as ambient blanks. No contaminants were found.

Sample ERH187 was identified as an equipment blank. No contaminants were found.

Sample ERH186 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH161** and ERH162 and samples ERH169** and ERH170 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Laboratory Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Field Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A1
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 2/6/17
 Page: 1 of 2
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

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

+ 1, 2 - Dichloroethane

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	1/2 PSD = 15 ICV = 20
IV.	Continuing calibration / closing CV	Δ	CV = 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 4, 5, 9, 11, 17, 18, 20 AB = 14, 19
VII.	Surrogate spikes	Δ	PB = 15 EB = 16
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	Δ	LCS
X.	Field duplicates	ND	D = 1, 2 7, 8
XI.	Internal standards	Δ	
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	Δ	

Note: A = Acceptable
 N = Not provided/applicable
 SW = See worksheet

ND = No compounds detected
 R = Rinsate
 FB = Field blank

AB = Ambient Blank
 D = Duplicate SB = Source blank
 TB = Trip blank OTHER:
 EB = Equipment blank

** Indicates sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1 3	ERH161** D	AZ48866**	Water	01/09/17
2 3	ERH162 D	AZ48867	Water	01/09/17
3 3	ERH164	AZ48868	Water	01/10/17
4 3	ERH163 TB	AZ48869	Water	01/10/17
5 3	ERH167 TB	AZ48870	Water	01/09/17
6 3	ERH168	AZ48871	Water	01/09/17
7 1	ERH169** P + 1, 2 - DEA	AZ48872**	Water	01/11/17
8 2	ERH170 P + 1, 2 - DEA	AZ48873	Water	01/11/17
9 2	ERH177 TB + 1, 2 - DEA	AZ48874	Water	01/11/17
10 4	ERH174	AZ48875	Water	01/10/17
11 4	ERH175 TB	AZ48876	Water	01/10/17
12 4	ERH176	AZ48877	Water	01/10/17
13 4	ERH179	AZ48878	Water	01/10/17

LDC #: 37996A1
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/6/17
 Page: 2 of 2
 Reviewer: F7
 2nd Reviewer: [Signature]

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

	Client ID	Lab ID	Matrix	Date
14	ERH197 AB	AZ48879	Water	01/09/17
15	ERH186 FB	AZ48880	Water	01/10/17
16	ERH187 EB	AZ48881	Water	01/10/17
17	ERH194 TB	AZ48882	Water	01/10/17
18	ERH173 TB	AZ48884	Water	01/10/17
19	ERH198 AB	AZ48885	Water	01/10/17
20	ERH196 TB	AZ48886	Water	01/09/17
21	ERH161MS	AZ48866MS	Water	01/09/17
22	ERH161MSD	AZ48866MSD	Water	01/09/17
23	ERH169MS	AZ48872MS	Water	01/11/17
24	ERH169MSD	AZ48872MSD	Water	01/11/17
25				
26				
27				
28				
29				

Notes:

1	170113A L1				
2	170113B L				
3	170113A L				
4	170113B L1				

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	/			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of > 0.990?			/	
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) > 0.05?	/			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	/			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?	/			
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	/			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			/	

LDC #: 37996A 1

VALIDATION FINDINGS CHECKLIST

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

Validation Area	Yes	No	NA	Findings/Comments
VIII: Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
IX: Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X: Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI: Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII: Compound quantitation				
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?	/			
XIII: Target compound identification				
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?	/			
XIV: System performance				
System performance was found to be acceptable.	/			
XV: Overall assessment of data				
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	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 #: 37996A)

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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

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	0113205	1/13/17	V (IS1)	1.8910	1.887	1.887	0.19	0.19
			EE (IS2)	2.263	2.411	2.411	6.5	6.5
			(IS3)					
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					

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 #: 37996A)

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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: 7

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane	25.0	25.18	101	101	0
1,2-Dichloroethane-d4	↓	24.57	98.3	98.3	↓
Toluene-d8	↓	25.17	101	101	↓
Bromofluorobenzene	↓	24.29	97.1	97.1	↓

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 #: 07996A1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

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

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = $|MSC - MSC| * 2 / (MSC + MSC)$

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD sample: 21 + 22

Compound	Spike Added (ug/l)		Sample Concentration (ug/l)	Spiked Sample Concentration (ug/l)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalculated
1,1-Dichloroethene											
Trichloroethene											
Benzene	10.0	10.0	ND	10.1	9.75	101	101	97.5	97.5	3.5	3.5
Toluene	10.0	↓	↓	10.8	10.3	108	108	103	103	4.7	4.7
Chlorobenzene											

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

LDC #: 37996A

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

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

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: 170113A L1 - LCS

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	NA	9.98	NA	99.8	99.8				
Toluene	10.0	↓	10.3	↓	103	103	NA			
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 0053

LDC Report Date: February 7, 2017

Parameters: Phenol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH162	AZ48867	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH186	AZ48880	Water	01/10/17
ERH187	AZ48881	Water	01/10/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% 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 ERH187 was identified as an equipment blank. No contaminants were found.

Sample ERH186 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH161** and ERH162 and samples ERH169** and ERH170 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Laboratory Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Field Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A2a
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/7/16
 Page: 1 of 2
 Reviewer: F7
 2nd Reviewer: KR

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	Δ / Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ / Δ	% RSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration / closing cv	Δ	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	FB = 10 EB = 11
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	Δ	100
X.	Field duplicates	ND	D = 1, 2 #5, 6
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH161 ** Δ	AZ48866 **	Water	01/09/17
2	ERH162 Δ	AZ48867	Water	01/09/17
3	ERH164	AZ48868	Water	01/10/17
4	ERH168 Δ	AZ48871	Water	01/09/17
5	ERH169** Δ	AZ48872**	Water	01/11/17
6	ERH170	AZ48873	Water	01/11/17
7	ERH174	AZ48875	Water	01/10/17
8	ERH176	AZ48877	Water	01/10/17
9	ERH179	AZ48878	Water	01/10/17
10	ERH186 FB	AZ48880	Water	01/10/17
11	ERH187 EB	AZ48881	Water	01/10/17
12	ERH161MS	AZ48866MS	Water	01/09/17
13	ERH161MSD	AZ48866MSD	Water	01/09/17

LDC #: 37996A2a

VALIDATION COMPLETENESS WORKSHEET

Date: 2/7/16

SDG #: 81965

Level C/D

Page: 2 of 2

Laboratory: APPL, Inc.

Reviewer: PJ

2nd Reviewer: PL

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

	Client ID	Lab ID	Matrix	Date
14				
15				
16				
17				
18				

Notes:

	170116A				

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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) 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?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) < 20% ?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed 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 completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?	/			
Were target compounds detected in the field blanks?		/		
VII. Surrogate spikes				
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 ?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/		not PT	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37996A2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

METHOD: GCMS 8270^D~~0~~

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

$$\text{RRF} = \frac{A_x(C_{is})}{(A_{is})(C_x)}$$

average RRF = sum of the RRFs/number of standards

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

Where:

A_x = Area of compound

C_x = Concentration of compound

S = Standard deviation of the RRFs

X = Mean of the RRFs

A_{is} = Area of associated internal standard

C_{is} = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 40 std)	Recalculated (RRF40 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	12/7/2016	A	2.002	2.002	1.974	1.974	2.00	2.00
	Yoda								

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:

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

$$\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$$

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 (Internal Standard)	Average RRF (Initial)	Reported	Recalculated	Reported	Recalculated
					RRF (CC)	RRF (CC)	%D	%D
1	12071322	1/18/17	A (1st IS)	1.974	2.000	2.000	1.3	1.3
			(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: 5

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	93.450	55.08931	58.9	58.9	0
2-Fluorobiphenyl	↓	50.29535	53.8	53.8	↓
Terphenyl-d14	↓	50.16496	53.7	53.7	
Phenol-d5	106.916	28.70808	15.4	15.4	
2-Fluorophenol	↓	49.65106	26.6	26.6	
2,4,6-Tribromophenol	↓	96.0005	51.4	51.4	↓
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					

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = $100 * (MSC - MSD) / (MSC + MSD)$

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: 12 + 13

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol	47.6	47.6	ND	11.7	12.3	24.6	24.6	25.8	25.8	5.0	5.0
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene											
Pentachlorophenol											
Pyrene											

Comments: Refer to Matrix Spike/Matrix Spike 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

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 170116A - LCS

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	50.0	NA	13.8	NA	27.6	27.6	NA			
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 0053

LDC Report Date: February 8, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH162	AZ48867	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH186	AZ48880	Water	01/10/17
ERH187	AZ48881	Water	01/10/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

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

Sample ERH187 was identified as an equipment blank. No contaminants were found.

Sample ERH186 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH161** and ERH162 and ERH169** and ERH170 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification
Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -
SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A2b
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 2/7/16
 Page: 1 of 2
 Reviewer: F7
 2nd Reviewer: K4

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	Δ, Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ, Δ	% PSD ≤ 15, r ² CV ≤ 20
IV.	Continuing calibration/dosing CV	Δ	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	FB = 10 EB = 11
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	Δ	LCs
X.	Field duplicates	ND	D = 1, 2 5, 6
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH161 ** D	AZ48866 **	Water	01/09/17
2	ERH162 D	AZ48867	Water	01/09/17
3	ERH164	AZ48868	Water	01/10/17
4	ERH168	AZ48871	Water	01/09/17
5	ERH169** D	AZ48872**	Water	01/11/17
6	ERH170 D	AZ48873	Water	01/11/17
7	ERH174	AZ48875	Water	01/10/17
8	ERH176	AZ48877	Water	01/10/17
9	ERH179	AZ48878	Water	01/10/17
10	ERH186 FB	AZ48880	Water	01/10/17
11	ERH187 EB	AZ48881	Water	01/10/17
12	ERH161MS	AZ48866MS	Water	01/09/17
13	ERH161MSD	AZ48866MSD	Water	01/09/17

W, TTT, S only

LDC #: 37996A2b

VALIDATION COMPLETENESS WORKSHEET

Date: 2/7/16

SDG #: 81965

Level C/D

Page: 2 of 2

Laboratory: APPL, Inc.

Reviewer: [Signature]

2nd Reviewer: [Signature]

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

	Client ID	Lab ID	Matrix	Date
14				
15				
16				
17				
18				

Notes:

	170116A				

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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) 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?	/			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) < 20% ?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed 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 completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?	/			
Were target compounds detected in the field blanks?		/		
VII. Surrogate spikes				
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 ?			/	

LDC #: 37996A02b

VALIDATION FINDINGS CHECKLIST

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

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37996A26

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

METHOD: GCMS 8270C ^D

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 (RRF5 std)	Recalculated (RRF5std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	1/16/2017	S	1.158	1.158	1.022	1.022	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	CW	1/18/17	S	1.022	1.185	1.185	16	16
			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
2	CW	1/19/17	S	1.022	1.065	1.065	4.2	4.2
			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th 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 #: 57996A26

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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: #5

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	4.673	3.28605	70.3	70.3	0
2-Fluorobiphenyl	↓	2.68116	57.5	57.5	↓
Terphenyl-d14	↓	4.31366	92.3	92.3	↓
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 #: 37996A06

VALIDATION FINDINGS WORKSHEET

Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

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

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = $|MSC - MSC1| * 2 / (MSC + MSC1)$

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: 12 + 13

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol											
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene											
Pentachlorophenol											
Pyrene							F7				
S	5.0	5.0	ND	2.70	2.79	54.0	55.8 54.0	55.0	55.8	3.3	3.3

Comments: Refer to Matrix Spike/Matrix Spike 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
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 170116A - LCS

Compound	Spike Added (ug/l)		Spike Concentration ()		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>S</u>	<u>5.0</u>	<u>NA</u>	<u>2.86</u>	<u>NA</u>	<u>57.2</u>	<u>57.2</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</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.

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 7, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH162	AZ48867	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH186	AZ48880	Water	01/10/17
ERH187	AZ48881	Water	01/10/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

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

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%.

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 ERH187 was identified as an equipment blank. No contaminants were found.

Sample ERH186 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 and MS/MSD percent recoveries were within QC limits. Additionally, all 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH161** and ERH162 and samples ERH169** and ERH170 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81965**

No Sample Data Qualified in this SDG

LDC #: 37996A2c
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 2/7/16

Page: 1 of 2

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D) ^{modified} (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 / closing	A	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	NP	FB = 10 FB = 11
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	ND	D = 1, 2 5, 6
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	△	Not reviewed for Level C validation.
XIII.	Target compound identification	△	Not reviewed for Level C validation.
XIV.	System performance	△	Not reviewed for Level C validation.
XV.	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

** Indicates sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH161 ** D	AZ48866 **	Water	01/09/17
2	ERH162 D	AZ48867	Water	01/09/17
3	ERH164	AZ48868	Water	01/10/17
4	ERH168	AZ48871	Water	01/09/17
5	ERH169** D	AZ48872**	Water	01/11/17
6	ERH170 D	AZ48873	Water	01/11/17
7	ERH174	AZ48875	Water	01/10/17
8	ERH176	AZ48877	Water	01/10/17
9	ERH179	AZ48878	Water	01/10/17
10	ERH186 FB	AZ48880	Water	01/10/17
11	ERH187 EB	AZ48881	Water	01/10/17
12	ERH161MS	AZ48866MS	Water	01/09/17
13	ERH161MSD	AZ48866MSD	Water	01/09/17

LDC #: 37996A2c

VALIDATION COMPLETENESS WORKSHEET

Date: 2/7/16

SDG #: 81965

Level C/D

Page: 2 of 2

Laboratory: APPL, Inc.

Reviewer: *[Signature]*
2nd Reviewer: *[Signature]*

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

	Client ID	Lab ID	Matrix	Date
14				
15				
16				
17				
18				

Notes:

	17013A1				

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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 ?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) $< 20\%$?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) $\leq 20\%$ and relative response factors (RRF) within method criteria?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed 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 completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?	/			
Were target compounds detected in the field blanks?		/		
VII. Surrogate spikes				
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 ?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37996 A2C

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GCMS ^D 8270~~0~~

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 400 std)	Recalculated (RRF400 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	12/20/2016	2-(2-Methoxyethoxy) Ethanol	0.2253	0.2253	0.2144	0.2144	9.90	9.90
	Yoda								

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, A_{is} = Area of associated internal standard
 C_x = Concentration of compound, 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	12204052 ccv	1/16/17	2-(2-Methoxyethoxy) (1st IS)	0.2144	0.2184	0.2184	1.9	1.9
			ethano) (2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
2	12204074 ccv	1/19/17	↓ (1st IS)	↓	0.2423	0.2423	13	13
			(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
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = $100 * (MSC - MSC1) / (MSC + MSCD)$

MSC = Matrix spike concentration

MSCD = Matrix spike duplicate concentration

MS/MSD samples: 12 + 13

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalc
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>ND</u>	<u>92.6</u>	<u>86.4</u>	<u>116</u>	<u>116</u>	<u>108</u>	<u>108</u>	<u>6.9</u>	<u>6.9</u>

Comments: Refer to Matrix Spike/Matrix Spike 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
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 170113A1 - LCS

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>0.0</u>	<u>NA</u>	<u>79.7</u>	<u>NA</u>	<u>99.6</u>	<u>99.6</u>	<u>NA</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.

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 7, 2017

Parameters: Wet Chemistry

Validation Level: Level C & D

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161	AZ48866	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17
ERH169MS	AZ48872MS	Water	01/11/17
ERH169MSD	AZ48872MSD	Water	01/11/17

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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

All sample results were subjected to Level III 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 IV 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
ERH161	Nitrate	78.17 hours	48 hours	J (all detects)	P
ERH164	Nitrate	53.95 hours	48 hours	J (all detects)	P
ERH168	Nitrate	74.73 hours	48 hours	J (all detects)	P
ERH174	Nitrate	49.30 hours	48 hours	UJ (all non-detects)	P
ERH176	Nitrate	52.27 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	Associated Samples
PB (prep blank)	Alkalinity	1.6 mg/L	All samples in SDG 81965

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) were analyzed as required by the methods. Percent recoveries (%R) 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.

XI. Overall Assessment of Data

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

Due to technical holding time, data were qualified as estimated in five samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Data Qualification Summary - SDG 81965**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH161 ERH164 ERH168 ERH174 ERH176	Nitrate	J (all detects) UJ (all non-detects)	P	Technical holding times (H)

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Field Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A6
 SDG #: 81965
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 1/31/17
 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)

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	SW	1/9-11/17
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	SW	
V.	Field blanks	2	
VI.	Matrix Spike/Matrix Spike Duplicates	A	MSD = (8.9) (10.11)
VII.	Duplicate sample analysis	2	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	2	
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH161	AZ48866	Water	01/09/17
2	ERH164	AZ48868	Water	01/10/17
3	ERH168	AZ48871	Water	01/09/17
4	ERH169**	AZ48872**	Water	01/11/17
5	ERH174	AZ48875	Water	01/10/17
6	ERH176	AZ48877	Water	01/10/17
7	ERH179	AZ48878	Water	01/10/17
8	ERH161MS	AJK AZ48866MS	Water	01/09/17
9	ERH161MSD	AZ48866MSD	Water	01/09/17
10	ERH169MS	AZ48872MS	Water	01/11/17
11	ERH169MSD	AZ48872MSD	Water	01/11/17
12				
13				
14				
15				

Notes: _____

Method: Inorganics (EPA Method See Cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.		<input checked="" type="checkbox"/>		
II. Calibration				
Were all instruments calibrated daily, each set-up time?	<input checked="" type="checkbox"/>			
Were the proper number of standards used?	<input checked="" type="checkbox"/>			
Were all initial calibration correlation coefficients > 0.995?	<input checked="" type="checkbox"/>			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	<input checked="" type="checkbox"/>			
Were titrant checks performed as required? (Level IV only)	<input checked="" type="checkbox"/>			
Were balance checks performed as required? (Level IV only)			<input checked="" type="checkbox"/>	
III. Blanks				
Was a method blank associated with every sample in this SDG?	<input checked="" type="checkbox"/>			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	<input checked="" type="checkbox"/>			
IV. Matrix spike/Matrix spike duplicates and Duplicates				
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.	<input checked="" type="checkbox"/>			
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.	<input checked="" type="checkbox"/>			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL (≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were < 5X the CRDL.	<input checked="" type="checkbox"/>			
V. Laboratory control samples				
Was an LCS analyzed for this SDG?	<input checked="" type="checkbox"/>			
Was an LCS analyzed per extraction batch?	<input checked="" type="checkbox"/>			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	<input checked="" type="checkbox"/>			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?			<input checked="" type="checkbox"/>	
Were the performance evaluation (PE) samples within the acceptance limits?			<input checked="" type="checkbox"/>	

VALIDATION FINDINGS CHECKLIST

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
Were detection limits < RL?	/			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.		/		
Target analytes were detected in the field duplicates.			/	
X. Field blanks				
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
1-7	pH TDS (Cl) F (NO ₃) NO ₂ (SO ₄) O-PO ₄ (Alk) CN NH ₃ TKN TOC Cr6+ ClO ₄ Fe ⁺²
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
QC-8-11	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ (Alk) CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄
	pH TDS Cl F NO ₃ NO ₂ SO ₄ O-PO ₄ Alk CN NH ₃ TKN TOC Cr6+ ClO ₄

Comments: _____

VALIDATION FINDINGS WORKSHEET
Blanks

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)		No Qualifiers													
Alkalinity	1.6		8														

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

LDC #: 377624

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

Page: 1 of 1
 Reviewer: SD
 2nd Reviewer: KK

Method: Inorganics, Method See Cover

The correlation coefficient (r) for the calibration of Fe²⁺ was recalculated. Calibration date: 5/20/16

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 ²	r or r ²	
Initial calibration	Fe ²⁺	s1	0.0	0	0.9998278	0.9998278	Y
		s2	1	0.101			
		s3	2	0.201			
		s4	4	0.403			
		s5	5	0.512			
		s6	10	0.999			
ICV 12:41 Calibration verification	Fe ²⁺	<u>Found</u> 3.0 mg/L	<u>True</u> 3 mg/L		100%R	100%R	Y
ICV 12:37 Calibration verification	Cl	18.18 mg/L	20 mg/L		90.9%R	91.1%R	Y*
ICV 12:37 Calibration verification	SO ₄	18.42 mg/L	20 mg/L		92.1%R	92.0%R	Y*

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

*Rounding

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

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	
LCS 16:19	Laboratory control sample	Fe ⁺²	3.91 mg/L	4 mg/L	97.8%R	97.8%R	Y
MS 13:13	Matrix spike sample	Alkalinity	(SSR-SR) 242.3 mg/L	250 mg/L	96.9%R	97.0%R	Y*
MSD 13:28	Duplicate sample	Alkalinity	315 mg/L	317 mg/L	0.63%RPD	0.63%RPD	Y

Comments: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 7, 2017

Parameters: Total Petroleum Hydrocarbons as Gasoline

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH162	AZ48867	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH163	AZ48869	Water	01/10/17
ERH167	AZ48870	Water	01/09/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH177	AZ48874	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH175	AZ48876	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH197	AZ48879	Water	01/09/17
ERH186	AZ48880	Water	01/10/17
ERH187	AZ48881	Water	01/10/17
ERH194	AZ48882	Water	01/10/17
ERH173	AZ48884	Water	01/10/17
ERH198	AZ48885	Water	01/10/17
ERH196	AZ48886	Water	01/09/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17
ERH169MS	AZ48872MS	Water	01/11/17
ERH169MSD	AZ48872MSD	Water	01/11/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 Gasoline 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 ERH163, ERH167, ERH177, ERH175, ERH194, ERH173, and ERH196 were identified as trip blanks. No contaminants were found.

Samples ERH197 and ERH198 were identified as ambient blanks. No contaminants were found.

Sample ERH187 was identified as an equipment blank. No contaminants were found.

Sample ERH186 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH161** and ERH162 and samples ERH169** and ERH170 were identified as field duplicates. No results were detected in any of the samples.

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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG
81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification
Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification
Summary - SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A7
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/6/17
 Page: 1 of 2
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC/MS TPH as Gasoline (EPA SW 846 Method 8260B)

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

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	△	
III.	Initial calibration/ICV	A / A	ICV ≤ 20
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	A	TB = 4, 5, 9, 11, 17, 18, 20 AB = 14, 19
VI.	Field blanks	ND	FB = 15 EB = 16
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCs
X.	Field duplicates	ND	D = 1, 2 7, B - 17, 18
XI.	Internal standards	△	
XII.	Compound quantitation RL/LOQ/LODs	△	Not reviewed for Level C validation.
XIII.	Target compound identification	△	Not reviewed for Level C validation.
XIV.	System performance	△	Not reviewed for Level C validation.
XV.	Overall assessment of data	A	

Note: A = Acceptable
 N = Not provided/applicable
 SW = See worksheet

ND = No compounds detected
 R = Rinsate
 FB = Field blank

D = Duplicate
 TB = Trip blank
 EB = Equipment blank

AB = Ambient Blank
 SB = Source blank
 OTHER:

** Indicates sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH161** D	AZ48866**	Water	01/09/17
2	ERH162 D	AZ48867	Water	01/09/17
3	ERH164	AZ48868	Water	01/10/17
4	ERH163 TB	AZ48869	Water	01/10/17
5	ERH167 TB	AZ48870	Water	01/09/17
6	ERH168	AZ48871	Water	01/09/17
7	ERH169** P	AZ48872**	Water	01/11/17
8	ERH170 P	AZ48873	Water	01/11/17
9	ERH177 TB	AZ48874	Water	01/11/17
10	ERH174	AZ48875	Water	01/10/17
11	ERH175 TB	AZ48876	Water	01/10/17
12	ERH176	AZ48877	Water	01/10/17
13	ERH179	AZ48878	Water	01/10/17

LDC #: 37996A7
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/6/17
 Page: 2 of 2
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC/MS TPH as Gasoline (EPA SW 846 Method 8260B)

	Client ID	Lab ID	Matrix	Date
14 ²	ERH197 Tunnel Ambient	AZ48879	Water	01/09/17
15 ²	ERH186 FB	AZ48880	Water	01/10/17
16 ²	ERH187 EB	AZ48881	Water	01/10/17
17 ²	ERH194 TB	AZ48882	Water	01/10/17
18 ²	ERH173 TB	AZ48884	Water	01/10/17
19 ²	ERH198 Ambient	AZ48885	Water	01/10/17
20 ²	ERH196 #1 Ambient TB	AZ48886	Water	01/09/17
21 ¹	ERH161MS	AZ48866MS	Water	01/09/17
22 ¹	ERH161MSD	AZ48866MSD	Water	01/09/17
23 ¹	ERH169MS	AZ48872MS	Water	01/11/17
24 ¹	ERH169MSD	AZ48872MSD	Water	01/11/17
25				
26				
27				
28				
29				

Notes:

1	170113AL				
2	170113BL				

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I: Technical: holding times				
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"/>	
II: GC/MS: Instrument performance check				
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"/>	
IIIa: Initial calibration				
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 ≥ 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) > 0.05 ?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
IIIb: Initial Calibration Verification				
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) $\leq 20\%$ or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV: Continuing calibration				
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) ≥ 0.05 ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
V: Laboratory Blanks				
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 completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VI: Field blanks				
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"/>	
VII: Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	

Validation Area	Yes	No	NA	Findings/Comments
VIII: Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/	/		
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
IX: Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X: Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI: Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII: Compound quantitation				
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?	/			
XIII: Target compound identification				
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?	/			
XIV: System performance				
System performance was found to be acceptable.	/			
XV: Overall assessment of data				
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#: 37996A7
 SDG#: See cover

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

Method: GRO (8260B)

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
1/12/2017	GCMS Loki	Gasoline Range Organics	1	10.22790007	0.8
			2	11.3350485	2
			3	13.2098067	4
			4	19.70700192	12
			5	29.05892957	24
			6	35.43328362	32
			7	42.58810881	40

Regression Output

Reported

Constant	9.740247	9.740000
Std Err of Y Est		
R Squared	0.999625	1.000000
Degrees of Freedom		
X Coefficient(s)	0.813400	0.813000
Std Err of Coef.		
Correlation Coefficient	0.999812	
Coefficient of Determination (r ²)	0.999625	1.000000

LDC #: 37996A7

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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

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	0113108 ccy	1/13/17	GRU (IS1)	300	300.52	300.52	0.17	0.17
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					

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 #: 3799697

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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: 7

	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>24.28</u>	<u>97.1</u>	<u>97.1</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 #: 3799647

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

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

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = $100 * (MSC - MSCD) / (MSC + MSCD)$

MSC = Matrix spike concentration

MSCD = Matrix spike duplicate concentration

MS/MSD sample: 21 & 22

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalculated
Gasoline Range											
1,1-Dichloroethene	300	300	ND	273	274	91.0	91.0	91.3	91.3	0.37	0.37
Trichloroethene											
Benzene											
Toluene											
Chlorobenzene											

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

LDC #: 37996A7

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

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

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: 170113AL - LCS

Compound	Spike Added (<u>ug/L</u>)		Spiked Sample Concentration (<u>ug/L</u>)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
gasoline range organics										
4,4-Dichloroethene	<u>300</u>	<u>NA</u>	<u>301</u>	<u>NA</u>	<u>100</u>	<u>100</u>	<u>NA</u>	<u>————</u>	<u>————</u>	
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 0053

LDC Report Date: February 10, 2017

Parameters: Total Petroleum Hydrocarbons as Extractables

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH162	AZ48867	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH186	AZ48880	Water	01/10/17
ERH187	AZ48881	Water	01/10/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds

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 ERH187 was identified as an equipment blank. No contaminants were found.

Sample ERH186 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH169** and ERH170 and samples ERH161** and ERH162 were identified as field duplicates. No results were detected in any of the samples.

Compound	Concentration (ug/L)		RPD
	ERH169**	ERH170	
Diesel (C10-C24)	28	23	20
Oil (C24-C40)	29	27	7

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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -
SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data
Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification
Summary - SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A8
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/6/17
 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 / CV ≤ 20
III.	Continuing calibration	Δ	CV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	FB = 10 FB = 11
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LOS
IX.	Field duplicates	SW	D = 5 + 6 * 1, 3
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH162	AZ48867	Water	01/09/17
2	ERH164	AZ48868	Water	01/10/17
3	ERH161 ** ERH183 F7	AZ48869 ⁶ **	Water	01/10/17 ⁹
4	ERH168	AZ48871	Water	01/09/17
5 ⁺	ERH169** D	AZ48872**	Water	01/11/17
6	ERH170 D	AZ48873	Water	01/11/17
7	ERH174	AZ48875	Water	01/10/17
8	ERH176	AZ48877	Water	01/10/17
9	ERH179	AZ48878	Water	01/10/17
10	ERH186 FB	AZ48880	Water	01/10/17
11	ERH187 FB	AZ48881	Water	01/10/17
12	ERH161MS	AZ48866MS	Water	01/09/17
13	ERH161MSD	AZ48866MSD	Water	01/09/17
14				
15	170116A			
16				
17				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. Initial calibration				
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"/>	
III. Initial calibration verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
III. Continuing calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
IV. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
V. Field Blanks				
Were field blanks 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"/>	
VI. Surrogate spikes				
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"/>	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

LDC #: 37996AD

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: FJ
 2nd Reviewer: YH

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
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 QC limits?	/			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?	/			
X. Compound Quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	/			
XII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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</u> / <u>l</u>)		%RPD Limit (≤ <u>50</u> %)	Qualification (Parent only)
	<u>5</u>	<u>6</u>		
Diesel (C ₁₀ -C ₂₄)	<u>28</u>	<u>23</u>	<u>20</u>	/
Oil (C ₂₄ -C ₄₀)	<u>29</u>	<u>27</u>	<u>7</u>	

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

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

LDC #: 37996A8

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

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=400)	Recalculated (CF4 std=400)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	11/3/2016	Diesel C10-C24)	1625582	Diesel C10-C24)	1727130	1727130	9.6	9.6
	Apollo								

LDC #: 3799648

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

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

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	ceV 118002	4/18/17	Diesel (C ₁₀ -C ₂₄)	172730	1690890	1690890	2.1	2.1
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 #: 37996A8

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1

Reviewer: FT

2nd reviewer: KR

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	
octacosane	/	40.0	41.438	104	104	0
o-Terphenyl		↓	32.863	82.2	82.2	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 #: 37996A8

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

METHOD: GC HPLC

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

$\%Recovery = 100 * (SSC - SC) / SA$

Where

SSC = Spiked sample concentration

MS = Matrix spike

SC = Sample concentration

MSD = Matrix spike duplicate

SA = Spike added

$RPD = ((SSCMS - SSCMSD) * 2) / (SSCMS + SSCMSD) * 100$

MS/MSD samples: 12 + 13

Compound	Spike Added (ug/L)		Sample Conc. (ug/L)	Spike Sample Concentration (ug/L)		Matrix spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)											
Diesel (610-024) (8015)	1330	1330	ND	1120	1120	84.0	84.0	84.0	84.0	0	0
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 Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 37996A8

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT
2nd Reviewer: ICK

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: 17D116A - LCS

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 (C _{10-C24}) (8015)	1330	NA	1080	NA	81.0	81.0	NA				
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.

LDC #: 3799648

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

Concentration= $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

Example:

Sample ID: #5 Compound Name Diesel c₁₀₋₂₄

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound
In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Concentration = $\frac{72547260 (2) (1000)}{1727130 (2) (1500)}$ =
28 ug/L

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 8, 2017

Parameters: Ethylene Dibromide

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH177	AZ48874	Water	01/11/17
ERH169MS	AZ48872MS	Water	01/11/17
ERH169MSD	AZ48872MSD	Water	01/11/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% for all compounds.

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% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

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

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

Sample ERH177 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH169** and ERH170 were identified as field duplicates. No results were detected in any of the samples.

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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Laboratory Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Field Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A10
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 2/6/17
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC Ethylene Dibromide (EPA SW 846 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	Δ Δ	
II.	Initial calibration/ICV	Δ Δ	% PSD / ICV ≤ 20
III.	Continuing calibration	Δ	CCV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 3
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	ND	D = 1, 2
X.	Compound quantitation RL/LOQ/LODs	Δ	Not reviewed for Level C validation.
XI.	Target compound identification	A	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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH169** D	AZ48872**	Water	01/11/17
2	ERH170 D	AZ48873	Water	01/11/17
3	ERH177 TB	AZ48874	Water	01/11/17
4	ERH169MS	AZ48872MS	Water	01/11/17
5	ERH169MSD	AZ48872MSD	Water	01/11/17
6				
7				
8				
9				
10				
11				
12				

Notes:

170118A				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. Initial calibration				
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"/>	
III. Initial calibration verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
III. Continuing calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
IV. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
V. Field Blanks				
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"/>	
VI. Surrogate spikes				
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"/>	
VII. Matrix spike/matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

LDC #: 37996A1U

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: F7
 2nd Reviewer: KK

Validation Area	Yes	No	NA	Findings/Comments
VI. Laboratory control samples				
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 QC limits?	/			
VII. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
VIII. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
IX. Target compound identification				
Were the retention times of reported detects within the RT windows?	/			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

LDC #: 37996A10

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

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	1/18/2017	EDB (DB-35MS)	626511	626511	669822	669822	13.0	13.0
	Herbie		EDB (DB-XLB)	1481528	1481528	1529800	1529800	7.2	7.2

LDC #: 37996A10

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1

Reviewer: FT
 2nd reviewer: KK

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	
<i>1,3-Dibromopropane</i>	<i>/</i>	<i>0.353</i>	<i>0.381</i>	<i>108</i>	<i>108</i>	<i>0</i>

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 #: 37996A1D

VALIDATION FINDINGS WORKSHEET

Matrix Spike/Matrix Spike Duplicates Results Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

METHOD: GC HPLC

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

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

Where

SSC = Spiked sample concentration

MS = Matrix spike

SC = Sample concentration

MSD = Matrix spike duplicate

SA = Spike added

$$\text{RPD} = ((\text{SSCMS} - \text{SSCMSD}) * 2) / (\text{SSCMS} + \text{SSCMSD}) * 100$$

MS/MSD samples: 4 & 5

Compound	Spike Added		Sample Conc.	Spike Sample Concentration		Matrix spike		Matrix Spike Duplicate		MS/MSD	
	()			()		Percent Recovery		Percent Recovery		RPD	
	MS	MSD		MS	MSD	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)											
EDB	0.250	0.250	ND	0.267	0.251	107	107	100	100	6.2	6.2

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

LDC #: 37996A10

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT
2nd Reviewer: KL

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: 170118A - LCS

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)										
EDB	0.250	NA	0.247	NA	98.8	98.8	NA			

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.

LDC #: 37996 A 10

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

Concentration = $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

Example:

Sample ID: 170118A-LCS Compound Name EDB

- A= Area or height of the compound to be measured
- Fv= Final Volume of extract
- Df= Dilution Factor
- RF= Average response factor of the compound
In the initial calibration
- Vs= Initial volume of the sample
- Ws= Initial weight of the sample
- %S= Percent Solid

Concentration = $\frac{334009 (0.99)}{669822 (2)}$ = 0.247 ug/l

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 7, 2017

Parameters: Methane

Validation Level: Level C & D

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH163	AZ48869	Water	01/10/17
ERH167	AZ48870	Water	01/09/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH177	AZ48874	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH175	AZ48876	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH194	AZ48882	Water	01/10/17
ERH173	AZ48884	Water	01/10/17
ERH196	AZ48886	Water	01/09/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17
ERH169MS	AZ48872MS	Water	01/11/17
ERH169MSD	AZ48872MSD	Water	01/11/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% with the following exceptions:

Date	Standard	Compound	%D	Associated Samples	Flag	A or P
01/16/17	17011603-CCV	Methane	25	All samples in SDG 81965	J (all detects) UJ (all non-detects)	A

Retention times of all compounds in the calibration standards were within the established retention time windows. 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 ERH177, ERH175, and ERH196 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. Relative percent differences (RPD) were within QC limits.

VII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

VIII. Field Duplicates

Samples ERH169** and ERH170 were identified as field duplicates. No results were detected in any of the samples.

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.

Due to continuing calibration %D, data were qualified as estimated in fifteen samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Data Qualification Summary - SDG 81965**

Sample	Compound	Flag	A or P	Reason (Code)
ERH161** ERH164 ERH163 ERH167 ERH168 ERH169** ERH170 ERH177 ERH174 ERH175 ERH176 ERH179 ERH194 ERH173 ERH196	Methane	J (all detects) UJ (all non-detects)	A	Continuing calibration (%D) (C)

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Laboratory Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Field Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A51

VALIDATION COMPLETENESS WORKSHEET

SDG #: 81965

Level C/D

Laboratory: APPL Labs

Date: 2/6/17

Page: 1 of 2

Reviewer: FJ

2nd Reviewer: KR

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	12 CW ≤ 20
III.	Continuing calibration	SW	CW ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	TB = 8, 10, 15
VI.	Matrix spike/Matrix spike duplicates	A	
VII.	Laboratory control samples	A	LCs
VIII.	Field duplicates	ND	D = 6, 7
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
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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH161**	AZ48866**	Water	01/09/17
2	ERH164	AZ48868	Water	01/10/17
3	ERH163	AZ48869	Water	01/10/17
4	ERH167	AZ48870	Water	01/09/17
5	ERH168	AZ48871	Water	01/09/17
6	ERH169** D	AZ48872**	Water	01/11/17
7	ERH170 D	AZ48873	Water	01/11/17
8	ERH177 TB	AZ48874	Water	01/11/17
9	ERH174	AZ48875	Water	01/10/17
10	ERH175 TB	AZ48876	Water	01/10/17
11	ERH176	AZ48877	Water	01/10/17
12	ERH179	AZ48878	Water	01/10/17
13	ERH194	AZ48882	Water	01/10/17
14	ERH173	AZ48884	Water	01/10/17
15	ERH196 TB	AZ48886	Water	01/09/17
16	ERH161MS	AZ48866MS	Water	01/09/17
17	ERH161MSD	AZ48866MSD	Water	01/09/17
18	ERH169MS	AZ48872MS	Water	01/11/17

LDC #: 37996A51

VALIDATION COMPLETENESS WORKSHEET

SDG #: 81965

Level C/D

Laboratory: APPL Labs

Date: 2/16/17

Page: 2 of 2

Reviewer: F7

2nd Reviewer: PL

METHOD: GC Methane (Method RSK-175)

	Client ID	Lab ID	Matrix	Date
19	ERH169MSD	AZ48872MSD	Water	01/11/17
20				
21				
22				
23				
24				

Notes:

	170116A				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. Initial calibration				
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"/>	
III. Initial calibration verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Were all the retention times within the acceptance windows?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
V. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VI. Field Blanks				
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"/>	
VII. Surrogate spikes				
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"/>	
VIII. Matrix spike/matrix spike duplicate				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

LDC #: 37996 A5 1

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: FJ
 2nd Reviewer: KE

Validation Area	Yes	No	NA	Findings/Comments
VII. Laboratory control samples				
Was an LCS analyzed for this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was an LCS analyzed per 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"/>	
VIII. Field duplicates				
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 type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
X. Compound quantitation				
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"/>	
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

LDC #: 37996451

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

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

METHOD: GC HPLC

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

- What type of continuing calibration calculation was performed? %D or %R
 Y N N/A Were continuing calibration standards analyzed at the required frequencies?
 Y N N/A Did the continuing calibration standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?
Level IV Only
 Y N N/A Were the retention times for all calibrated compounds within their respective acceptance windows?

code = C

#	Date	Standard ID	Detector/Column	Compound	%D (Limit ≤ 20.0)	RT (limit)	Associated Samples	Qualifications
	1/16/17	17011603-ccv		methane	25		All	J/45/A ND+Det

LDC#: 37996A51
 SDG#: fu lower

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
 Reviewer: FS
 2nd Reviewer: KK

Method: RSK 175

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
9/1/2016	Ints 7890	Methane	1	6703	0.9
			2	10209	1.8
			3	15515	5.1
			4	45792	13.33
			5	28664	26.7
			6	67137	66.75
			7	126422	106.8
			8	421052	320.4
			9	723824	667.5
			10	1454283	1335

Regression Output

Reported

Constant	14373.549641	14400.00
Std Err of Y Est		
R Squared	0.997596	0.998000
Degrees of Freedom		
X Coefficient(s)	1083.161249	1083.00
Std Err of Coef.		
Correlation Coefficient	0.998797	
Coefficient of Determination (r ²)	0.997596	0.998000

LDC #: 37996A5/

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

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

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	17011603 CCV	1/16/17	methane	1335	1001	1001	25	25
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 #: 37996AS1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

METHOD: GC HPLC

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

%Recovery = 100 * (SSC - SC)/SA

Where

SSC = Spiked sample concentration

MS = Matrix spike

SC = Sample concentration

MSD = Matrix spike duplicate

SA = Spike added

RPD = (((SSCMS - SSCMSD) * 2) / (SSCMS + SSCMSD)) * 100

MS/MSD samples: 16 + 17

Compound	Spike Added (ug/l)		Sample Conc. (ug/l)	Spike Sample Concentration (ug/l)		Matrix spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)											
Diesel (8015)											
Benzene (8021B)											
Methane (RSK-175)	1340	1340	ND	1060	1050	79.4	79.4	78.7	78.7	0.95	0.95
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 Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 37996A51

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT

2nd Reviewer: KK

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: 170116A

Compound	Spike Added (<u>ug/L</u>)		Spike Sample Concentration (<u>ug/L</u>)		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)	<u>1340</u>	<u>NA</u>	<u>1000</u>	<u>NA</u>	<u>74.9</u>	<u>74.9</u>					
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.

LDC #: 37996A5/

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

Concentration = $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

Example:

Sample ID: 17D116A-LCS Compound Name Methane

Concentration = $\frac{(1098930 - 14400)}{1083.0}$ = 1000 ug/L

- A= Area or height of the compound to be measured
- Fv= Final Volume of extract
- Df= Dilution Factor
- RF= Average response factor of the compound
In the initial calibration
- Vs= Initial volume of the sample
- Ws= Initial weight of the sample
- %S= Percent Solid

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

**Red Hill Bulk Storage Facility, CTO 0053 - SDG 81965
LDC 37996**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD:													
C													
METHOD: 2320B													
ERH161	AZ48866	1	ALKALINITY, AS CaCO3	1/9/2017 10:30:00 AM	1/16/2017 12:21:00 PM	D	62.5	MG_L		2.0	1.70		
ERH161	AZ48866	1	ALKALINITY, BICARBONATE	1/9/2017 10:30:00 AM	1/16/2017 12:21:00 PM	D	62.5	MG_L		2.0	1.70		
ERH161	AZ48866	1	ALKALINITY, CARBONATE	1/9/2017 10:30:00 AM	1/16/2017 12:21:00 PM	D	1.70	MG_L	U	2.0	1.70		U
ERH164	AZ48868	1	ALKALINITY, AS CaCO3	1/10/2017 10:30:00 AM	1/16/2017 12:55:00 PM	C	105	MG_L		2.0	1.70		
ERH164	AZ48868	1	ALKALINITY, BICARBONATE	1/10/2017 10:30:00 AM	1/16/2017 12:55:00 PM	C	105	MG_L		2.0	1.70		
ERH164	AZ48868	1	ALKALINITY, CARBONATE	1/10/2017 10:30:00 AM	1/16/2017 12:55:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH168	AZ48871	1	ALKALINITY, AS CaCO3	1/9/2017 2:10:00 PM	1/16/2017 1:01:00 PM	C	114	MG_L		2.0	1.70		
ERH168	AZ48871	1	ALKALINITY, BICARBONATE	1/9/2017 2:10:00 PM	1/16/2017 1:01:00 PM	C	114	MG_L		2.0	1.70		
ERH168	AZ48871	1	ALKALINITY, CARBONATE	1/9/2017 2:10:00 PM	1/16/2017 1:01:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH169	AZ48872	1	ALKALINITY, AS CaCO3	1/11/2017 10:00:00 AM	1/16/2017 1:08:00 PM	D	72.4	MG_L		2.0	1.70		
ERH169	AZ48872	1	ALKALINITY, BICARBONATE	1/11/2017 10:00:00 AM	1/16/2017 1:08:00 PM	D	72.4	MG_L		2.0	1.70		
ERH169	AZ48872	1	ALKALINITY, CARBONATE	1/11/2017 10:00:00 AM	1/16/2017 1:08:00 PM	D	1.70	MG_L	U	2.0	1.70		U
ERH174	AZ48875	1	ALKALINITY, AS CaCO3	1/10/2017 2:15:00 PM	1/16/2017 1:43:00 PM	C	211	MG_L		2.0	1.70		
ERH174	AZ48875	1	ALKALINITY, BICARBONATE	1/10/2017 2:15:00 PM	1/16/2017 1:43:00 PM	C	211	MG_L		2.0	1.70		
ERH174	AZ48875	1	ALKALINITY, CARBONATE	1/10/2017 2:15:00 PM	1/16/2017 1:43:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH176	AZ48877	1	ALKALINITY, AS CaCO3	1/10/2017 11:30:00 AM	1/16/2017 1:55:00 PM	C	52.7	MG_L		2.0	1.70		
ERH176	AZ48877	1	ALKALINITY, BICARBONATE	1/10/2017 11:30:00 AM	1/16/2017 1:55:00 PM	C	52.7	MG_L		2.0	1.70		
ERH176	AZ48877	1	ALKALINITY, CARBONATE	1/10/2017 11:30:00 AM	1/16/2017 1:55:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH179	AZ48878	1	ALKALINITY, AS CaCO3	1/10/2017 5:35:00 PM	1/16/2017 2:00:00 PM	C	120	MG_L		2.0	1.70		
ERH179	AZ48878	1	ALKALINITY, BICARBONATE	1/10/2017 5:35:00 PM	1/16/2017 2:00:00 PM	C	120	MG_L		2.0	1.70		
ERH179	AZ48878	1	ALKALINITY, CARBONATE	1/10/2017 5:35:00 PM	1/16/2017 2:00:00 PM	C	1.70	MG_L	U	2.0	1.70		U
METHOD: 300.0													
ERH161	AZ48866	5	CHLORIDE	1/9/2017 10:30:00 AM	1/12/2017 6:42:00 PM	D	85.8	MG_L	D	5.0	1.00		
ERH161	AZ48866	1	NITRATE	1/9/2017 10:30:00 AM	1/12/2017 4:40:00 PM	D	2.5	MG_L		0.5	0.18	J	h

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 300.0													
ERH161	AZ48866	1	SULFATE	1/9/2017 10:30:00 AM	1/12/2017 4:40:00 PM	D	14.3	MG_L		1.0	0.20		
ERH164	AZ48868	5	CHLORIDE	1/10/2017 10:30:00 AM	1/12/2017 6:29:00 PM	C	154	MG_L	D	5.0	1.00		
ERH164	AZ48868	1	NITRATE	1/10/2017 10:30:00 AM	1/12/2017 4:27:00 PM	C	4.2	MG_L		0.5	0.18	J	h
ERH164	AZ48868	1	SULFATE	1/10/2017 10:30:00 AM	1/12/2017 4:27:00 PM	C	47.5	MG_L		1.0	0.20		
ERH168	AZ48871	20	CHLORIDE	1/9/2017 2:10:00 PM	1/12/2017 7:09:00 PM	C	368	MG_L	D	20.0	4.00		
ERH168	AZ48871	2	NITRATE	1/9/2017 2:10:00 PM	1/12/2017 4:54:00 PM	C	3.5	MG_L		1.0	0.36	J	h
ERH168	AZ48871	2	SULFATE	1/9/2017 2:10:00 PM	1/12/2017 4:54:00 PM	C	85.8	MG_L		2.0	0.40		
ERH169	AZ48872	5	CHLORIDE	1/11/2017 10:00:00 AM	1/12/2017 6:15:00 PM	D	169	MG_L	D	5.0	1.00		
ERH169	AZ48872	1	NITRATE	1/11/2017 10:00:00 AM	1/12/2017 4:13:00 PM	D	2.1	MG_L		0.5	0.18		
ERH169	AZ48872	5	SULFATE	1/11/2017 10:00:00 AM	1/12/2017 6:15:00 PM	D	76.0	MG_L	D	5.0	1.00		
ERH174	AZ48875	1	CHLORIDE	1/10/2017 2:15:00 PM	1/12/2017 3:33:00 PM	C	39.4	MG_L		1.0	0.20		
ERH174	AZ48875	1	NITRATE	1/10/2017 2:15:00 PM	1/12/2017 3:33:00 PM	C	0.18	MG_L	U	0.5	0.18	UJ	h
ERH174	AZ48875	1	SULFATE	1/10/2017 2:15:00 PM	1/12/2017 3:33:00 PM	C	0.79	MG_L	J	1.0	0.20	J	
ERH176	AZ48877	5	CHLORIDE	1/10/2017 11:30:00 AM	1/12/2017 6:02:00 PM	C	86.3	MG_L	D	5.0	1.00		
ERH176	AZ48877	1	NITRATE	1/10/2017 11:30:00 AM	1/12/2017 3:46:00 PM	C	1.1	MG_L		0.5	0.18	J	h
ERH176	AZ48877	1	SULFATE	1/10/2017 11:30:00 AM	1/12/2017 3:46:00 PM	C	26.6	MG_L		1.0	0.20		
ERH179	AZ48878	20	CHLORIDE	1/10/2017 5:35:00 PM	1/12/2017 6:56:00 PM	C	361	MG_L	D	20.0	4.00		
ERH179	AZ48878	2	NITRATE	1/10/2017 5:35:00 PM	1/12/2017 4:00:00 PM	C	4.0	MG_L		1.0	0.36		
ERH179	AZ48878	2	SULFATE	1/10/2017 5:35:00 PM	1/12/2017 4:00:00 PM	C	63.7	MG_L		2.0	0.40		
METHOD: 3500_FE_B													
ERH161	AZ48866	1	IRON, FERROUS	1/9/2017 10:30:00 AM	1/12/2017 4:21:00 PM	D	0.32	MG_L	U	1.0	0.32	U	
ERH164	AZ48868	1	IRON, FERROUS	1/10/2017 10:30:00 AM	1/12/2017 4:22:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
ERH168	AZ48871	1	IRON, FERROUS	1/9/2017 2:10:00 PM	1/12/2017 4:23:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
ERH169	AZ48872	1	IRON, FERROUS	1/11/2017 10:00:00 AM	1/12/2017 4:24:00 PM	D	0.32	MG_L	U	1.0	0.32	U	
ERH174	AZ48875	1	IRON, FERROUS	1/10/2017 2:15:00 PM	1/12/2017 4:25:00 PM	C	3.0	MG_L		1.0	0.32		
ERH176	AZ48877	1	IRON, FERROUS	1/10/2017 11:30:00 AM	1/12/2017 4:26:00 PM	C	3.5	MG_L		1.0	0.32		
ERH179	AZ48878	1	IRON, FERROUS	1/10/2017 5:35:00 PM	1/12/2017 4:27:00 PM	C	0.32	MG_L	U	1.0	0.32	U	

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8011													
ERH169	AZ48872	1	1,2-DIBROMOETHANE	1/11/2017 10:00:00 AM	1/18/2017 5:14:00 PM	D	0.020	UG_L	U	0.02	0.020	U	
ERH170	AZ48873	1	1,2-DIBROMOETHANE	1/11/2017 10:00:00 AM	1/18/2017 5:35:00 PM	C	0.020	UG_L	U	0.02	0.020	U	
ERH177	AZ48874	1	1,2-DIBROMOETHANE	1/11/2017 8:30:00 AM	1/18/2017 5:56:00 PM	C	0.020	UG_L	U	0.02	0.020	U	
METHOD: 8015B_E													
ERH161	AZ48866	1	TPH-DIESEL RANGE	1/9/2017 10:30:00 AM	1/18/2017 6:45:00 PM	D	25.00	UG_L	U	40.0	25.00	U	
ERH161	AZ48866	1	TPH-OIL RANGE	1/9/2017 10:30:00 AM	1/18/2017 6:45:00 PM	D	40.00	UG_L	U	40.0	40.00	U	
ERH162	AZ48867	1	TPH-DIESEL RANGE	1/9/2017 10:30:00 AM	1/18/2017 8:27:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH162	AZ48867	1	TPH-OIL RANGE	1/9/2017 10:30:00 AM	1/18/2017 8:27:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH164	AZ48868	1	TPH-DIESEL RANGE	1/10/2017 10:30:00 AM	1/18/2017 8:48:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH164	AZ48868	1	TPH-OIL RANGE	1/10/2017 10:30:00 AM	1/18/2017 8:48:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH168	AZ48871	1	TPH-DIESEL RANGE	1/9/2017 2:10:00 PM	1/18/2017 9:08:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH168	AZ48871	1	TPH-OIL RANGE	1/9/2017 2:10:00 PM	1/18/2017 9:08:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH169	AZ48872	1	TPH-DIESEL RANGE	1/11/2017 10:00:00 AM	1/18/2017 9:29:00 PM	D	28	UG_L	JT3I	40.0	25.00	J	
ERH169	AZ48872	1	TPH-OIL RANGE	1/11/2017 10:00:00 AM	1/18/2017 9:29:00 PM	D	29	UG_L	J	40.0	40.00	J	
ERH170	AZ48873	1	TPH-DIESEL RANGE	1/11/2017 10:00:00 AM	1/18/2017 9:49:00 PM	C	23	UG_L	JT3I	40.0	25.00	J	
ERH170	AZ48873	1	TPH-OIL RANGE	1/11/2017 10:00:00 AM	1/18/2017 9:49:00 PM	C	27	UG_L	J	40.0	40.00	J	
ERH174	AZ48875	1	TPH-DIESEL RANGE	1/10/2017 2:15:00 PM	1/18/2017 10:10:00 PM	C	1400	UG_L	T6	40.0	25.00		
ERH174	AZ48875	1	TPH-OIL RANGE	1/10/2017 2:15:00 PM	1/18/2017 10:10:00 PM	C	42	UG_L		40.0	40.00		
ERH176	AZ48877	1	TPH-DIESEL RANGE	1/10/2017 11:30:00 AM	1/18/2017 10:30:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH176	AZ48877	1	TPH-OIL RANGE	1/10/2017 11:30:00 AM	1/18/2017 10:30:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH179	AZ48878	1	TPH-DIESEL RANGE	1/10/2017 5:35:00 PM	1/18/2017 10:51:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH179	AZ48878	1	TPH-OIL RANGE	1/10/2017 5:35:00 PM	1/18/2017 10:51:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH186	AZ48880	1	TPH-DIESEL RANGE	1/10/2017 2:35:00 PM	1/18/2017 11:11:00 PM	C	25.00	UG_L	U	40.0	25.00	U	
ERH186	AZ48880	1	TPH-OIL RANGE	1/10/2017 2:35:00 PM	1/18/2017 11:11:00 PM	C	40.00	UG_L	U	40.0	40.00	U	
ERH187	AZ48881	1	TPH-DIESEL RANGE	1/10/2017 3:05:00 PM	1/19/2017 12:13:00 AM	C	25.00	UG_L	U	40.0	25.00	U	
ERH187	AZ48881	1	TPH-OIL RANGE	1/10/2017 3:05:00 PM	1/19/2017 12:13:00 AM	C	40.00	UG_L	U	40.0	40.00	U	

METHOD: 8260B

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8260B													
ERH161	AZ48866	1	BENZENE	1/9/2017 10:30:00 AM	1/13/2017 2:39:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH161	AZ48866	1	ETHYLBENZENE	1/9/2017 10:30:00 AM	1/13/2017 2:39:00 PM	D	0.50	UG_L	U	1.0	0.50	U	
ERH161	AZ48866	1	TOLUENE	1/9/2017 10:30:00 AM	1/13/2017 2:39:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH161	AZ48866	1	TPH-GASOLINE RANGE C6-C10	1/9/2017 10:30:00 AM	1/13/2017 2:38:00 PM	D	18.0	UG_L	U	20	18.0	U	
ERH161	AZ48866	1	XYLENES, TOTAL	1/9/2017 10:30:00 AM	1/13/2017 2:39:00 PM	D	0.30	UG_L	U	2.0	0.30	U	
ERH162	AZ48867	1	BENZENE	1/9/2017 10:30:00 AM	1/13/2017 3:06:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH162	AZ48867	1	ETHYLBENZENE	1/9/2017 10:30:00 AM	1/13/2017 3:06:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH162	AZ48867	1	TOLUENE	1/9/2017 10:30:00 AM	1/13/2017 3:06:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH162	AZ48867	1	TPH-GASOLINE RANGE C6-C10	1/9/2017 10:30:00 AM	1/13/2017 3:07:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH162	AZ48867	1	XYLENES, TOTAL	1/9/2017 10:30:00 AM	1/13/2017 3:06:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH164	AZ48868	1	BENZENE	1/10/2017 10:30:00 AM	1/13/2017 3:34:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH164	AZ48868	1	ETHYLBENZENE	1/10/2017 10:30:00 AM	1/13/2017 3:34:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH164	AZ48868	1	TOLUENE	1/10/2017 10:30:00 AM	1/13/2017 3:34:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH164	AZ48868	1	TPH-GASOLINE RANGE C6-C10	1/10/2017 10:30:00 AM	1/13/2017 3:35:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH164	AZ48868	1	XYLENES, TOTAL	1/10/2017 10:30:00 AM	1/13/2017 3:34:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH163	AZ48869	1	BENZENE	1/10/2017 10:00:00 AM	1/13/2017 4:02:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH163	AZ48869	1	ETHYLBENZENE	1/10/2017 10:00:00 AM	1/13/2017 4:02:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH163	AZ48869	1	TOLUENE	1/10/2017 10:00:00 AM	1/13/2017 4:02:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH163	AZ48869	1	TPH-GASOLINE RANGE C6-C10	1/10/2017 10:00:00 AM	1/13/2017 4:03:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH163	AZ48869	1	XYLENES, TOTAL	1/10/2017 10:00:00 AM	1/13/2017 4:02:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH167	AZ48870	1	BENZENE	1/9/2017 1:25:00 PM	1/13/2017 4:31:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH167	AZ48870	1	ETHYLBENZENE	1/9/2017 1:25:00 PM	1/13/2017 4:31:00 PM	C	0.50	UG_L	U	1.0	0.50	U	
ERH167	AZ48870	1	TOLUENE	1/9/2017 1:25:00 PM	1/13/2017 4:31:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH167	AZ48870	1	TPH-GASOLINE RANGE C6-C10	1/9/2017 1:25:00 PM	1/13/2017 4:30:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH167	AZ48870	1	XYLENES, TOTAL	1/9/2017 1:25:00 PM	1/13/2017 4:31:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH168	AZ48871	1	BENZENE	1/9/2017 2:10:00 PM	1/13/2017 4:58:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH168	AZ48871	1	ETHYLBENZENE	1/9/2017 2:10:00 PM	1/13/2017 4:58:00 PM	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
METHOD: 8260B													
ERH168	AZ48871	1	TOLUENE	1/9/2017 2:10:00 PM	1/13/2017 4:58:00 PM	C	0.30	UG_L	U	1.0	0.30	U	
ERH168	AZ48871	1	TPH-GASOLINE RANGE C6-C10	1/9/2017 2:10:00 PM	1/13/2017 4:59:00 PM	C	18.0	UG_L	U	20	18.0	U	
ERH168	AZ48871	1	XYLENES, TOTAL	1/9/2017 2:10:00 PM	1/13/2017 4:58:00 PM	C	0.30	UG_L	U	2.0	0.30	U	
ERH169	AZ48872	1	1,2-DICHLOROETHANE	1/11/2017 10:00:00 AM	1/13/2017 5:26:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH169	AZ48872	1	BENZENE	1/11/2017 10:00:00 AM	1/13/2017 5:26:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH169	AZ48872	1	ETHYLBENZENE	1/11/2017 10:00:00 AM	1/13/2017 5:26:00 PM	D	0.50	UG_L	U	1.0	0.50	U	
ERH169	AZ48872	1	TOLUENE	1/11/2017 10:00:00 AM	1/13/2017 5:26:00 PM	D	0.30	UG_L	U	1.0	0.30	U	
ERH169	AZ48872	1	TPH-GASOLINE RANGE C6-C10	1/11/2017 10:00:00 AM	1/13/2017 5:27:00 PM	D	18.0	UG_L	U	20	18.0	U	
ERH169	AZ48872	1	XYLENES, TOTAL	1/11/2017 10:00:00 AM	1/13/2017 5:26:00 PM	D	0.30	UG_L	U	2.0	0.30	U	
ERH170	AZ48873	1	1,2-DICHLOROETHANE	1/11/2017 10:00:00 AM	1/14/2017 3:42:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH170	AZ48873	1	BENZENE	1/11/2017 10:00:00 AM	1/14/2017 3:42:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH170	AZ48873	1	ETHYLBENZENE	1/11/2017 10:00:00 AM	1/14/2017 3:42:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH170	AZ48873	1	TOLUENE	1/11/2017 10:00:00 AM	1/14/2017 3:42:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH170	AZ48873	1	TPH-GASOLINE RANGE C6-C10	1/11/2017 10:00:00 AM	1/14/2017 3:43:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH170	AZ48873	1	XYLENES, TOTAL	1/11/2017 10:00:00 AM	1/14/2017 3:42:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH177	AZ48874	1	1,2-DICHLOROETHANE	1/11/2017 8:30:00 AM	1/14/2017 4:10:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH177	AZ48874	1	BENZENE	1/11/2017 8:30:00 AM	1/14/2017 4:10:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH177	AZ48874	1	ETHYLBENZENE	1/11/2017 8:30:00 AM	1/14/2017 4:10:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH177	AZ48874	1	TOLUENE	1/11/2017 8:30:00 AM	1/14/2017 4:10:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH177	AZ48874	1	TPH-GASOLINE RANGE C6-C10	1/11/2017 8:30:00 AM	1/14/2017 4:11:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH177	AZ48874	1	XYLENES, TOTAL	1/11/2017 8:30:00 AM	1/14/2017 4:10:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH174	AZ48875	1	BENZENE	1/10/2017 2:15:00 PM	1/14/2017 4:38:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH174	AZ48875	1	ETHYLBENZENE	1/10/2017 2:15:00 PM	1/14/2017 4:38:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH174	AZ48875	1	TOLUENE	1/10/2017 2:15:00 PM	1/14/2017 4:38:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH174	AZ48875	1	TPH-GASOLINE RANGE C6-C10	1/10/2017 2:15:00 PM	1/14/2017 4:39:00 AM	C	63	UG_L	G3D	20	18.0		
ERH174	AZ48875	1	XYLENES, TOTAL	1/10/2017 2:15:00 PM	1/14/2017 4:38:00 AM	C	0.26	UG_L	J	2.0	0.30	J	
ERH175	AZ48876	1	BENZENE	1/10/2007 9:30:00 AM	1/14/2017 5:06:00 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
METHOD: 8260B													
ERH175	AZ48876	1	ETHYLBENZENE	1/10/2007 9:30:00 AM	1/14/2017 5:06:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH175	AZ48876	1	TOLUENE	1/10/2007 9:30:00 AM	1/14/2017 5:06:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH175	AZ48876	1	TPH-GASOLINE RANGE C6-C10	1/10/2007 9:30:00 AM	1/14/2017 5:07:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH175	AZ48876	1	XYLENES, TOTAL	1/10/2007 9:30:00 AM	1/14/2017 5:06:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH176	AZ48877	1	BENZENE	1/10/2017 11:30:00 AM	1/14/2017 5:34:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH176	AZ48877	1	ETHYLBENZENE	1/10/2017 11:30:00 AM	1/14/2017 5:34:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH176	AZ48877	1	TOLUENE	1/10/2017 11:30:00 AM	1/14/2017 5:34:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH176	AZ48877	1	TPH-GASOLINE RANGE C6-C10	1/10/2017 11:30:00 AM	1/14/2017 5:35:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH176	AZ48877	1	XYLENES, TOTAL	1/10/2017 11:30:00 AM	1/14/2017 5:34:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH179	AZ48878	1	BENZENE	1/10/2017 5:35:00 PM	1/14/2017 6:02:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH179	AZ48878	1	ETHYLBENZENE	1/10/2017 5:35:00 PM	1/14/2017 6:02:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH179	AZ48878	1	TOLUENE	1/10/2017 5:35:00 PM	1/14/2017 6:02:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH179	AZ48878	1	TPH-GASOLINE RANGE C6-C10	1/10/2017 5:35:00 PM	1/14/2017 6:03:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH179	AZ48878	1	XYLENES, TOTAL	1/10/2017 5:35:00 PM	1/14/2017 6:02:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH197	AZ48879	1	BENZENE	1/9/2017 3:45:00 PM	1/14/2017 6:30:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH197	AZ48879	1	ETHYLBENZENE	1/9/2017 3:45:00 PM	1/14/2017 6:30:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH197	AZ48879	1	TOLUENE	1/9/2017 3:45:00 PM	1/14/2017 6:30:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH197	AZ48879	1	TPH-GASOLINE RANGE C6-C10	1/9/2017 3:45:00 PM	1/14/2017 6:31:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH197	AZ48879	1	XYLENES, TOTAL	1/9/2017 3:45:00 PM	1/14/2017 6:30:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH186	AZ48880	1	BENZENE	1/10/2017 2:35:00 PM	1/14/2017 6:59:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH186	AZ48880	1	ETHYLBENZENE	1/10/2017 2:35:00 PM	1/14/2017 6:59:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH186	AZ48880	1	TOLUENE	1/10/2017 2:35:00 PM	1/14/2017 6:59:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH186	AZ48880	1	TPH-GASOLINE RANGE C6-C10	1/10/2017 2:35:00 PM	1/14/2017 6:58:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH186	AZ48880	1	XYLENES, TOTAL	1/10/2017 2:35:00 PM	1/14/2017 6:59:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH187	AZ48881	1	BENZENE	1/10/2017 3:05:00 PM	1/14/2017 7:26:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH187	AZ48881	1	ETHYLBENZENE	1/10/2017 3:05:00 PM	1/14/2017 7:26:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH187	AZ48881	1	TOLUENE	1/10/2017 3:05:00 PM	1/14/2017 7:26:00 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
METHOD: 8260B													
ERH187	AZ48881	1	TPH-GASOLINE RANGE C6-C10	1/10/2017 3:05:00 PM	1/14/2017 7:27:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH187	AZ48881	1	XYLENES, TOTAL	1/10/2017 3:05:00 PM	1/14/2017 7:26:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH194	AZ48882	1	BENZENE	1/10/2017 2:20:00 PM	1/14/2017 7:54:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH194	AZ48882	1	ETHYLBENZENE	1/10/2017 2:20:00 PM	1/14/2017 7:54:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH194	AZ48882	1	TOLUENE	1/10/2017 2:20:00 PM	1/14/2017 7:54:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH194	AZ48882	1	TPH-GASOLINE RANGE C6-C10	1/10/2017 2:20:00 PM	1/14/2017 7:55:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH194	AZ48882	1	XYLENES, TOTAL	1/10/2017 2:20:00 PM	1/14/2017 7:54:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH173	AZ48884	1	BENZENE	1/10/2017 2:10:00 PM	1/14/2017 8:22:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH173	AZ48884	1	ETHYLBENZENE	1/10/2017 2:10:00 PM	1/14/2017 8:22:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH173	AZ48884	1	TOLUENE	1/10/2017 2:10:00 PM	1/14/2017 8:22:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH173	AZ48884	1	TPH-GASOLINE RANGE C6-C10	1/10/2017 2:10:00 PM	1/14/2017 8:23:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH173	AZ48884	1	XYLENES, TOTAL	1/10/2017 2:10:00 PM	1/14/2017 8:22:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH198	AZ48885	1	BENZENE	1/10/2017 7:10:00 PM	1/14/2017 8:50:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH198	AZ48885	1	ETHYLBENZENE	1/10/2017 7:10:00 PM	1/14/2017 8:50:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH198	AZ48885	1	TOLUENE	1/10/2017 7:10:00 PM	1/14/2017 8:50:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH198	AZ48885	1	TPH-GASOLINE RANGE C6-C10	1/10/2017 7:10:00 PM	1/14/2017 8:51:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH198	AZ48885	1	XYLENES, TOTAL	1/10/2017 7:10:00 PM	1/14/2017 8:50:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH196	AZ48886	1	BENZENE	1/9/2017 10:00:00 AM	1/14/2017 9:19:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH196	AZ48886	1	ETHYLBENZENE	1/9/2017 10:00:00 AM	1/14/2017 9:19:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH196	AZ48886	1	TOLUENE	1/9/2017 10:00:00 AM	1/14/2017 9:19:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH196	AZ48886	1	TPH-GASOLINE RANGE C6-C10	1/9/2017 10:00:00 AM	1/14/2017 9:18:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH196	AZ48886	1	XYLENES, TOTAL	1/9/2017 10:00:00 AM	1/14/2017 9:19:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
METHOD: 8270D													
ERH161	AZ48866	1	2-(2-METHOXYETHOXY)-ETHANOL	1/9/2017 10:30:00 AM	1/16/2017 6:50:00 PM	D	80.0	UG_L	U	100	80.0	U	
ERH161	AZ48866	1	PHENOL	1/9/2017 10:30:00 AM	1/18/2017 12:21:00 PM	D	4.00	UG_L	U	5.0	4.00	U	
ERH162	AZ48867	1	2-(2-METHOXYETHOXY)-ETHANOL	1/9/2017 10:30:00 AM	1/16/2017 7:20:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH162	AZ48867	1	PHENOL	1/9/2017 10:30:00 AM	1/18/2017 12:51:00 PM	C	4.00	UG_L	U	5.0	4.00	U	

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8270D													
ERH164	AZ48868	1	2-(2-METHOXYETHOXY)-ETHANOL	1/10/2017 10:30:00 AM	1/16/2017 7:50:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH164	AZ48868	1	PHENOL	1/10/2017 10:30:00 AM	1/18/2017 1:21:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH168	AZ48871	1	2-(2-METHOXYETHOXY)-ETHANOL	1/9/2017 2:10:00 PM	1/16/2017 8:20:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH168	AZ48871	1	PHENOL	1/9/2017 2:10:00 PM	1/18/2017 1:51:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH169	AZ48872	1	2-(2-METHOXYETHOXY)-ETHANOL	1/11/2017 10:00:00 AM	1/16/2017 8:50:00 PM	D	80.0	UG_L	U	100	80.0	U	
ERH169	AZ48872	1	PHENOL	1/11/2017 10:00:00 AM	1/18/2017 2:22:00 PM	D	4.00	UG_L	U	5.0	4.00	U	
ERH170	AZ48873	1	2-(2-METHOXYETHOXY)-ETHANOL	1/11/2017 10:00:00 AM	1/16/2017 9:20:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH170	AZ48873	1	PHENOL	1/11/2017 10:00:00 AM	1/18/2017 2:52:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH174	AZ48875	1	2-(2-METHOXYETHOXY)-ETHANOL	1/10/2017 2:15:00 PM	1/16/2017 9:50:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH174	AZ48875	1	PHENOL	1/10/2017 2:15:00 PM	1/18/2017 3:22:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH176	AZ48877	1	2-(2-METHOXYETHOXY)-ETHANOL	1/10/2017 11:30:00 AM	1/16/2017 10:20:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH176	AZ48877	1	PHENOL	1/10/2017 11:30:00 AM	1/18/2017 3:52:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH179	AZ48878	1	2-(2-METHOXYETHOXY)-ETHANOL	1/10/2017 5:35:00 PM	1/16/2017 10:50:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH179	AZ48878	1	PHENOL	1/10/2017 5:35:00 PM	1/18/2017 4:22:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH186	AZ48880	1	2-(2-METHOXYETHOXY)-ETHANOL	1/10/2017 2:35:00 PM	1/16/2017 11:21:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH186	AZ48880	1	PHENOL	1/10/2017 2:35:00 PM	1/18/2017 4:52:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH187	AZ48881	1	2-(2-METHOXYETHOXY)-ETHANOL	1/10/2017 3:05:00 PM	1/16/2017 11:51:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH187	AZ48881	1	PHENOL	1/10/2017 3:05:00 PM	1/18/2017 5:22:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
METHOD: 8270D_SIM													
ERH161	AZ48866	1	1-METHYLNAPHTHALENE	1/9/2017 10:30:00 AM	1/19/2017 10:31:00 AM	D	0.10	UG_L	U	0.2	0.10	U	
ERH161	AZ48866	1	2-METHYLNAPHTHALENE	1/9/2017 10:30:00 AM	1/19/2017 10:31:00 AM	D	0.10	UG_L	U	0.2	0.10	U	
ERH161	AZ48866	1	NAPHTHALENE	1/9/2017 10:30:00 AM	1/19/2017 10:31:00 AM	D	0.10	UG_L	U	0.2	0.10	U	
ERH162	AZ48867	1	1-METHYLNAPHTHALENE	1/9/2017 10:30:00 AM	1/19/2017 10:58:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH162	AZ48867	1	2-METHYLNAPHTHALENE	1/9/2017 10:30:00 AM	1/19/2017 10:58:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH162	AZ48867	1	NAPHTHALENE	1/9/2017 10:30:00 AM	1/19/2017 10:58:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH164	AZ48868	1	1-METHYLNAPHTHALENE	1/10/2017 10:30:00 AM	1/19/2017 11:25:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH164	AZ48868	1	2-METHYLNAPHTHALENE	1/10/2017 10:30:00 AM	1/19/2017 11:25:00 AM	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
METHOD: 8270D_SIM													
ERH164	AZ48868	1	NAPHTHALENE	1/10/2017 10:30:00 AM	1/19/2017 11:25:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH168	AZ48871	1	1-METHYLNAPHTHALENE	1/9/2017 2:10:00 PM	1/19/2017 1:17:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH168	AZ48871	1	2-METHYLNAPHTHALENE	1/9/2017 2:10:00 PM	1/19/2017 1:17:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH168	AZ48871	1	NAPHTHALENE	1/9/2017 2:10:00 PM	1/19/2017 1:17:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH169	AZ48872	1	1-METHYLNAPHTHALENE	1/11/2017 10:00:00 AM	1/19/2017 12:21:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH169	AZ48872	1	2-METHYLNAPHTHALENE	1/11/2017 10:00:00 AM	1/19/2017 12:21:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH169	AZ48872	1	NAPHTHALENE	1/11/2017 10:00:00 AM	1/19/2017 12:21:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH170	AZ48873	1	1-METHYLNAPHTHALENE	1/11/2017 10:00:00 AM	1/18/2017 5:06:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH170	AZ48873	1	2-METHYLNAPHTHALENE	1/11/2017 10:00:00 AM	1/18/2017 5:06:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH170	AZ48873	1	NAPHTHALENE	1/11/2017 10:00:00 AM	1/18/2017 5:06:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH174	AZ48875	1	1-METHYLNAPHTHALENE	1/10/2017 2:15:00 PM	1/18/2017 5:34:00 PM	C	25	UG_L		0.2	0.10		
ERH174	AZ48875	1	2-METHYLNAPHTHALENE	1/10/2017 2:15:00 PM	1/18/2017 5:34:00 PM	C	11	UG_L		0.2	0.10		
ERH174	AZ48875	1	NAPHTHALENE	1/10/2017 2:15:00 PM	1/18/2017 5:34:00 PM	C	69	UG_L		0.2	0.10		
ERH176	AZ48877	1	1-METHYLNAPHTHALENE	1/10/2017 11:30:00 AM	1/18/2017 6:02:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH176	AZ48877	1	2-METHYLNAPHTHALENE	1/10/2017 11:30:00 AM	1/18/2017 6:02:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH176	AZ48877	1	NAPHTHALENE	1/10/2017 11:30:00 AM	1/18/2017 6:02:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH179	AZ48878	1	1-METHYLNAPHTHALENE	1/10/2017 5:35:00 PM	1/18/2017 6:29:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH179	AZ48878	1	2-METHYLNAPHTHALENE	1/10/2017 5:35:00 PM	1/18/2017 6:29:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH179	AZ48878	1	NAPHTHALENE	1/10/2017 5:35:00 PM	1/18/2017 6:29:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH186	AZ48880	1	1-METHYLNAPHTHALENE	1/10/2017 2:35:00 PM	1/18/2017 6:57:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH186	AZ48880	1	2-METHYLNAPHTHALENE	1/10/2017 2:35:00 PM	1/18/2017 6:57:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH186	AZ48880	1	NAPHTHALENE	1/10/2017 2:35:00 PM	1/18/2017 6:57:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH187	AZ48881	1	1-METHYLNAPHTHALENE	1/10/2017 3:05:00 PM	1/18/2017 7:25:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH187	AZ48881	1	2-METHYLNAPHTHALENE	1/10/2017 3:05:00 PM	1/18/2017 7:25:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH187	AZ48881	1	NAPHTHALENE	1/10/2017 3:05:00 PM	1/18/2017 7:25:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
METHOD: RSK-175													
ERH161	AZ48866	1	METHANE	1/9/2017 10:30:00 AM	1/16/2017 10:59:00 AM	D	1.00	UG_L	U	5.0	1.00	UJ	c

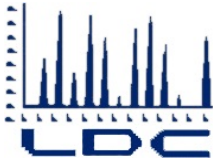
EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: RSK-175													
ERH164	AZ48868	1	METHANE	1/10/2017 10:30:00 AM	1/16/2017 11:11:00 AM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH163	AZ48869	1	METHANE	1/10/2017 10:00:00 AM	1/16/2017 11:15:00 AM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH167	AZ48870	1	METHANE	1/9/2017 1:25:00 PM	1/16/2017 11:18:00 AM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH168	AZ48871	1	METHANE	1/9/2017 2:10:00 PM	1/16/2017 11:21:00 AM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH169	AZ48872	1	METHANE	1/11/2017 10:00:00 AM	1/16/2017 11:27:00 AM	D	1.00	UG_L	U	5.0	1.00	UJ	c
ERH170	AZ48873	1	METHANE	1/11/2017 10:00:00 AM	1/16/2017 11:37:00 AM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH177	AZ48874	1	METHANE	1/11/2017 8:30:00 AM	1/16/2017 11:40:00 AM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH174	AZ48875	50	METHANE	1/10/2017 2:15:00 PM	1/16/2017 11:47:00 AM	C	21000	UG_L	D	250.0	50.00	J	c
ERH175	AZ48876	1	METHANE	1/10/2007 9:30:00 AM	1/16/2017 12:13:00 PM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH176	AZ48877	1	METHANE	1/10/2017 11:30:00 AM	1/16/2017 12:16:00 PM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH179	AZ48878	1	METHANE	1/10/2017 5:35:00 PM	1/16/2017 12:21:00 PM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH194	AZ48882	1	METHANE	1/10/2017 2:20:00 PM	1/16/2017 12:40:00 PM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH173	AZ48884	1	METHANE	1/10/2017 2:10:00 PM	1/16/2017 12:43:00 PM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH196	AZ48886	1	METHANE	1/9/2017 10:00:00 AM	1/16/2017 12:47:00 PM	C	1.00	UG_L	U	5.0	1.00	UJ	c

The attached zipped file contains two files:

<u>File</u>	<u>Format</u>	<u>Description</u>
1) Readme_RedHill_021017.docx	MS Word 2007	A "Readme" file (this document).
2) 81965_RH_COPC_dva.xlsx	MS Excel 2007	<u>A spreadsheet for the following SDGs:</u> 81965 37996A

No discrepancies were observed between the hardcopy data packages and the electronic data deliverables during verification.

Please contact Stella Cuenco or Judy Ecklund at (760) 827-1100 if you have any questions regarding this electronic data submittal.



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 Thach

February 28, 2017

SUBJECT: Revised Red Hill Bulk Storage Facility, CTO 0053, Data Validation

Dear Ms. Thach,

Enclosed is the revised validation report for the fractions listed below. Please replace the previously submitted reports with the enclosed revised reports.

LDC Project #37996:

SDG #

Fraction

81965 Volatiles, Phenol, Polynuclear Aromatic Hydrocarbons, 2-(2-Methoxyethoxy)-ethanol, TPH as Gasoline, TPH as Extractables

- Revision: Added equipment blanks to the fractions listed above.

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

Sincerely,

Stella Cuenco
Operations Manager/Senior Chemist

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 27, 2017

Parameters: Volatiles

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH162	AZ48867	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH163	AZ48869	Water	01/10/17
ERH167	AZ48870	Water	01/09/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH177	AZ48874	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH175	AZ48876	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH197	AZ48879	Water	01/09/17
ERH186	AZ48880	Water	01/10/17
ERH187	AZ48881	Water	01/10/17
ERH194	AZ48882	Water	01/10/17
ERH173	AZ48884	Water	01/10/17
ERH198	AZ48885	Water	01/10/17
ERH196	AZ48886	Water	01/09/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17
ERH169MS	AZ48872MS	Water	01/11/17
ERH169MSD	AZ48872MSD	Water	01/11/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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. 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 ERH163, ERH167, ERH177, ERH175, ERH194, ERH173, and ERH196 were identified as trip blanks. No contaminants were found.

Samples ERH197 and ERH198 were identified as ambient blanks. No contaminants were found.

Samples ERH187 and ERH192 (from SDG 81936) were identified as equipment blanks. No contaminants were found.

Sample ERH186 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH161** and ERH162 and samples ERH169** and ERH170 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Laboratory Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Field Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A1
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/6/17
 Page: 1 of 2
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC/MS Volatiles (BTEX) (EPA SW 846 Method 8260B)
 + 1,2 - Dichloroethane

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	1/0 PSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	TB = 4, 5, 9, 11, 17, 18, 20 AB = 14, 19
VII.	Surrogate spikes	Δ	PB = 15 EB = 16, ERH192 (8926)
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	Δ	LCS
X.	Field duplicates	ND	D = 1, 2 7, 8
XI.	Internal standards	Δ	
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	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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1 3	ERH161** D	AZ48866**	Water	01/09/17
2 3	ERH162 D	AZ48867	Water	01/09/17
3 3	ERH164	AZ48868	Water	01/10/17
4 3	ERH163 TB	AZ48869	Water	01/10/17
5 3	ERH167 TB	AZ48870	Water	01/09/17
6 3	ERH168	AZ48871	Water	01/09/17
7 1	ERH169** P + 1,2 - DEA	AZ48872**	Water	01/11/17
8 2	ERH170 P + 1,2 - DCA	AZ48873	Water	01/11/17
9 2	ERH177 TB + 1,2 DCA	AZ48874	Water	01/11/17
10 4	ERH174	AZ48875	Water	01/10/17
11 4	ERH175 TB	AZ48876	Water	01/10/17
12 1	ERH176	AZ48877	Water	01/10/17
13 4	ERH179	AZ48878	Water	01/10/17

LDC #: 37996A1

VALIDATION COMPLETENESS WORKSHEET

Date: 2/6/17

SDG #: 81965

Level C/D

Page: 1 of 2

Laboratory: APPL, Inc.

Reviewer: F7

2nd Reviewer: [Signature]

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

	Client ID	Lab ID	Matrix	Date
14	ERH197 AB	AZ48879	Water	01/09/17
15	ERH186 FB	AZ48880	Water	01/10/17
16	ERH187 EPB	AZ48881	Water	01/10/17
17	ERH194 TB	AZ48882	Water	01/10/17
18	ERH173 TB	AZ48884	Water	01/10/17
19	ERH198 AB	AZ48885	Water	01/10/17
20	ERH196 TB	AZ48886	Water	01/09/17
21	ERH161MS	AZ48866MS	Water	01/09/17
22	ERH161MSD	AZ48866MSD	Water	01/09/17
23	ERH169MS	AZ48872MS	Water	01/11/17
24	ERH169MSD	AZ48872MSD	Water	01/11/17
25				
26				
27				
28				
29				

Notes:

1	170113A L1				
2	170113B L				
3	170113A L				
4	170113B L1				

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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 ?	/			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) $< 20\%$ or percent recoveries (%R) 80-120%?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	/			
Were all percent differences (%D) $\leq 20\%$ and relative response factors (RRF) ≥ 0.05 ?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?	/			
Were target compounds detected in the field blanks?		/		
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	/			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			/	

LDC #: 37996A)

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: FJ
 2nd Reviewer: KK

Validation Area	Yes	No	NA	Findings/Comments
VIII: Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
IX: Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X: Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI: Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII: Compound quantitation				
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?	/			
XIII: Target compound identification				
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?	/			
XIV: System performance				
System performance was found to be acceptable.	/			
XV: Overall assessment of data				
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.

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 * (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, 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	0113105	1/13/17	V (IS1)	1.8910	1.887	1.887	0.19	0.19
			EE (IS2)	2.263	2.411	2.411	6.5	6.5
			(IS3)					
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					

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 #: 37996A

VALIDATION FINDINGS WORKSHEET Surrogate Results Verification

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

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: 7

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane	25.0	25.18	101	101	0
1,2-Dichloroethane-d4	↓	24.57	98.3	98.3	↓
Toluene-d8	↓	25.17	101	101	↓
Bromofluorobenzene	↓	24.28	97.1	97.1	↓

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 #: 07996A1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

% Recovery = 100 * (SSC - SC)/SA

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = |MSC - MSC| * 2 / (MSC + MSCD)

MSC = Matrix spike concentration

MSCD = Matrix spike duplicate concentration

MS/MSD sample: 21 + 22

Compound	Spike Added (ug/l)		Sample Concentration (ug/l)	Spiked Sample Concentration (ug/l)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalculated
1,1-Dichloroethene											
Trichloroethene											
Benzene	10.0	10.0	ND	10.1	9.75	101	101	97.5	97.5	3.5	3.5
Toluene	10.0	↓	↓	10.8	10.3	108	108	103	103	4.7	4.7
Chlorobenzene											

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

LDC #: 37996A

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

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

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: 170113A L1 - LCS

Compound	Spike Added ($\mu\text{g/L}$)		Spiked Sample Concentration ($\mu\text{g/L}$)		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	NA	9.98	NA	99.8	99.8				
Toluene	10.0	↓	10.3	↓	103	103	NA			
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 0053

LDC Report Date: February 27, 2017

Parameters: Phenol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH162	AZ48867	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH186	AZ48880	Water	01/10/17
ERH187	AZ48881	Water	01/10/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% 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 ERH187 and ERH192 (from SDG 81936) were identified as equipment blanks. No contaminants were found.

Sample ERH186 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH161** and ERH162 and samples ERH169** and ERH170 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Laboratory Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Field Blank Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A2a
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/7/16
 Page: 1 of 2
 Reviewer: F7
 2nd Reviewer: PK

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	Δ / Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ / Δ	% RSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	FB = 10 EB = 11, ERH192 (81936)
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	Δ	ICS
X.	Field duplicates	ND	D = 1, 2 #5, 6
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH161 ** Δ	AZ48866 ** Δ	Water	01/09/17
2	ERH162 Δ	AZ48867	Water	01/09/17
3	ERH164	AZ48868	Water	01/10/17
4	ERH168 Δ	AZ48871	Water	01/09/17
5	ERH169** Δ	AZ48872**	Water	01/11/17
6	ERH170	AZ48873	Water	01/11/17
7	ERH174	AZ48875	Water	01/10/17
8	ERH176	AZ48877	Water	01/10/17
9	ERH179	AZ48878	Water	01/10/17
10	ERH186 FB	AZ48880	Water	01/10/17
11	ERH187 EB	AZ48881	Water	01/10/17
12	ERH161MS	AZ48866MS	Water	01/09/17
13	ERH161MSD	AZ48866MSD	Water	01/09/17

LDC #: 37996A2a

VALIDATION COMPLETENESS WORKSHEET

Date: 2/7/16

SDG #: 81965

Level C/D

Page: 2 of 2

Laboratory: APPL, Inc.

Reviewer: [Signature]

2nd Reviewer: [Signature]

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

	Client ID	Lab ID	Matrix	Date
14				
15				
16				
17				
18				

Notes:

	170116A						

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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 ?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) \leq 20% ?	/			
IV. Continuing calibration				
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?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?	/			
Were target compounds detected in the field blanks?		/		
VII. Surrogate spikes				
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 ?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			add FT
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37976A2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

METHOD: GCMS 8270^D~~Q~~

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 40 std)	Recalculated (RRF40 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	12/7/2016	A	2.002	2.002	1.974	1.974	2.00	2.00
	Yoda								

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 * (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	1207Y322	1/18/17	A (1st IS)	1.974	2.000	2.000	1.3	1.3
			(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: 5

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	93.450	55.08931	58.9	58.9	0
2-Fluorobiphenyl	↓	50.29535	53.8	53.8	↓
Terphenyl-d14	↓	50.16496	53.7	53.7	
Phenol-d5	186.916	28.70808	15.4	15.4	↓
2-Fluorophenol	↓	49.65106	26.6	26.6	
2,4,6-Tribromophenol	↓	96.0005	51.4	51.4	↓
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					

VALIDATION FINDINGS WORKSHEET

Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = $|MSC - MSC| * 2 / (MSC + MSDC)$

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: 12 + 13

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol	47.6	47.6	ND	11.7	12.3	24.6	24.6	25.8	25.8	5.0	5.0
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene											
Pentachlorophenol											
Pyrene											

Comments: Refer to Matrix Spike/Matrix Spike 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
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 170116A - LCS

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	50.0	NA	13.8	NA	27.6	27.6	NA			
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 0053

LDC Report Date: February 27, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH162	AZ48867	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH186	AZ48880	Water	01/10/17
ERH187	AZ48881	Water	01/10/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

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 ERH187 and ERH192 (from SDG 81936) were identified as equipment blanks. No contaminants were found.

Sample ERH186 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH161** and ERH162 and ERH169** and ERH170 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification
Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -
SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A2b
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/7/16
 Page: 1 of 2
 Reviewer: F7
 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	Δ, Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ, Δ	% PSD = 15, r ² CV = 20
IV.	Continuing calibration/dosing CV	Δ	CV = 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	FB = 10 FB = 11, ERH192 (81936)
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	Δ	
IX.	Laboratory control samples	Δ	LCs
X.	Field duplicates	ND	D = 1, 2 5, 6
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH161 ** D	AZ48866 **	Water	01/09/17
2	ERH162 D	AZ48867	Water	01/09/17
3	ERH164	AZ48868	Water	01/10/17
4	ERH168	AZ48871	Water	01/09/17
5	ERH169** D	AZ48872**	Water	01/11/17
6	ERH170 D	AZ48873	Water	01/11/17
7	ERH174	AZ48875	Water	01/10/17
8	ERH176	AZ48877	Water	01/10/17
9	ERH179	AZ48878	Water	01/10/17
10	ERH186 FB	AZ48880	Water	01/10/17
11	ERH187 EB	AZ48881	Water	01/10/17
12	ERH161MS	AZ48866MS	Water	01/09/17
13	ERH161MSD	AZ48866MSD	Water	01/09/17

W, TTT, S only

LDC #: 37996A2b

VALIDATION COMPLETENESS WORKSHEET

Date: 2/7/16

SDG #: 81965

Level C/D

Page: 2 of 2

Laboratory: APPL, Inc.

Reviewer: FJ

2nd Reviewer: VJ

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

	Client ID	Lab ID	Matrix	Date
14				
15				
16				
17				
18				

Notes:

	170116A				

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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 ?	/			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) $< 20\%$?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) $\leq 20\%$ and relative response factors (RRF) within method criteria?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed 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 completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?	/			
Were target compounds detected in the field blanks?		/		
VII: Surrogate spikes				
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 ?			/	

LDC #: 37996A06

VALIDATION FINDINGS CHECKLIST

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

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37996A2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GCMS ^D 8270C

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 (RRF5 std)	Recalculated (RRF5std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	1/16/2017	S	1.158	1.158	1.022	1.022	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	CW	1/18/17	S (1st IS)	1.022	1.185	1.185	16	16
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
2	CW	1/19/17	S (1st IS)	1.022	1.065	1.065	4.2	4.2
			(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 #: 37996A26

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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: #5

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	4.673	3.28605	70.3	70.3	0
2-Fluorobiphenyl	↓	2.68776	57.5	57.5	↓
Terphenyl-d14	↓	4.31366	92.3	92.3	↓
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 #: 37996A06

VALIDATION FINDINGS WORKSHEET Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

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

Where: SSC = Spiked sample concentration
SA = Spike added

SC = Sample concentration

RPD = $100 * (MSC - MSD) / (MSC + MSD)$

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: 12 + 13

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol											
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene											
Pentachlorophenol											
Pyrene							F7				
S	5.0	5.0	ND	2.70	2.79	54.0	55.8 54.0	55.0	55.8	3.3	3.3

Comments: Refer to Matrix Spike/Matrix Spike 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
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 170116A - LCS

Compound	Spike Added (ug/l)		Spike Concentration ()		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>S</u>	<u>5.0</u>	<u>NA</u>	<u>2.86</u>	<u>NA</u>	<u>57.2</u>	<u>57.2</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</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_x = Area of the characteristic ion (EICP) for the compound to be measured
- A_s = Area of the characteristic ion (EICP) for the specific internal standard
- I_s = Amount of internal standard added in nanograms (ng)
- V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).
- V_i = Volume of extract injected in microliters (ul)
- V_t = 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. 170116A - LES S

$$\text{Conc.} = \frac{22357 (2.5)}{19126 (1.022)}$$

=

$$2.86 \text{ ug/L}$$

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 27, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH162	AZ48867	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH186	AZ48880	Water	01/10/17
ERH187	AZ48881	Water	01/10/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

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

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%.

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

Samples ERH187 and ERH192 (from SDG 81936) were identified as equipment blanks. No contaminants were found.

Sample ERH186 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 and MS/MSD percent recoveries were within QC limits. Additionally, all 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples ERH161** and ERH162 and samples ERH169** and ERH170 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81965**

No Sample Data Qualified in this SDG

LDC #: 37996A2c
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/7/16
 Page: 1 of 2
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D) ^{modified} (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	Δ	CCV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	NP	FB = 10 FB = 11, ERH192 (81936)
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	ND	D = 1, 2 5, 6
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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH161 ** D	AZ48866 **	Water	01/09/17
2	ERH162 D	AZ48867	Water	01/09/17
3	ERH164	AZ48868	Water	01/10/17
4	ERH168	AZ48871	Water	01/09/17
5	ERH169** D	AZ48872**	Water	01/11/17
6	ERH170 D	AZ48873	Water	01/11/17
7	ERH174	AZ48875	Water	01/10/17
8	ERH176	AZ48877	Water	01/10/17
9	ERH179	AZ48878	Water	01/10/17
10	ERH186 FB	AZ48880	Water	01/10/17
11	ERH187 EB	AZ48881	Water	01/10/17
12	ERH161MS	AZ48866MS	Water	01/09/17
13	ERH161MSD	AZ48866MSD	Water	01/09/17

LDC #: 37996A2c

VALIDATION COMPLETENESS WORKSHEET

SDG #: 81965

Level C/D

Laboratory: APPL, Inc.

Date: 2/7/16

Page: 2 of 2

Reviewer: [Signature]

2nd Reviewer: [Signature]

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

	Client ID	Lab ID	Matrix	Date
14				
15				
16				
17				
18				

Notes:

	17013A1				

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. GC/MS Instrument performance check				
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"/>	
IIIa. Initial calibration				
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"/>	
IIIb. Initial Calibration Verification				
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"/>	
IV. Continuing calibration				
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"/>	
V. Laboratory Blanks				
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 completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VI. Field blanks				
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"/>	
VII. Surrogate spikes				
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"/>	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 37996A2C

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?

Table with 5 columns: #, Sample ID, Surrogate, %R (Limits), and Qualifications. The first row contains a detailed text explanation: 'Surrogates were not added to all samples as required by the method. Using professional judgment, no data were qualified, since the LCS and MS/MSD percent recoveries were within QC limits. Additionally, all surrogate percent recoveries were within QC limits in the phenol analysis.'

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

LDC #: 37996 A2C

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GCMS ^D 8270~~0~~

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_x = Area of compound

C_x = Concentration of compound

S = Standard deviation of the RRFs

X = Mean of the RRFs

A_{is} = Area of associated internal standard

C_{is} = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 400 std)	Recalculated (RRF400 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	12/20/2016	2-(2-Methoxyethoxy) Ethanol	0.2253	0.2253	0.2144	0.2144	9.90	9.90
	Yoda								

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, A_{is} = Area of associated internal standard
 C_x = Concentration of compound, 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	12204052 ccv	1/16/17	2-(2-Methoxyethoxy) (1st IS)	0.2144	0.2184	0.2184	1.9	1.9
			ethano) (2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th IS)					
			(6th IS)					
2	12204074 ccv	1/19/17	↓ (1st IS)	↓	0.2423	0.2423	13	13
			(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 #: 37996A2C

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

% Recovery = 100 * (SSC - SC)/SA

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = | MSC - MSC | * 2 / (MSC + MSDC)

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: 12 + 13

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalc
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>ND</u>	<u>92.6</u>	<u>86.4</u>	<u>116</u>	<u>116</u>	<u>108</u>	<u>108</u>	<u>6.9</u>	<u>6.9</u>

Comments: Refer to Matrix Spike/Matrix Spike 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
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 170113A1 - LCS

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										
2-(2-MEE)	0.0	NA	19.7	NA	99.6	99.6	NA			

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 0053

LDC Report Date: February 27, 2017

Parameters: Total Petroleum Hydrocarbons as Gasoline

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH162	AZ48867	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH163	AZ48869	Water	01/10/17
ERH167	AZ48870	Water	01/09/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH177	AZ48874	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH175	AZ48876	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH197	AZ48879	Water	01/09/17
ERH186	AZ48880	Water	01/10/17
ERH187	AZ48881	Water	01/10/17
ERH194	AZ48882	Water	01/10/17
ERH173	AZ48884	Water	01/10/17
ERH198	AZ48885	Water	01/10/17
ERH196	AZ48886	Water	01/09/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17
ERH169MS	AZ48872MS	Water	01/11/17
ERH169MSD	AZ48872MSD	Water	01/11/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 Gasoline 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 ERH163, ERH167, ERH177, ERH175, ERH194, ERH173, and ERH196 were identified as trip blanks. No contaminants were found.

Samples ERH197 and ERH198 were identified as ambient blanks. No contaminants were found.

Samples ERH187 and ERH192 (from SDG 81936) were identified as equipment blanks. No contaminants were found.

Sample ERH186 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

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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH161** and ERH162 and samples ERH169** and ERH170 were identified as field duplicates. No results were detected in any of the samples.

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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG
81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification
Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification
Summary - SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A7

VALIDATION COMPLETENESS WORKSHEET

SDG #: 81965

Level C/D

Laboratory: APPL, Inc.

Date: 2/6/17

Page: 1 of 2

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: GC/MS TPH as Gasoline (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	ICV ≤ 20
IV.	Continuing calibration	A	CCV ≤ 20
V.	Laboratory Blanks	A	TB = 4, 5, 9, 11, 17, 18, 20 AB = 14, 19
VI.	Field blanks	ND	FB = 15 EB = 16, ERH192 (R1936)
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCs
X.	Field duplicates	ND	D = 1, 2 7, B - 17, 18
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
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

AB = Ambient Blank
SB = Source blank
OTHER:

** Indicates sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH161** P	AZ48866**	Water	01/09/17
2	ERH162 P	AZ48867	Water	01/09/17
3	ERH164	AZ48868	Water	01/10/17
4	ERH163 TB	AZ48869	Water	01/10/17
5	ERH167 TB	AZ48870	Water	01/09/17
6	ERH168	AZ48871	Water	01/09/17
7	ERH169** P	AZ48872**	Water	01/11/17
8	ERH170 P	AZ48873	Water	01/11/17
9	ERH177 TB	AZ48874	Water	01/11/17
10	ERH174	AZ48875	Water	01/10/17
11	ERH175 TB	AZ48876	Water	01/10/17
12	ERH176	AZ48877	Water	01/10/17
13	ERH179	AZ48878	Water	01/10/17

LDC #: 37996A7

VALIDATION COMPLETENESS WORKSHEET

SDG #: 81965

Level C/D

Laboratory: APPL, Inc.

Date: 2/6/17

Page: 2 of 2

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: GC/MS TPH as Gasoline (EPA SW 846 Method 8260B)

	Client ID	Lab ID	Matrix	Date
14 ²	ERH197 Tunnel Ambient	AZ48879	Water	01/09/17
15 ²	ERH186 FB	AZ48880	Water	01/10/17
16 ²	ERH187 EB	AZ48881	Water	01/10/17
17 ²	ERH194 TB	AZ48882	Water	01/10/17
18 ²	ERH173 TB	AZ48884	Water	01/10/17
19 ²	ERH198 Ambient	AZ48885	Water	01/10/17
20 ²	ERH196 #1 Ambient TB	AZ48886	Water	01/09/17
21 ¹	ERH161MS	AZ48866MS	Water	01/09/17
22 ¹	ERH161MSD	AZ48866MSD	Water	01/09/17
23 ¹	ERH169MS	AZ48872MS	Water	01/11/17
24 ¹	ERH169MSD	AZ48872MSD	Water	01/11/17
25				
26				
27				
28				
29				

Notes:

1	170113AL				
2	170113BL				

LDC #: 3799647

VALIDATION FINDINGS CHECKLIST

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

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical: holding times				
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"/>	
II. GC/MS: Instrument performance check				
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"/>	
IIIa. Initial calibration				
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 ≥ 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) > 0.05 ?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
IIIb. Initial Calibration Verification				
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) $\leq 20\%$ or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing calibration				
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) ≥ 0.05 ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
V. Laboratory Blanks				
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 completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VI. Field blanks				
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"/>	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	

Validation Area	Yes	No	NA	Findings/Comments
VIII: Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	/			
Was a MS/MSD analyzed every 20 samples of each matrix?	/			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	/			
IX: Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X: Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?		/		
XI: Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII: Compound quantitation				
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?	/			
XIII: Target compound identification				
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?	/			
XIV: System performance				
System performance was found to be acceptable.	/			
XV: Overall assessment of data				
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#: 37996A7
 SDG#: Jee Coner

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

Method: GRO (8260B)

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
1/12/2017	GCMS Loki	Gasoline Range Organics	1	10.22790007	0.8
			2	11.3350485	2
			3	13.2098067	4
			4	19.70700192	12
			5	29.05892957	24
			6	35.43328362	32
			7	42.58810881	40

Regression Output

Reported

Constant	9.740247	9.740000
Std Err of Y Est		
R Squared	0.999625	1.000000
Degrees of Freedom		
X Coefficient(s)	0.813400	0.813000
Std Err of Coef.		
Correlation Coefficient	0.999812	
Coefficient of Determination (r^2)	0.999625	1.000000

LDC #: 37996A7

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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

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	0113208 ccy	1/13/17	GRU (IS1)	300	300.52	300.52	0.17	0.17
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					

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 #: 37996A7

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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: 7

	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>24.28</u>	<u>97.1</u>	<u>97.1</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 #: 3799647

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

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

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

Where: SSC = Spiked sample concentration
 SA = Spike added

SC = Sample concentration

RPD = $|MSC - MSC| * 2 / (MSC + MSDC)$

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD sample: 2/22

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc	Reported	Recalc	Reported	Recalculated
Gasoline Range											
4,1-Dichloroethene	300	300	ND	273	274	91.0	91.0	91.3	91.3	0.37	0.37
Trichloroethene											
Benzene											
Toluene											
Chlorobenzene											

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

LDC #: 37996A7

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

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

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: 170113AL - LCS

Compound	Spike Added (<u>ug/L</u>)		Spiked Sample Concentration (<u>ug/L</u>)		LCS		LCSD		LCS/LCSD	
	LCS	LCSD	LCS	LCSD	Percent Recovery		Percent Recovery		RPD	
					Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
gasoline range organics										
4,4-Dichloroethene	<u>300</u>	<u>NA</u>	<u>301</u>	<u>NA</u>	<u>100</u>	<u>100</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>
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 #: 37996A7

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1

Reviewer: FT
2nd reviewer: KY

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?

Concentration = $\frac{(A_s)(I_s)(DF)}{(A_i)(RRF)(V_s)(\%S)}$

- A_s = Area of the characteristic ion (EICP) for the compound to be measured
- A_i = 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_s = 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. 170113A LCS GRU

Conc. = _____

= 301. ug/L

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification
	15254482	= 0.813 ($\frac{x}{25}$)	+ 9.74		
	781563				
		x = 301.0 ug/L			

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 27, 2017

Parameters: Total Petroleum Hydrocarbons as Extractables

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81965

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH161**	AZ48866**	Water	01/09/17
ERH162	AZ48867	Water	01/09/17
ERH164	AZ48868	Water	01/10/17
ERH168	AZ48871	Water	01/09/17
ERH169**	AZ48872**	Water	01/11/17
ERH170	AZ48873	Water	01/11/17
ERH174	AZ48875	Water	01/10/17
ERH176	AZ48877	Water	01/10/17
ERH179	AZ48878	Water	01/10/17
ERH186	AZ48880	Water	01/10/17
ERH187	AZ48881	Water	01/10/17
ERH161MS	AZ48866MS	Water	01/09/17
ERH161MSD	AZ48866MSD	Water	01/09/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds

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

Samples ERH187 and ERH192 (from SDG 81936) were identified as equipment blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH192	01/06/17	Diesel (C10-C24)	42 ug/L	ERH176

Sample ERH186 was identified as a field blank. No contaminants were found.

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. 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) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples ERH169** and ERH170 and samples ERH161** and ERH162 were identified as field duplicates. No results were detected in any of the samples.

Compound	Concentration (ug/L)		RPD
	ERH169**	ERH170	
Diesel (C10-C24)	28	23	20
Oil (C24-C40)	29	27	7

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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -
SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data
Qualification Summary - SDG 81965**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification
Summary - SDG 81965**

No Sample Data Qualified in this SDG

LDC #: 37996A8
 SDG #: 81965
 Laboratory: APPL, Inc.

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/6/17
 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 / CV ≤ 20
III.	Continuing calibration	Δ	CV ≤ 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	SW, Δ	FB = 10* EB = 11*, ERH192 (81926)
VI.	Surrogate spikes	Δ	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LOS
IX.	Field duplicates	SW	D = 5 + 6 * 1, 3
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
 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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH162	AZ48867	Water	01/09/17
2	ERH164	AZ48868	Water	01/10/17
3	ERH161 ** ERH103 F7	AZ48869	Water	01/10/17
4	ERH168	AZ48871	Water	01/09/17
5*	ERH169** D	AZ48872**	Water	01/11/17
6	ERH170 D	AZ48873	Water	01/11/17
7	ERH174	AZ48875	Water	01/10/17
8	ERH176	AZ48877	Water	01/10/17
9	ERH179	AZ48878	Water	01/10/17
10	ERH186 FB	AZ48880	Water	01/10/17
11	ERH187 FB	AZ48881	Water	01/10/17
12	ERH161MS	AZ48866MS	Water	01/09/17
13	ERH161MSD	AZ48866MSD	Water	01/09/17
14				
15	170116A			
16				
17				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. Initial calibration				
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"/>	
III. Initial calibration verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
V. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
VI. Field Blanks				
Were field blanks identified in this SDG?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Were target compounds detected in the field blanks?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VII. Surrogate spikes				
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"/>	
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

LDC #: 31996AB

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: F7
 2nd Reviewer: YH

Validation Area	Yes	No	NA	Findings/Comments
VII. Laboratory control samples				
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 QC limits?	/			
VIII. Field duplicates				
Were field duplicate pairs identified in this SDG?	/			
Were target compounds detected in the field duplicates?	/			
IX. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	/			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

LDC #: 37996A8

VALIDATION FINDINGS WORKSHEET Field Blanks

Page: 1 of 1
Reviewer: 9
2nd Reviewer: SL

METHOD: GC

Y N N/A Field blanks were 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: 1/6/17

Field blank type: (circle one) Field Blank / Rinsate / Other: EB Associated Samples: 8

Compound	Blank ID	Sample Identification							
(SDG 81936)	ERH192								
Diesel (C10-C24)	42								

Blank units: _____ Associated sample units: _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification							

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".

VALIDATION FINDINGS WORKSHEET
Field Duplicates

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</u> / <u>l</u>)		%RPD Limit (≤ <u>50</u> %)	Qualification (Parent only)
	<u>5</u>	<u>6</u>		
Diesel (C ₁₀ -C ₂₄)	<u>28</u>	<u>23</u>	<u>20</u>	/
Oil (C ₂₄ -C ₄₀)	<u>29</u>	<u>27</u>	<u>7</u>	

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

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

LDC #: 37996A8

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

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:

$$CF = A/C$$

$$\text{average CF} = \text{sum of the CF}/\text{number of standards}$$

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

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=400)	Recalculated (CF4 std=400)	Reported Average CF (Initial)	Recalculated Average CF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	11/3/2016	Diesel C10-C24	1625582	Diesel C10-C24	1727130	1727130	9.6	9.6
	Apollo								

LDC #: 37996A8

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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	
octacosane	/	40.0	41.438	104	104	0
o-Terphenyl		↓	32.863	82.2	82.2	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 #: 37996A8

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

METHOD: GC HPLC

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

%Recovery = 100 * (SSC - SC)/SA

Where

SSC = Spiked sample concentration

MS = Matrix spike

SC = Sample concentration

MSD = Matrix spike duplicate

SA = Spike added

RPD = ((SSCMS - SSCMSD) * 2) / (SSCMS + SSCMSD) * 100

MS/MSD samples: 12 + 13

Compound	Spike Added (ug/L)		Sample Conc. (ug/L)	Spike Sample Concentration (ug/L)		Matrix spike		Matrix Spike Duplicate		MS/MSD	
	MS	MSD		MS	MSD	Percent Recovery		Percent Recovery		RPD	
						Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)											
Diesel (610-024) (8015)	1330	1330	ND	1120	1120	84.0	84.0	84.0	84.0	0	0
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 Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 37996A8

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT
2nd Reviewer: ICK

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: 17D116A - LCS

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 (C _{10-C24}) (8015)	1330	NA	1080	NA	81.0	81.0	NA			
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.

LDC #: 3799648

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

$$\text{Concentration} = \frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$$

Example:

Sample ID: #5 Compound Name Diesel c₁₀₋₂₄

- A= Area or height of the compound to be measured
- Fv= Final Volume of extract
- Df= Dilution Factor
- RF= Average response factor of the compound
In the initial calibration
- Vs= Initial volume of the sample
- Ws= Initial weight of the sample
- %S= Percent Solid

$$\text{Concentration} = \frac{72547260 (2) (1000)}{1727130 (2) (1500)} = 2.8 \text{ ug/L}$$

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____



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 Thach

February 15, 2017

SUBJECT: Red Hill Bulk Storage Facility, CTO 0053, Data Validation

Dear Ms. Thach,

Enclosed is the final validation report for the fractions listed below. This SDG was received on January 31, 2017. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #38023:

<u>SDG #</u>	<u>Fraction</u>
81971	Volatiles, Phenol, Polynuclear Aromatic Hydrocarbons, 2-(2-Methoxyethoxy)-ethanol, Wet Chemistry, TPH as Gasoline, TPH 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:

- Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i, August 2016
- Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i, Revision 01, November 2016
- Project Procedures Manual Naval Facilities Engineering Command, Environmental Restoration Program, NAVFAC Pacific, DON 2015
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

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

Sincerely,

Stella Cuenco
Operations Manager/Senior Chemist

EDD 90/10

LDC #38023 (AECOM-Honolulu, HI / Red Hill Bulk Storage Facility, CTO 0053)

LDC	SDG#	DATE REC'D	(3) DATE DUE	BTEX 1,2-DCA (8260B)		3 PAHs (8270D -SIM)		Phenol (8270D)		2,2-MEE (8270D-M)		TPH-G (8260B)		TPH-E (8015B)		EDB (8011)		Methane (175)		Alk. (2320B)		Cl, NO ₃ ,SO ₄ (300.0)		Fe II (3500-Fe B)													
				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				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				
A	81971	01/31/17	02/21/17	11	0	3	0	3	0	3	0	11	0	3	0	4	0	7	0	3	0	3	0	3	0												
A	81971	01/31/17	02/21/17	2	0	1	0	1	0	1	0	2	0	1	0	0	0	1	0	1	0	1	0	1	0												
Total	J/SC			13	0	4	0	4	0	4	0	13	0	4	0	4	0	8	0	4	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	66	

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 10, 2017

Parameters: Volatiles

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH171	AZ48914	Water	01/11/17
ERH172**	AZ48915**	Water	01/11/17
ERH178**	AZ48916**	Water	01/11/17
ERH185	AZ48917	Water	01/11/17
ERH199	AZ48918	Water	01/11/17
ERH200	AZ48919	Water	01/11/17
ERH201	AZ48920	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH203	AZ48922	Water	01/12/17
ERH180	AZ48923	Water	01/12/17
ERH183	AZ48924	Water	01/12/17
ERH184	AZ48925	Water	01/12/17
ERH202	AZ48926	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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. 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 ERH171, ERH185, ERH180, and ERH183 were identified as trip blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH183	01/14/17	Xylenes, total	0.78 ug/L	ERH184

Samples ERH199, ERH200, ERH201, ERH203, ERH202 were identified as ambient blanks. No contaminants were found.

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X for common contaminants, >5X for other contaminants) than the concentrations found in the associated field blanks.

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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Laboratory Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Field Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A1
 SDG #: 81971
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 2/9/17
 Page: of 2
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC/MS Volatiles (BTEX) (EPA SW 846 Method 8260B)
 + 1,2 - Dichloroethane

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	% PSD = 15 101 ≤ 20
IV.	Continuing calibration/closing CV	A	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	SW	TB = 1, 4, 10, 11 * AB = 5, 6, 7, 9, 13
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	Δ	CS
X.	Field duplicates	N	
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
 N = Not provided/applicable
 SW = See worksheet

ND = No compounds detected
 R = Rinsate
 FB = Field blank

D = Duplicate
 TB = Trip blank
 EB = Equipment blank

AB = Ambient Blank
 SB = Source blank
 OTHER:

** Indicates sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1 3	ERH171 TB	AZ48914	Water	01/11/17
2 3	ERH172**	AZ48915**	Water	01/11/17
3 3	ERH178** + 12 PCD	AZ48916	Water	01/11/17
4 3	ERH185 TB + 12 PCD	AZ48917	Water	01/11/17
5 1	ERH199 AB + 12 PCD	AZ48918	Water	01/11/17
6 1	ERH200 AB	AZ48919	Water	01/11/17
7 2	ERH201 AB + 12 PCD	AZ48920	Water	01/11/17
8 2	ERH181	AZ48921	Water	01/12/17
9 2	ERH203 AB	AZ48922	Water	01/12/17
10 2	ERH180 TB	AZ48923	Water	01/12/17
11 2	ERH183 TB	AZ48924	Water	01/12/17
12 2	ERH184	AZ48925	Water	01/12/17
13 2	ERH202 AB	AZ48926	Water	01/12/17

LDC #: 38023A1

VALIDATION COMPLETENESS WORKSHEET

Date: 2/9/17

SDG #: 81971

Level C/D

Page: 2 of 2

Laboratory: APPL, Labs

Reviewer: [Signature]

2nd Reviewer: [Signature]

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

	Client ID	Lab ID	Matrix	Date
14				
15				
16				
17				
18				

Notes:

1	170113AM				
2	170113BM1				
3	170113BL				

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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 ?	/			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) $< 20\%$ or percent recoveries (%R) 80-120%?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	/			
Were all percent differences (%D) $\leq 20\%$ and relative response factors (RRF) ≥ 0.05 ?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?	/			
Were target compounds detected in the field blanks?	/			
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	/			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			/	

LDC #: 38023A

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: PT
 2nd Reviewer: PH

Validation Area	Yes	No	NA	Findings/Comments
VIII: Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX: Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X: Field duplicates				
Were field duplicate pairs identified in this SDG?		/	/	
Were target compounds detected in the field duplicates?		/	/	
XI: Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII: Compound quantitation				
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?	/			
XIII: Target compound identification				
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?	/			
XIV: System performance				
System performance was found to be acceptable.	/			
XV: Overall assessment of data				
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 #: 38023A/

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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

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:

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

$$\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$$

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	0113 L35	1/13/17	V (IS1)	1.8910	1.828	1.828	3.3	3.3
			EE (IS2)	2.2630	2.287	2.287	1.0	1.0
			(IS3)					
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					

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 #: 38023A1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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	25.0	24.92	99.7	99.7	0
1,2-Dichloroethane-d4	↓	24.42	97.7	97.7	↓
Toluene-d8	↓	24.42	97.7	97.7	↓
Bromofluorobenzene	↓	24.17	96.7	96.7	↓

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 #: 38023A/

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Page: 1 of 1
 Reviewer: FT
 2nd Reviewer: K/K

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: 170113BL - LCS

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	NA	9.67	NA	96.7	96.7				
Toluene	10.0	↓	9.94	↓	99.4	99.4	WA			
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 0053

LDC Report Date: February 10, 2017

Parameters: Phenol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH172**	AZ48915**	Water	01/11/17
ERH178	AZ48916	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH184	AZ48925	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Laboratory Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Field Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A2a
 SDG #: 81971
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 2/8/17
 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	A Δ	% RSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20
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
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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH172**	AZ48915**	Water	01/11/17
2	ERH178	AZ48916	Water	01/11/17
3	ERH181	AZ48921	Water	01/12/17
4	ERH184	AZ48925	Water	01/12/17
5				
6				
7				
8				
9				

Notes:

170116A				

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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 \geq 0.990?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) $<$ 20% ?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) \leq 20% and relative response factors (RRF) within method criteria?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed 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 completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?		/		
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
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 ?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 38023A2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GCMS 8270C

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_x = Area of compound

C_x = Concentration of compound

S = Standard deviation of the RRFs

X = Mean of the RRFs

A_{is} = Area of associated internal standard

C_{is} = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 40 std)	Recalculated (RRF40 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	12/7/2016	A	2.002	2.002	1.974	1.974	2.00	2.00
	Yoda								

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 * (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, A_{is} = Area of associated internal standard
 C_x = Concentration of compound, 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	12074322 ccv	1/18/17	A	1.974	2.00	2.00	1.3	1.3
			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th 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: $SF/SS \cdot 100$

Where: SF = Surrogate Found
 SS = Surrogate Spiked

Sample ID: # 1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	100	57.98352	58.0	58.0	0
2-Fluorobiphenyl	↓	52.32881	52.3	52.3	↓
Terphenyl-d14	↓	55.48198	55.5	55.5	
Phenol-d5	200.0	29.18197	14.6	14.6	
2-Fluorophenol	200.0	49.14536	24.6	24.6	
2,4,6-Tribromophenol	↓	109.93439	55.0	55.0	↓
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					

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

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: 170116A - LCS

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	50.0	NA	13.8	NA	27.6	27.6	NA			
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 0053

LDC Report Date: February 10, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH172**	AZ48915**	Water	01/11/17
ERH178	AZ48916	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH184	AZ48925	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

For compounds where average relative response factors (RRFs) were utilized, 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification
Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -
SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A2b
 SDG #: 81971
 Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/9/17
 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	Δ	
III.	Initial calibration/ICV	A / Δ	% PSD ≤ 15 CV ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20
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	LCS
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	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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH172**	AZ48915**	Water	01/11/17
2	ERH178	AZ48916	Water	01/11/17
3	ERH181	AZ48921	Water	01/12/17
4	ERH184	AZ48925	Water	01/12/17
5				
6				
7				
8				
9				

Notes:

170116A				

TFT, W & S only

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

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check (Not required)				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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 \geq 0.990?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) \leq 20% ?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) $<$ 20% and relative response factors (RRF) $>$ 0.05?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.			/	
VI. Field blanks				
Were field blanks identified in this SDG?		/		
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
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?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
XI. Internal standards				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 38623A2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

METHOD: GCMS 8270^D

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 (RRF5 std)	Recalculated (RRF 5 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL Linus	1/16/2017	S (IS1)	1.158	1.158	1.022	1.022	12.00	12.00

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, A_{is} = Area of associated internal standard
 C_x = Concentration of compound, 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	0116 L022 CCV	1/18/17	S (1st IS)	1.022	1.185	1.185	16	16
			(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: # 1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	4.673	3.24447	69.4	69.4	0
2-Fluorobiphenyl	↓	3.25736	69.7	69.7	↓
Terphenyl-d14	↓	3.95807	84.7	84.7	↓
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					

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

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: 170116A - LCS

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>S</u>	<u>5.0</u>	<u>NA</u>	<u>2.86</u>	<u>NA</u>	<u>57.2</u>	<u>57.2</u>	<u>NA</u>	<u>NA</u>	<u>NA</u>	<u>NA</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_x = Area of the characteristic ion (EICP) for the compound to be measured
- A_s = Area of the characteristic ion (EICP) for the specific internal standard
- I_s = Amount of internal standard added in nanograms (ng)
- V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).
- V_i = Volume of extract injected in microliters (ul)
- V_i = 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. 170116A-LCS : S

Conc. = $\frac{22357 (2.5)}{(1.022)(19126)}$

=

2.86 ug/L

#	Sample ID	Compound	Reported Concentration ()	Calculated Concentration ()	Qualification

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 10, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH172**	AZ48915**	Water	01/11/17
ERH178	AZ48916	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH184	AZ48925	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

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

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%.

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 percent recoveries were within QC limits. Additionally, all 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) were analyzed as required by the method. Percent recoveries (%R) 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 with the exception noted in Section VII. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81971**

No Sample Data Qualified in this SDG

LDC #: 38023A2c
 SDG #: 81971
 Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 2/8/17

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

METHOD: GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-STM) *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, Δ	% RSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration / dosing CV	Δ	CV ≤ 20
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	LCS
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	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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH172**	AZ48915**	Water	01/11/17
2	ERH178	AZ48916	Water	01/11/17
3	ERH181	AZ48921	Water	01/12/17
4	ERH184	AZ48925	Water	01/12/17
5				
6				
7				
8				
9				

Notes:

170118A				

LDC #: 3802 3A 2C

VALIDATION FINDINGS CHECKLIST

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

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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 ?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) \leq 20% ?	/			
IV. Continuing calibration				
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?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.	/ F1	/		
VI. Field blanks				
Were field blanks were identified in this SDG?		/		
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
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 ?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			<input checked="" type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?			<input checked="" type="checkbox"/>	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			<input checked="" type="checkbox"/>	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	<input checked="" type="checkbox"/>			
Was an LCS analyzed per analytical batch?	<input checked="" type="checkbox"/>			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	<input checked="" type="checkbox"/>			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		<input checked="" type="checkbox"/>		
Were target compounds detected in the field duplicates?			<input checked="" type="checkbox"/>	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	<input checked="" type="checkbox"/>			
Were retention times within + 30 seconds of the associated calibration standard?	<input checked="" type="checkbox"/>			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	<input checked="" 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"/>			
XIII. Target compound identification				
Were relative retention times (RRT's) within + 0.06 RRT units of the standard?	<input checked="" type="checkbox"/>			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	<input checked="" type="checkbox"/>			
Were chromatogram peaks verified and accounted for?	<input checked="" type="checkbox"/>			
XIV. System performance				
System performance was found to be acceptable.	<input checked="" type="checkbox"/>			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	<input checked="" type="checkbox"/>			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 38023 A2c

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GCMS 8270C

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 400 std)	Recalculated (RRF400 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	12/20/2016	2-(2-Methoxyethoxy) Ethanol	0.2253	0.2253	0.2144	0.2144	9.90	9.90
	Yoda								

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 * (ave. RRF - RRF)/ave. RRF
 RRF = (A_x)(C_s)/(A_s)(C_x)

Where: ave. RRF = initial calibration average RRF
 RRF = continuing calibration RRF
 A_x = Area of compound, A_s = Area of associated internal standard
 C_x = Concentration of compound, C_s = 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	1220Y074	1/19/17	2-(2-MEE)	(1st IS) 0.2144	0.2423	0.2423	13	13
				(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
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 170110A - LCS

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>NA</u>	<u>41.2</u>	<u>NA</u>	<u>51.5</u>	<u>51.5</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.

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 13, 2017

Parameters: Wet Chemistry

Validation Level: Level C & D

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH172**	AZ48915**	Water	01/11/17
ERH178	AZ48916	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH184	AZ48925	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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

All sample results were subjected to Level III 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 IV 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).
- 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
ERH172**	Nitrate	48.12 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	Associated Samples
PB (prep blank)	Bicarbonate alkalinity Total alkalinity	1.6 mg/L 1.6 mg/L	All samples in SDG 81971

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) were analyzed as required by the methods. Percent recoveries (%R) 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.

XI. Overall Assessment of Data

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

Due to technical holding time, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Data Qualification Summary - SDG 81971**

Sample	Analyte	Flag	A or P	Reason (Code)
ERH172**	Nitrate	J (all detects)	P	Technical holding times (H)

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Field Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A6
 SDG #: 81971
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET

Level C **10**

Date: **2-9-17**

Page: **1 of 1**

Reviewer: **MG**
 2nd Reviewer: **PF**

METHOD: (Analyte) Alkalinity (SM2320B), Chloride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B)

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	SW	
II.	Initial calibration	A	
III.	Calibration verification	A	
IV.	Laboratory Blanks	SW	
V.	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VII.	Duplicate sample analysis	N	" "
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Sample result verification	A*	
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

****Level D**

	Client ID	Lab ID	Matrix	Date
1	ERH172 **	AZ48915	Water	01/11/17
2	ERH178	AZ48916	Water	01/11/17
3	ERH181	AZ48921	Water	01/12/17
4	ERH184	AZ48925	Water	01/12/17
5				
6				
7				
8				
9				
10				
11				
12				
13	PBW1			
14	PBW2			
15	PBW3			

Notes:

Method: Inorganics (EPA Method *see cover*)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.		✓		
Cooler temperature criteria was met.	✓			
II. Calibration				
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)			✓	
III. Blanks				
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.	✓			
IV. Matrix spike/Matrix spike duplicates and Duplicates				
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 / <u>Water</u>		✓		
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) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL (≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were < 5X the CRDL.			✓	
V. Laboratory control samples				
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?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?			✓	

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

VALIDATION FINDINGS WORKSHEET

Blanks

METHOD: Inorganics, Method See Cover

Conc. units: mg/L

Associated Samples: all (>LOQ)

Analyte	Blank ID	Blank ID	Blank Action Limit														
	PB	ICB/CCB (mg/L)		No Qual's.													
Bicarbonate Alkalinity	1.6																
Total Alkalinity	1.6																

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

LDC #: 38023A6

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Page: 1 of 1
 Reviewer: MG
 2nd Reviewer: RK

METHOD: Inorganics, Method See coverThe correlation coefficient (r) for the calibration of Fe²⁺ was recalculated. Calibration date: 1-13-17

An initial or 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 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 ID	Conc. Found (units)	Abs. True (units)	Recalculated	Reported	Acceptable (Y/N)
					r or %R	r or %R	
Initial calibration	Ferrous Iron	Blank	0 (mg/L)	0.000	$r^2 = 0.9998278$	$r^2 = 0.9998278$	Y
		Standard 1	1 ()	0.101			
		Standard 2	2 ()	0.201			
		Standard 3	4 ()	0.403			
		Standard 4	5 ()	0.512			
		Standard 5	10 (↓)	0.999			
		Standard 6	-	-			
		Standard 7	-	-			
Calibration verification	Cl	0910 CCV	24.38 (mg/L)	25 (mg/L)	97.5	97.5	
Calibration verification	NO ₃	0910 CCV	21.63 (mg/L)	22.1 (mg/L)	97.9	97.9	
Calibration verification	SO ₄	0910 CCV	23.81 (mg/L)	25 (mg/L)	95.2	95.3	↓

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 #: 38023A6

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Page: 1 of 1
 Reviewer: MG
 2nd Reviewer: RK

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	
LCS	Laboratory control sample	Total Alk	247.8 (mg/L)	250 (mg/L)	99.1	99.2	Y
—	Matrix spike sample	—	(SSR-SR)	—	—	—	—
—	Duplicate sample	—	—	—	—	—	—

Comments: Refer to appropriate 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 0053

LDC Report Date: February 10, 2017

Parameters: Total Petroleum Hydrocarbons as Gasoline

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH171	AZ48914	Water	01/11/17
ERH172**	AZ48915**	Water	01/11/17
ERH178**	AZ48916**	Water	01/11/17
ERH185	AZ48917	Water	01/11/17
ERH199	AZ48918	Water	01/11/17
ERH200	AZ48919	Water	01/11/17
ERH201	AZ48920	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH203	AZ48922	Water	01/12/17
ERH180	AZ48923	Water	01/12/17
ERH183	AZ48924	Water	01/12/17
ERH184	AZ48925	Water	01/12/17
ERH202	AZ48926	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 Gasoline 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 ERH171, ERH185, ERH180, and ERH183 were identified as trip blanks. No contaminants were found.

Samples ERH199, ERH200, ERH201, ERH203, and ERH202 were identified as ambient 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG
81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification
Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification
Summary - SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A7

VALIDATION COMPLETENESS WORKSHEET

Date: 2/9/17

SDG #: 81971

Level C/D

Page: 1 of 2

Laboratory: APPL Labs

Reviewer: EF2nd Reviewer: EF

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	Δ/A	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ/A	1 ² ICV = 20
IV.	Continuing calibration	Δ	CW = 20
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1, 4, 10, 11 AB = 5, 6, 7, 9, 13
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	Δ	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	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

ΔB = Ambient Blank

SB = Source blank
OTHER:

** Indicates sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1 3	ERH171 TB	AZ48914	Water	01/11/17
2 3	ERH172**	AZ48915**	Water	01/11/17
3 3	ERH178 **	AZ48916* *	Water	01/11/17
4 3	ERH185 TB	AZ48917	Water	01/11/17
5 1	ERH199 AB	AZ48918	Water	01/11/17
6 1	ERH200 AB	AZ48919	Water	01/11/17
7 2	ERH201 AB	AZ48920	Water	01/11/17
8 2	ERH181	AZ48921	Water	01/12/17
9 2	ERH203 AB	AZ48922	Water	01/12/17
10 2	ERH180 TB	AZ48923	Water	01/12/17
11 2	ERH183 TB	AZ48924	Water	01/12/17
12 2	ERH184	AZ48925	Water	01/12/17
13 2	ERH202 AD	AZ48926	Water	01/12/17

LDC #: 38023A7
SDG #: 81971
Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 2/9/17
Page: 2 of 2
Reviewer: [Signature]
2nd Reviewer: [Signature]

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

	Client ID	Lab ID	Matrix	Date
14				
15				
16				
17				
18				

Notes:

1	170113AM					
2	170113BM					
3	170113BL					

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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 ?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) $< 20\%$ or percent recoveries (%R) 80-120%?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?			/	
Were all percent differences (%D) $\leq 20\%$ and relative response factors (RRF) ≥ 0.05 ?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?	/			
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	/			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII: Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX: Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X: Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
XI: Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII: Compound quantitation				
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?	/			
XIII: Target compound identification				
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?	/			
XIV: System performance				
System performance was found to be acceptable.	/			
XV: Overall assessment of data				
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#: 3802397
 SDG#: see cover

VALIDATION FINDINGS WORKSHEET
 Initial Calibration Calculation Verification

Page: 1 of 1
 Reviewer: EF
 2nd Reviewer: KK

Method: GRO (8260B)

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
1/12/2017	GCMS Loki	Gasoline Range Organics	1	10.22790007	0.8
			2	11.3350485	2
			3	13.2098067	4
			4	19.70700192	12
			5	29.05892957	24
			6	35.43328362	32
			7	42.58810881	40

Regression Output

Reported

Constant	9.740247	9.740000
Std Err of Y Est		
R Squared	0.999625	1.000000
Degrees of Freedom		
X Coefficient(s)	0.813400	0.813000
Std Err of Coef.		
Correlation Coefficient	0.999812	
Coefficient of Determination (r ²)	0.999625	1.000000

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	0113138 occa	11/14/17	GRU (IS1)	300.0	293.07	293.07	2.3	2.3
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					

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 #: 38023A7

VALIDATION FINDINGS WORKSHEET

Surrogate Results Verification

Page: 1 of 1Reviewer: FT2nd reviewer: VF**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 SpikedSample ID: #2

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene	25.0	24.17	96.7	96.7	0

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 #: 38023A7

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

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

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: F0113BL - LCS

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
GRO 1,1-Dichloroethene	300	NA	293	NA	97.7	97.7	NA			
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 0053
LDC Report Date: February 10, 2017
Parameters: Total Petroleum Hydrocarbons as Extractables
Validation Level: Level C & D
Laboratory: APPL, Inc.
Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH172**	AZ48915**	Water	01/11/17
ERH178	AZ48916	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH184	AZ48925	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds

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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -
SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data
Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification
Summary - SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A8
 SDG #: 81971
 Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/8/17
 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 / A	
II.	Initial calibration/ICV	A / A	% RSD / ICV ≤ 20
III.	Continuing calibration	A	CW ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LCS
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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH172**	AZ48915**	Water	01/11/17
2	ERH178	AZ48916	Water	01/11/17
3	ERH181	AZ48921	Water	01/12/17
4	ERH184	AZ48925	Water	01/12/17
5				
6				
7				
8				
9				
10				
11				

Notes:

170116A				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
II. Instrument Holding Times				
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"/>	
III. Initial Calibration				
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 ≥ 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"/>	
III. Initial Calibration Verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
III. Continuing Calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) \leq 20% or percent recoveries (%R) 80-120%?	<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"/>	
IV. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
V. Field Blanks				
Were field blanks 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"/>	
VI. Surrogate Spikes				
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"/>	
VII. Matrix Spike/Matrix Spike Duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD, Soil / Water.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

Validation Area	Yes	No	NA	Findings/Comments
VII Laboratory control samples				
Was an LCS analyzed for this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was an LCS analyzed per 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"/>	
VIII Field duplicates				
Were field duplicate pairs identified in this SDG?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Were target compounds detected in the field duplicates?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
IX Compound quantitation				
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"/>	
XI Target compound identification				
Were the retention times of reported detects within the RT windows?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
XIII Overall assessment of data				
Overall assessment of data was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

LDC #: 38023A8

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT
2nd Reviewer: KK

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: 170116A - LC 9

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 [C10-C14] (8015)	1330	NA	1080	NA	81.0	81	NA			
Benzene (8021B)			(1082.681)							
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.

LDC #: 38023A8

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

$$\text{Concentration} = \frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$$

Example:

Sample ID: #1 Compound Name Dieldrin 90-24

- A= Area or height of the compound to be measured
- Fv= Final Volume of extract
- Df= Dilution Factor
- RF= Average response factor of the compound
in the initial calibration
- Vs= Initial volume of the sample
- Ws= Initial weight of the sample
- %S= Percent Solid

$$\text{Concentration} = \frac{227275411 (2) (1000)}{1727130 (1500) (2)} = 88 \text{ ug/L}$$

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 10, 2017

Parameters: Ethylene Dibromide

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH178	AZ48916	Water	01/11/17
ERH185	AZ48917	Water	01/11/17
ERH199	AZ48918	Water	01/11/17
ERH201	AZ48920	Water	01/11/17

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% for all compounds.

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 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 ERH185 was identified as a trip blank. No contaminants were found.

Samples ERH199 and ERH201 were identified as ambient 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Laboratory Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Ethylene Dibromide - Field Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A10
 SDG #: 81971
 Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET

Level C

Date: 2/8/17
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC Ethylene Dibromide (EPA SW 846 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 ≤ 20
III.	Continuing calibration	A	CCV ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	TB = 2 AB = 3,4
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LCS
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

AB = Ambient Blank
 SB = Source blank
 OTHER:

	Client ID	Lab ID	Matrix	Date
1	ERH178	AZ48916	Water	01/11/17
2	ERH185 TB	AZ48917	Water	01/11/17
3	ERH199 AB	AZ48918	Water	01/11/17
4	ERH201 AB	AZ48920	Water	01/11/17
5				
6				
7				
8				
9				
10				
11				

Notes:

170118A				

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 10, 2017

Parameters: Methane

Validation Level: Level C & D

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH171	AZ48914	Water	01/11/17
ERH172**	AZ48915**	Water	01/11/17
ERH178	AZ48916	Water	01/11/17
ERH185	AZ48917	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH180	AZ48923	Water	01/12/17
ERH183	AZ48924	Water	01/12/17
ERH184	AZ48925	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 of all compounds in the calibration standards were within the established retention time windows. 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 ERH171, ERH185, ERH180, and ERH183 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Laboratory Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Field Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A51
 SDG #: 81971
 Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/8/17
 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	Δ / Δ	
II.	Initial calibration/ICV	Δ / A	ICV = 70
III.	Continuing calibration	Δ	CW = 20
IV.	Laboratory Blanks	Δ	
V.	Field blanks	ND	TB = 1, 4, 7, 8
VI.	Matrix spike/Matrix spike duplicates	N	CS
VII.	Laboratory control samples	A	CS
VIII.	Field duplicates	N	
IX.	Compound quantitation RL/LOQ/LODs	Δ	Not reviewed for Level C validation.
X.	Target compound identification	Δ	Not reviewed for Level C validation.
XI.	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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH171 TB	AZ48914	Water	01/11/17
2	ERH172**	AZ48915**	Water	01/11/17
3	ERH178	AZ48916	Water	01/11/17
4	ERH185 TB	AZ48917	Water	01/11/17
5	ERH181	AZ48921	Water	01/12/17
6	ERH203 AD M	AZ48922 M	Water	01/12/17
7	ERH180 TB	AZ48923	Water	01/12/17
8	ERH183 TB	AZ48924	Water	01/12/17
9	ERH184	AZ48925	Water	01/12/17
10				
11				
12				
13				
14				

Notes:

- 10116 B				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. Initial calibration				
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"/>	
III. Initial calibration verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
III. Continuing calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
IV. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
V. Field Blanks				
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"/>	
VI. Surrogate spikes				
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"/>	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

VALIDATION FINDINGS CHECKLIST

Validation Area	Yes	No	NA	Findings/Comments
III Laboratory control samples				
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 QC limits?	/			
IV Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
V Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
VI Target compound identification				
Were the retention times of reported detects within the RT windows?	/			
VII Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

LDC#: 3802375/
 SDG#: to lower

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

Method: RSK 175

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
9/1/2016	Ints 7890	Methane	1	6703	0.9
			2	10209	1.8
			3	15515	5.1
			4	45792	13.33
			5	28664	26.7
			6	67137	66.75
			7	126422	106.8
			8	421052	320.4
			9	723824	667.5
			10	1454283	1335

Regression Output

Reported

Constant	14373.549641	14400.00
Std Err of Y Est		
R Squared	0.997596	0.998000
Degrees of Freedom		
X Coefficient(s)	1083.161249	1083.00
Std Err of Coef.		
Correlation Coefficient	0.998797	
Coefficient of Determination (r ²)	0.997596	0.998000

LDC #: 3802395/

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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

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	17011631 ccv	1/16/17	Methane	1335	1064.918	1064.918	20	20
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 #: 38023A5/

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT

2nd Reviewer: K/K

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: 17016B

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)	1340	NA	1060	NA	79.4	79.4	NA			
2,4-D (8151)			(1064.918)							
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.

LDC #: 38023A5/

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

Page: 1 of 1
Reviewer: FT
2nd Reviewer: K/L

METHOD: GC HPLC

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 within 10% of the reported results?

Concentration = $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

Example:

Sample ID: #2 Compound Name Methane

- A= Area or height of the compound to be measured
- Fv= Final Volume of extract
- Df= Dilution Factor
- RF= Average response factor of the compound
 In the initial calibration
- Vs= Initial volume of the sample
- Ws= Initial weight of the sample
- %S= Percent Solid

Concentration = $\frac{(517617 - 1.44 \times 10^4)(10)}{(1.08 \times 10^3)}$
= 4600 ug/L

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

**Red Hill Bulk Storage Facility, CTO 0053 - SDG 81971
LDC 38023**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 2320B													
ERH172	AZ48915	1	ALKALINITY, AS CaCO3	1/11/2017 12:05:00 PM	1/16/2017 2:06:00 PM	D	92.9	MG_L		2.0	1.70		
ERH172	AZ48915	1	ALKALINITY, BICARBONATE	1/11/2017 12:05:00 PM	1/16/2017 2:06:00 PM	D	92.9	MG_L		2.0	1.70		
ERH172	AZ48915	1	ALKALINITY, CARBONATE	1/11/2017 12:05:00 PM	1/16/2017 2:06:00 PM	D	1.70	MG_L	U	2.0	1.70		U
ERH178	AZ48916	1	ALKALINITY, AS CaCO3	1/11/2017 4:05:00 PM	1/16/2017 2:12:00 PM	C	70.6	MG_L		2.0	1.70		
ERH178	AZ48916	1	ALKALINITY, BICARBONATE	1/11/2017 4:05:00 PM	1/16/2017 2:12:00 PM	C	70.6	MG_L		2.0	1.70		
ERH178	AZ48916	1	ALKALINITY, CARBONATE	1/11/2017 4:05:00 PM	1/16/2017 2:12:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH181	AZ48921	1	ALKALINITY, AS CaCO3	1/12/2017 10:15:00 AM	1/16/2017 2:17:00 PM	C	294	MG_L		2.0	1.70		
ERH181	AZ48921	1	ALKALINITY, BICARBONATE	1/12/2017 10:15:00 AM	1/16/2017 2:17:00 PM	C	294	MG_L		2.0	1.70		
ERH181	AZ48921	1	ALKALINITY, CARBONATE	1/12/2017 10:15:00 AM	1/16/2017 2:17:00 PM	C	1.70	MG_L	U	2.0	1.70		U
ERH184	AZ48925	1	ALKALINITY, AS CaCO3	1/12/2017 10:05:00 AM	1/16/2017 2:32:00 PM	C	178	MG_L		2.0	1.70		
ERH184	AZ48925	1	ALKALINITY, BICARBONATE	1/12/2017 10:05:00 AM	1/16/2017 2:32:00 PM	C	178	MG_L		2.0	1.70		
ERH184	AZ48925	1	ALKALINITY, CARBONATE	1/12/2017 10:05:00 AM	1/16/2017 2:32:00 PM	C	1.70	MG_L	U	2.0	1.70		U
METHOD: 300.0													
ERH172	AZ48915	1	CHLORIDE	1/11/2017 12:05:00 PM	1/13/2017 12:12:00 PM	D	39.9	MG_L		1.0	0.20		
ERH172	AZ48915	1	NITRATE	1/11/2017 12:05:00 PM	1/13/2017 12:12:00 PM	D	0.42	MG_L	J	0.5	0.18	J	h
ERH172	AZ48915	1	SULFATE	1/11/2017 12:05:00 PM	1/13/2017 12:12:00 PM	D	4.5	MG_L		1.0	0.20		
ERH178	AZ48916	2	CHLORIDE	1/11/2017 4:05:00 PM	1/13/2017 1:59:00 PM	C	51.9	MG_L	D	2.0	0.40		
ERH178	AZ48916	1	NITRATE	1/11/2017 4:05:00 PM	1/13/2017 12:26:00 PM	C	2.2	MG_L		0.5	0.18		
ERH178	AZ48916	1	SULFATE	1/11/2017 4:05:00 PM	1/13/2017 12:26:00 PM	C	9.3	MG_L		1.0	0.20		
ERH181	AZ48921	1	CHLORIDE	1/12/2017 10:15:00 AM	1/13/2017 3:34:00 PM	C	47.1	MG_L		1.0	0.20		
ERH181	AZ48921	1	NITRATE	1/12/2017 10:15:00 AM	1/13/2017 3:34:00 PM	C	6.2	MG_L		0.5	0.18		
ERH181	AZ48921	1	SULFATE	1/12/2017 10:15:00 AM	1/13/2017 3:34:00 PM	C	44.2	MG_L		1.0	0.20		
ERH184	AZ48925	50	CHLORIDE	1/12/2017 10:05:00 AM	1/16/2017 11:51:00 AM	C	1040	MG_L		50.0	10.00		
ERH184	AZ48925	5	NITRATE	1/12/2017 10:05:00 AM	1/13/2017 3:47:00 PM	C	7.9	MG_L		2.5	0.90		
ERH184	AZ48925	50	SULFATE	1/12/2017 10:05:00 AM	1/16/2017 11:51:00 AM	C	328	MG_L		50.0	10.00		
METHOD: 3500_FE_B													

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 3500_FE_B													
ERH172	AZ48915	1	IRON, FERROUS	1/11/2017 12:05:00 PM	1/13/2017 6:03:00 PM	D	0.56	MG_L	J	1.0	0.32	J	
ERH178	AZ48916	1	IRON, FERROUS	1/11/2017 4:05:00 PM	1/13/2017 6:04:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
ERH181	AZ48921	1	IRON, FERROUS	1/12/2017 10:15:00 AM	1/13/2017 6:05:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
ERH184	AZ48925	1	IRON, FERROUS	1/12/2017 10:05:00 AM	1/13/2017 6:06:00 PM	C	0.32	MG_L	U	1.0	0.32	U	
METHOD: 8011													
ERH178	AZ48916	1	1,2-DIBROMOETHANE	1/11/2017 4:05:00 PM	1/18/2017 6:17:00 PM	C	0.020	UG_L	U	0.02	0.020	U	
ERH185	AZ48917	1	1,2-DIBROMOETHANE	1/11/2017 1:40:00 PM	1/18/2017 6:38:00 PM	C	0.020	UG_L	U	0.02	0.020	U	
ERH199	AZ48918	1	1,2-DIBROMOETHANE	1/11/2017 2:00:00 PM	1/18/2017 6:58:00 PM	C	0.020	UG_L	U	0.02	0.020	U	
ERH201	AZ48920	1	1,2-DIBROMOETHANE	1/11/2017 5:10:00 PM	1/18/2017 7:19:00 PM	C	0.020	UG_L	U	0.02	0.020	U	
METHOD: 8015B_E													
ERH172	AZ48915	1	TPH-DIESEL RANGE	1/11/2017 12:05:00 PM	1/19/2017 12:34:00 AM	D	88	UG_L	T6	40.0	25.00		
ERH172	AZ48915	1	TPH-OIL RANGE	1/11/2017 12:05:00 PM	1/19/2017 12:34:00 AM	D	40.00	UG_L	U	40.0	40.00	U	
ERH178	AZ48916	1	TPH-DIESEL RANGE	1/11/2017 4:05:00 PM	1/19/2017 12:54:00 AM	C	25.00	UG_L	U	40.0	25.00	U	
ERH178	AZ48916	1	TPH-OIL RANGE	1/11/2017 4:05:00 PM	1/19/2017 12:54:00 AM	C	40.00	UG_L	U	40.0	40.00	U	
ERH181	AZ48921	1	TPH-DIESEL RANGE	1/12/2017 10:15:00 AM	1/19/2017 1:15:00 AM	C	51	UG_L	T3I	40.0	25.00		
ERH181	AZ48921	1	TPH-OIL RANGE	1/12/2017 10:15:00 AM	1/19/2017 1:15:00 AM	C	46	UG_L		40.0	40.00		
ERH184	AZ48925	1	TPH-DIESEL RANGE	1/12/2017 10:05:00 AM	1/19/2017 1:35:00 AM	C	25.00	UG_L	U	40.0	25.00	U	
ERH184	AZ48925	1	TPH-OIL RANGE	1/12/2017 10:05:00 AM	1/19/2017 1:35:00 AM	C	45	UG_L	T3M	40.0	40.00		
METHOD: 8260B													
ERH171	AZ48914	1	BENZENE	1/11/2017 12:00:00 PM	1/14/2017 9:47:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH171	AZ48914	1	ETHYLBENZENE	1/11/2017 12:00:00 PM	1/14/2017 9:47:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH171	AZ48914	1	TOLUENE	1/11/2017 12:00:00 PM	1/14/2017 9:47:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH171	AZ48914	1	TPH-GASOLINE RANGE C6-C10	1/11/2017 12:00:00 PM	1/14/2017 9:46:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH171	AZ48914	1	XYLENES, TOTAL	1/11/2017 12:00:00 PM	1/14/2017 9:47:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH172	AZ48915	1	BENZENE	1/11/2017 12:05:00 PM	1/14/2017 10:14:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH172	AZ48915	1	ETHYLBENZENE	1/11/2017 12:05:00 PM	1/14/2017 10:14:00 AM	D	0.50	UG_L	U	1.0	0.50	U	
ERH172	AZ48915	1	TOLUENE	1/11/2017 12:05:00 PM	1/14/2017 10:14:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH172	AZ48915	1	TPH-GASOLINE RANGE C6-C10	1/11/2017 12:05:00 PM	1/14/2017 10:15:00 AM	D	18.0	UG_L	U	20	18.0	U	

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8260B													
ERH172	AZ48915	1	XYLENES, TOTAL	1/11/2017 12:05:00 PM	1/14/2017 10:14:00 AM	D	0.30	UG_L	U	2.0	0.30	U	
ERH178	AZ48916	1	1,2-DICHLOROETHANE	1/11/2017 4:05:00 PM	1/14/2017 10:42:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH178	AZ48916	1	BENZENE	1/11/2017 4:05:00 PM	1/14/2017 10:42:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH178	AZ48916	1	ETHYLBENZENE	1/11/2017 4:05:00 PM	1/14/2017 10:42:00 AM	D	0.50	UG_L	U	1.0	0.50	U	
ERH178	AZ48916	1	TOLUENE	1/11/2017 4:05:00 PM	1/14/2017 10:42:00 AM	D	0.30	UG_L	U	1.0	0.30	U	
ERH178	AZ48916	1	TPH-GASOLINE RANGE C6-C10	1/11/2017 4:05:00 PM	1/14/2017 10:43:00 AM	D	18.0	UG_L	U	20	18.0	U	
ERH178	AZ48916	1	XYLENES, TOTAL	1/11/2017 4:05:00 PM	1/14/2017 10:42:00 AM	D	0.30	UG_L	U	2.0	0.30	U	
ERH185	AZ48917	1	1,2-DICHLOROETHANE	1/11/2017 1:40:00 PM	1/14/2017 11:10:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH185	AZ48917	1	BENZENE	1/11/2017 1:40:00 PM	1/14/2017 11:10:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH185	AZ48917	1	ETHYLBENZENE	1/11/2017 1:40:00 PM	1/14/2017 11:10:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH185	AZ48917	1	TOLUENE	1/11/2017 1:40:00 PM	1/14/2017 11:10:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH185	AZ48917	1	TPH-GASOLINE RANGE C6-C10	1/11/2017 1:40:00 PM	1/14/2017 11:11:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH185	AZ48917	1	XYLENES, TOTAL	1/11/2017 1:40:00 PM	1/14/2017 11:10:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH199	AZ48918	1	1,2-DICHLOROETHANE	1/11/2017 2:00:00 PM	1/14/2017 12:21:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH199	AZ48918	1	BENZENE	1/11/2017 2:00:00 PM	1/14/2017 12:21:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH199	AZ48918	1	ETHYLBENZENE	1/11/2017 2:00:00 PM	1/14/2017 12:21:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH199	AZ48918	1	TOLUENE	1/11/2017 2:00:00 PM	1/14/2017 12:21:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH199	AZ48918	1	TPH-GASOLINE RANGE C6-C10	1/11/2017 2:00:00 PM	1/14/2017 12:22:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH199	AZ48918	1	XYLENES, TOTAL	1/11/2017 2:00:00 PM	1/14/2017 12:21:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH200	AZ48919	1	BENZENE	1/11/2017 1:40:00 PM	1/14/2017 12:50:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH200	AZ48919	1	ETHYLBENZENE	1/11/2017 1:40:00 PM	1/14/2017 12:50:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH200	AZ48919	1	TOLUENE	1/11/2017 1:40:00 PM	1/14/2017 12:50:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH200	AZ48919	1	TPH-GASOLINE RANGE C6-C10	1/11/2017 1:40:00 PM	1/14/2017 12:49:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH200	AZ48919	1	XYLENES, TOTAL	1/11/2017 1:40:00 PM	1/14/2017 12:50:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH201	AZ48920	1	1,2-DICHLOROETHANE	1/11/2017 5:10:00 PM	1/14/2017 7:25:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH201	AZ48920	1	BENZENE	1/11/2017 5:10:00 PM	1/14/2017 7:25:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH201	AZ48920	1	ETHYLBENZENE	1/11/2017 5:10:00 PM	1/14/2017 7:25:00 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
METHOD: 8260B													
ERH201	AZ48920	1	TOLUENE	1/11/2017 5:10:00 PM	1/14/2017 7:25:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH201	AZ48920	1	TPH-GASOLINE RANGE C6-C10	1/11/2017 5:10:00 PM	1/14/2017 7:24:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH201	AZ48920	1	XYLENES, TOTAL	1/11/2017 5:10:00 PM	1/14/2017 7:25:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH181	AZ48921	1	BENZENE	1/12/2017 10:15:00 AM	1/14/2017 7:52:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH181	AZ48921	1	ETHYLBENZENE	1/12/2017 10:15:00 AM	1/14/2017 7:52:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH181	AZ48921	1	TOLUENE	1/12/2017 10:15:00 AM	1/14/2017 7:52:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH181	AZ48921	1	TPH-GASOLINE RANGE C6-C10	1/12/2017 10:15:00 AM	1/14/2017 7:53:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH181	AZ48921	1	XYLENES, TOTAL	1/12/2017 10:15:00 AM	1/14/2017 7:52:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH203	AZ48922	1	BENZENE	1/12/2017 11:15:00 AM	1/14/2017 8:20:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH203	AZ48922	1	ETHYLBENZENE	1/12/2017 11:15:00 AM	1/14/2017 8:20:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH203	AZ48922	1	TOLUENE	1/12/2017 11:15:00 AM	1/14/2017 8:20:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH203	AZ48922	1	TPH-GASOLINE RANGE C6-C10	1/12/2017 11:15:00 AM	1/14/2017 8:21:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH203	AZ48922	1	XYLENES, TOTAL	1/12/2017 11:15:00 AM	1/14/2017 8:20:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH180	AZ48923	1	BENZENE	1/12/2017 9:45:00 AM	1/14/2017 8:48:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH180	AZ48923	1	ETHYLBENZENE	1/12/2017 9:45:00 AM	1/14/2017 8:48:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH180	AZ48923	1	TOLUENE	1/12/2017 9:45:00 AM	1/14/2017 8:48:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH180	AZ48923	1	TPH-GASOLINE RANGE C6-C10	1/12/2017 9:45:00 AM	1/14/2017 8:49:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH180	AZ48923	1	XYLENES, TOTAL	1/12/2017 9:45:00 AM	1/14/2017 8:48:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH183	AZ48924	1	BENZENE	1/12/2017 8:00:00 AM	1/14/2017 9:17:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH183	AZ48924	1	ETHYLBENZENE	1/12/2017 8:00:00 AM	1/14/2017 9:17:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH183	AZ48924	1	TOLUENE	1/12/2017 8:00:00 AM	1/14/2017 9:17:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH183	AZ48924	1	TPH-GASOLINE RANGE C6-C10	1/12/2017 8:00:00 AM	1/14/2017 9:18:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH183	AZ48924	1	XYLENES, TOTAL	1/12/2017 8:00:00 AM	1/14/2017 9:17:00 AM	C	0.78	UG_L	J	2.0	0.30	J	
ERH184	AZ48925	1	BENZENE	1/12/2017 10:05:00 AM	1/14/2017 9:45:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH184	AZ48925	1	ETHYLBENZENE	1/12/2017 10:05:00 AM	1/14/2017 9:45:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH184	AZ48925	1	TOLUENE	1/12/2017 10:05:00 AM	1/14/2017 9:45:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH184	AZ48925	1	TPH-GASOLINE RANGE C6-C10	1/12/2017 10:05:00 AM	1/14/2017 9:46:00 AM	C	18.0	UG_L	U	20	18.0	U	

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8260B													
ERH184	AZ48925	1	XYLENES, TOTAL	1/12/2017 10:05:00 AM	1/14/2017 9:45:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH202	AZ48926	1	BENZENE	1/12/2017 10:30:00 AM	1/14/2017 10:14:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH202	AZ48926	1	ETHYLBENZENE	1/12/2017 10:30:00 AM	1/14/2017 10:14:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH202	AZ48926	1	TOLUENE	1/12/2017 10:30:00 AM	1/14/2017 10:14:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH202	AZ48926	1	TPH-GASOLINE RANGE C6-C10	1/12/2017 10:30:00 AM	1/14/2017 10:13:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH202	AZ48926	1	XYLENES, TOTAL	1/12/2017 10:30:00 AM	1/14/2017 10:14:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
METHOD: 8270D													
ERH172	AZ48915	1	2-(2-METHOXYETHOXY)-ETHANOL	1/11/2017 12:05:00 PM	1/19/2017 12:27:00 PM	D	80.0	UG_L	U	100	80.0	U	
ERH172	AZ48915	1	PHENOL	1/11/2017 12:05:00 PM	1/18/2017 5:52:00 PM	D	4.00	UG_L	U	5.0	4.00	U	
ERH178	AZ48916	1	2-(2-METHOXYETHOXY)-ETHANOL	1/11/2017 4:05:00 PM	1/19/2017 12:57:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH178	AZ48916	1	PHENOL	1/11/2017 4:05:00 PM	1/18/2017 6:23:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH181	AZ48921	1	2-(2-METHOXYETHOXY)-ETHANOL	1/12/2017 10:15:00 AM	1/19/2017 1:28:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH181	AZ48921	1	PHENOL	1/12/2017 10:15:00 AM	1/18/2017 6:53:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH184	AZ48925	1	2-(2-METHOXYETHOXY)-ETHANOL	1/12/2017 10:05:00 AM	1/19/2017 1:58:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH184	AZ48925	1	PHENOL	1/12/2017 10:05:00 AM	1/18/2017 7:23:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
METHOD: 8270D_SIM													
ERH172	AZ48915	1	1-METHYLNAPHTHALENE	1/11/2017 12:05:00 PM	1/18/2017 7:53:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH172	AZ48915	1	2-METHYLNAPHTHALENE	1/11/2017 12:05:00 PM	1/18/2017 7:53:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH172	AZ48915	1	NAPHTHALENE	1/11/2017 12:05:00 PM	1/18/2017 7:53:00 PM	D	0.10	UG_L	U	0.2	0.10	U	
ERH178	AZ48916	1	1-METHYLNAPHTHALENE	1/11/2017 4:05:00 PM	1/18/2017 8:21:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH178	AZ48916	1	2-METHYLNAPHTHALENE	1/11/2017 4:05:00 PM	1/18/2017 8:21:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH178	AZ48916	1	NAPHTHALENE	1/11/2017 4:05:00 PM	1/18/2017 8:21:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH181	AZ48921	1	1-METHYLNAPHTHALENE	1/12/2017 10:15:00 AM	1/18/2017 8:49:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH181	AZ48921	1	2-METHYLNAPHTHALENE	1/12/2017 10:15:00 AM	1/18/2017 8:49:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH181	AZ48921	1	NAPHTHALENE	1/12/2017 10:15:00 AM	1/18/2017 8:49:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH184	AZ48925	1	1-METHYLNAPHTHALENE	1/12/2017 10:05:00 AM	1/18/2017 9:17:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH184	AZ48925	1	2-METHYLNAPHTHALENE	1/12/2017 10:05:00 AM	1/18/2017 9:17:00 PM	C	0.10	UG_L	U	0.2	0.10	U	

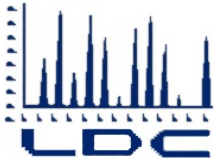
EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8270D_SIM													
ERH184	AZ48925	1	NAPHTHALENE	1/12/2017 10:05:00 AM	1/18/2017 9:17:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
METHOD: RSK-175													
ERH171	AZ48914	1	METHANE	1/11/2017 12:00:00 PM	1/16/2017 1:23:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH172	AZ48915	10	METHANE	1/11/2017 12:05:00 PM	1/16/2017 1:32:00 PM	D	4600	UG_L		50.0	10.00		
ERH178	AZ48916	1	METHANE	1/11/2017 4:05:00 PM	1/16/2017 1:36:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH185	AZ48917	1	METHANE	1/11/2017 1:40:00 PM	1/16/2017 1:39:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH181	AZ48921	1	METHANE	1/12/2017 10:15:00 AM	1/16/2017 1:42:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH180	AZ48923	1	METHANE	1/12/2017 9:45:00 AM	1/16/2017 1:45:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH183	AZ48924	1	METHANE	1/12/2017 8:00:00 AM	1/16/2017 1:47:00 PM	C	1.00	UG_L	U	5.0	1.00	U	
ERH184	AZ48925	1	METHANE	1/12/2017 10:05:00 AM	1/16/2017 1:50:00 PM	C	1.00	UG_L	U	5.0	1.00	U	

The attached zipped file contains one file:

<u>File</u>	<u>Format</u>	<u>Description</u>
1) Readme_RedHill_021517.docx	MS Word 2007	A "Readme" file (this document).
2) 81971_RH_COPC_dva.xlsx	MS Excel 2007	<u>A spreadsheet for the following SDGs:</u> 8197i 38023A

No discrepancies were observed between the hardcopy data packages and the electronic data deliverables during verification.

Please contact Stella Cuenco or Judy Ecklund at (760) 827-1100 if you have any questions regarding this electronic data submittal.



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 Thach

February 28, 2017

SUBJECT: Revised Red Hill Bulk Storage Facility, CTO 0053, Data Validation

Dear Ms. Thach,

Enclosed is the revised validation report for the fractions listed below. Please replace the previously submitted reports with the enclosed revised reports.

LDC Project #38023:

SDG #

Fraction

81971 Volatiles, Phenol, Polynuclear Aromatic Hydrocarbons, 2-(2-Methoxyethoxy)-ethanol, TPH as Gasoline, TPH as Extractables

- Revision: Added equipment blanks to the fractions listed above.

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

Sincerely,

Stella Cuenco
Operations Manager/Senior Chemist

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 27, 2017

Parameters: Volatiles

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH171	AZ48914	Water	01/11/17
ERH172**	AZ48915**	Water	01/11/17
ERH178**	AZ48916**	Water	01/11/17
ERH185	AZ48917	Water	01/11/17
ERH199	AZ48918	Water	01/11/17
ERH200	AZ48919	Water	01/11/17
ERH201	AZ48920	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH203	AZ48922	Water	01/12/17
ERH180	AZ48923	Water	01/12/17
ERH183	AZ48924	Water	01/12/17
ERH184	AZ48925	Water	01/12/17
ERH202	AZ48926	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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. 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 ERH171, ERH185, ERH180, and ERH183 were identified as trip blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH183	01/14/17	Xylenes, total	0.78 ug/L	ERH184

Samples ERH191 and ERH192 (from SDG 81936) were identified as equipment blanks. No contaminants were found.

Samples ERH199, ERH200, ERH201, ERH203, ERH202 were identified as ambient blanks. No contaminants were found.

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X for common contaminants, >5X for other contaminants) than the concentrations found in the associated field blanks.

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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Laboratory Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Field Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A1

VALIDATION COMPLETENESS WORKSHEET

Date: 2/9/17

SDG #: 81971

Level C/D

Page: of 2

Laboratory: APPL, Labs

Reviewer: PS2nd Reviewer: KK

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

+ 1,2 - Dichloroethane

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	% PSD = 15 ICV \leq 20
IV.	Continuing calibration/closing cert	A	CV \leq 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	SW	TB = 1, 4, 10, 11 * AB = 5, 6, 7, 9, 13 * EB = ERH191, ERH192 (81936)
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	Δ	CS
X.	Field duplicates	N	
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
N = Not provided/applicable
SW = See worksheet

ND = No compounds detected
R = Rinsate
FB = Field blank

D = Duplicate
TB = Trip blank
EB = Equipment blank

AB = Ambient Blank
SB = Source blank
OTHER:

** Indicates sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1 3	ERH171 TB	AZ48914	Water	01/11/17
2 3	ERH172**	AZ48915**	Water	01/11/17
3 3	ERH178** + 12 DCA	AZ48916	Water	01/11/17
4 3	ERH185 TB + 12 DCA	AZ48917	Water	01/11/17
5 1	ERH199 AB + 12 DCA	AZ48918	Water	01/11/17
6 1	ERH200 AB	AZ48919	Water	01/11/17
7 2	ERH201 AB + 12 DCA	AZ48920	Water	01/11/17
8 2	ERH181	AZ48921	Water	01/12/17
9 2	ERH203 AB	AZ48922	Water	01/12/17
10 2	ERH180 TB	AZ48923	Water	01/12/17
11 2	ERH183 ^m TB	AZ48924 ^m	Water	01/12/17
12 2	ERH184	AZ48925	Water	01/12/17
13 2	ERH202 AB	AZ48926	Water	01/12/17

LDC #: 38023A1
SDG #: 81971
Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET
Level C/D

Date: 2/9/17
Page: 2 of 2
Reviewer: [Signature]
2nd Reviewer: [Signature]

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

	Client ID	Lab ID	Matrix	Date
14				
15				
16				
17				
18				

Notes:

1	170113AM				
2	170113BM1				
3	170113BL				

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. GC/MS Instrument performance check				
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"/>	
IIIa. Initial calibration				
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 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 all percent relative standard deviations (%RSD) $\leq 30\%$ (15%) and relative response factors (RRF) ≥ 0.05 ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IIIb. Initial Calibration Verification				
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) $< 20\%$ or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing calibration				
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 checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) $\leq 20\%$ and relative response factors (RRF) ≥ 0.05 ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
V. Laboratory Blanks				
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 completeness worksheet.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
VI. Field blanks				
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 checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	<input checked="" type="checkbox"/>	<input 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 type="checkbox"/>	<input checked="" type="checkbox"/>	

LDC #: 38023A

VALIDATION FINDINGS CHECKLIST

Page: 2 of 2
 Reviewer: PF
 2nd Reviewer: PF

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		/	/	
Were target compounds detected in the field duplicates?			/	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
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	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 #: 38023 A)

VALIDATION FINDINGS WORKSHEET Field Blanks

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

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

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: 1/18/17

Field blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: TB Associated Samples: 12 (ND)

Compound	Blank ID	Sample Identification							
	<u>11</u>								
<u>GG</u>	<u>0.78</u>								

Blank units: _____ Associated sample units: _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification							

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as Methylene chloride, Acetone, 2-Butanone and Carbon disulfide that were detected in samples within ten times the associated field blank concentration were qualified as not detected, "U". Other contaminants within five times the field blank concentration were also qualified as not detected, "U".

LDC #: 38023A/

VALIDATION FINDINGS WORKSHEET Continuing Calibration Results Verification

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

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	0113 L35	1/13/17	V (IS1)	1.8910	1.828	1.828	3.3	3.3
			EE (IS2)	2.2630	2.287	2.287	1.0	1.0
			(IS3)					
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					

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 #: 38023A1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1

Reviewer: FT
 2nd reviewer: [Signature]

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	25.0	24.92	99.7	99.7	0
1,2-Dichloroethane-d4	↓	24.42	97.7	97.7	↓
Toluene-d8	↓	24.42	97.7	97.7	↓
Bromofluorobenzene	↓	24.17	96.7	96.7	↓

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 #: 38023A)

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

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: H0113BL - 105

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	NA	9.67	NA	96.7	96.7				
Toluene	10.0	↓	9.94	↓	99.4	99.4	WA			
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 0053
LDC Report Date: February 27, 2017
Parameters: Phenol
Validation Level: Level C & D
Laboratory: APPL, Inc.
Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH172**	AZ48915**	Water	01/11/17
ERH178	AZ48916	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH184	AZ48925	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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% 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 ERH191 and ERH192 (both from SDG 81936) were identified as equipment blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH191	01/06/17	Phenol	2.5 ug/L	ERH172**

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X for common contaminants, >5X for other contaminants) than the concentrations found in the associated field blanks.

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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Laboratory Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Field Blank Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A2a

VALIDATION COMPLETENESS WORKSHEET

Date: 2/8/17

SDG #: 81971

Level C/D

Page: 1 of 1

Laboratory: APPL, Labs

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	A / A	% RSD ≤ 15 ICV ≤ 20
IV.	Continuing calibration / closing CV	Δ	CV ≤ 20
V.	Laboratory Blanks	A	
VI.	Field blanks	SW	EB = ERH191, ERH192 (81936)
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	CS
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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH172**	AZ48915**	Water	01/11/17
2	ERH178	AZ48916	Water	01/11/17
3	ERH181	AZ48921	Water	01/12/17
4	ERH184	AZ48925	Water	01/12/17
5				
6				
7				
8				
9				

Notes:

170116A				

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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) 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?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) < 20% ?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed 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 completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?	/	X		
Were target compounds detected in the field blanks?	/		X	
VII. Surrogate spikes				
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 ?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 31023A2A

VALIDATION FINDINGS WORKSHEET Field Blanks

Page: 1 of 1

Reviewer: [Signature]

2nd Reviewer: [Signature]

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

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: 1/6/17

Field blank type: (circle one) Field Blank / Rinsate / Other: EB Associated Samples: 1

Compound	Blank ID	Sample Identification							
(SDG 81936)	ERH191								
Phenol	2.5								

Blank units: _____ **Associated sample units:** _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification							

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated field blank concentration were qualified as not detected, "U". Other contaminants within five times the field blank concentration were also qualified as not detected, "U".

LDC #: 38023A2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GCMS 8270C

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_x = Area of compound

C_x = Concentration of compound

S = Standard deviation of the RRFs

X = Mean of the RRFs

A_{is} = Area of associated internal standard

C_{is} = Concentration of internal Standard

#	Standard ID	Calibration Date	Compound	Reported (RRF 40 std)	Recalculated (RRF40 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	12/7/2016	A	2.002	2.002	1.974	1.974	2.00	2.00
	Yoda								

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, A_{is} = Area of associated internal standard
 C_x = Concentration of compound, 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	12074322 ccv	1/18/17	A (1st IS)	1.974	2.00	2.00	1.3	1.3
			(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 #: 38023422

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1

Reviewer: FT

2nd reviewer: RF

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	100	57.98352	58.0	58.0	0
2-Fluorobiphenyl	↓	52.32881	52.3	52.3	↓
Terphenyl-d14	↓	55.48198	55.5	55.5	
Phenol-d5	200.0	29.18197	14.6	14.6	
2-Fluorophenol	200.0	49.14536	24.6	24.6	
2,4,6-Tribromophenol	↓	109.93439	55.0	55.0	
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					

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

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: 17D116A - LCS

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	50.0	NA	13.8	NA	27.6	27.6	NA			
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 0053

LDC Report Date: February 27, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH172**	AZ48915**	Water	01/11/17
ERH178	AZ48916	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH184	AZ48925	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

For compounds where average relative response factors (RRFs) were utilized, 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 ERH191 and ERH192 (both from SDG 81936) were identified as equipment 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification
Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -
SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A2b
 SDG #: 81971
 Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 2/9/17
 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	Δ	
III.	Initial calibration/ICV	A, Δ	% PSD ≤ 15 CV ≤ 20
IV.	Continuing calibration /closing cov	Δ	CV ≤ 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	EB = ERH191, ERH192 (81936)
VII.	Surrogate spikes	Δ	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
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	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 sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH172**	AZ48915**	Water	01/11/17
2	ERH178	AZ48916	Water	01/11/17
3	ERH181	AZ48921	Water	01/12/17
4	ERH184	AZ48925	Water	01/12/17
5				
6				
7				
8				
9				

Notes:

170116A				

TFT, W + S only

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

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check (Not required)				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) < 20% ?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) < 20% and relative response factors (RRF) > 0.05?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.			/	
VI. Field blanks				
Were field blanks identified in this SDG?	/			
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
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?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			/	
Was a MS/MSD analyzed every 20 samples of each matrix?			/	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			/	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	/			
Was an LCS analyzed per analytical batch?	/			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	/			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		/		
Were target compounds detected in the field duplicates?			/	
XI. Internal standards				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	/			
Were retention times within + 30 seconds of the associated calibration standard?	/			
XII. Compound quantitation				
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?	/			
XIII. Target compound identification				
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?	/			
XIV. System performance				
System performance was found to be acceptable.	/			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 38023A2b

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1

Reviewer: FT

2nd Reviewer: KK

METHOD: GCMS 8270^P~~0~~

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 (RRF5 std)	Recalculated (RRF 5 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL Linus	1/16/2017	S (IS1)	1.158	1.158	1.022	1.022	12.00	12.00

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	0116 L022 CCV	1/18/17	S	1.022	1.185	1.185	16	16
			(1st IS)					
			(2nd IS)					
			(3rd IS)					
			(4th IS)					
			(5th 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: # 1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	4.673	3.24447	69.4	69.4	0
2-Fluorobiphenyl	↓	3.25736	69.7	69.7	↓
Terphenyl-d14	↓	3.95807	84.7	84.7	↓
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					

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

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: 170116A - LCS

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	5.0	NA	2.86	NA	57.2	57.2	NA			

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 0053

LDC Report Date: February 27, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH172**	AZ48915**	Water	01/11/17
ERH178	AZ48916	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH184	AZ48925	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

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

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%.

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

Samples ERH191 and ERH192 (both from SDG 81936) were identified as equipment blanks. 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 percent recoveries were within QC limits. Additionally, all 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) were analyzed as required by the method. Percent recoveries (%R) 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 with the exception noted in Section VII. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81971**

No Sample Data Qualified in this SDG

LDC #: 38023A2c
 SDG #: 81971
 Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/8/17
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: [Signature]

METHOD: GC/MS 2-(2-Methoxyethoxy)-Ethanol (EPA SW 846 Method 8270D-SM) *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, Δ	% RSD ≤ 15 10V = 20
IV.	Continuing calibration / closing CV	Δ	CV = 20
V.	Laboratory Blanks	Δ	
VI.	Field blanks	ND	EB = ERH191, ERH192 (81936)
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH172**	AZ48915**	Water	01/11/17
2	ERH178	AZ48916	Water	01/11/17
3	ERH181	AZ48921	Water	01/12/17
4	ERH184	AZ48925	Water	01/12/17
5				
6				
7				
8				
9				

Notes:

170118A				

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
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) 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?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) < 20% ?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed 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 completeness worksheet.	/ F7	/		
VI. Field blanks				
Were field blanks were identified in this SDG?	/	/		
Were target compounds detected in the field blanks?		/	X	
VII. Surrogate spikes				
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 ?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			✓	
Was a MS/MSD analyzed every 20 samples of each matrix?				
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			✓	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		✓		
Were target compounds detected in the field duplicates?			✓	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within + 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
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?	✓			
XIII. Target compound identification				
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?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

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

LDC #: 38023A2c

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

METHOD: GCMS 8270C

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 400 std)	Recalculated (RRF400 std)	Reported AverageRRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
	ICAL	12/20/2016	2-(2-Methoxyethoxy) Ethanol	0.2253	0.2253	0.2144	0.2144	9.90	9.90
	Yoda								

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, A_{is} = Area of associated internal standard
 C_x = Concentration of compound, 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	1220Y074	1/19/17	2-(2-MEE) (1st IS)	0.2144	0.2423	0.2423	13	13
			(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
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

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: 170110A - 105

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-(3-MEF)</u>	<u>80.0</u>	<u>NA</u>	<u>41.2</u>	<u>NA</u>	<u>51.5</u>	<u>51.5</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.

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 27, 2017

Parameters: Total Petroleum Hydrocarbons as Gasoline

Validation Level: Level C & D

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH171	AZ48914	Water	01/11/17
ERH172**	AZ48915**	Water	01/11/17
ERH178**	AZ48916**	Water	01/11/17
ERH185	AZ48917	Water	01/11/17
ERH199	AZ48918	Water	01/11/17
ERH200	AZ48919	Water	01/11/17
ERH201	AZ48920	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH203	AZ48922	Water	01/12/17
ERH180	AZ48923	Water	01/12/17
ERH183	AZ48924	Water	01/12/17
ERH184	AZ48925	Water	01/12/17
ERH202	AZ48926	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 Gasoline 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 ERH171, ERH185, ERH180, and ERH183 were identified as trip blanks. No contaminants were found.

Samples ERH191 and ERH192 (both from SDG 81936) were identified as equipment blanks. No contaminants were found.

Samples ERH199, ERH200, ERH201, ERH203, and ERH202 were identified as ambient 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG
81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification
Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification
Summary - SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A7
 SDG #: 81971
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 2/9/17

Page: 1 of 2

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	Δ / Δ	
II.	GC/MS Instrument performance check	Δ	
III.	Initial calibration/ICV	Δ / Δ	r ² ICV = 20
IV.	Continuing calibration	Δ	CW = 20
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 1, 4, 10, 11 AB = 5, 6, 7, 9, 13
VII.	Surrogate spikes	Δ	EB = ERH191, ERH192 (81936)
VIII.	Matrix spike/Matrix spike duplicates	N	
IX.	Laboratory control samples	Δ	LC
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	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

ΔB = Ambient Blank

SB=Source blank
 OTHER:

** Indicates sample was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1 3	ERH171 TB	AZ48914	Water	01/11/17
2 3	ERH172**	AZ48915**	Water	01/11/17
3 3	ERH178 **	AZ48916 **	Water	01/11/17
4 3	ERH185 TB	AZ48917	Water	01/11/17
5 1	ERH199 AB	AZ48918	Water	01/11/17
6 1	ERH200 AB	AZ48919	Water	01/11/17
7 2	ERH201 AB	AZ48920	Water	01/11/17
8 2	ERH181	AZ48921	Water	01/12/17
9 2	ERH203 AB	AZ48922	Water	01/12/17
10 2	ERH180 TB	AZ48923	Water	01/12/17
11 2	ERH183 TB	AZ48924	Water	01/12/17
12 2	ERH184	AZ48925	Water	01/12/17
13 2	ERH202 AB	AZ48926	Water	01/12/17

LDC #: 38023A7
SDG #: 81971
Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET
Level C/D

Date: 2/9/17
Page: 2 of 2
Reviewer: [Signature]
2nd Reviewer: [Signature]

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

	Client ID	Lab ID	Matrix	Date
14				
15				
16				
17				
18				

Notes:

1	170113AM					
2	170113BM					
3	170113BL					

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
II. Technical holding times				
Were all technical holding times met?	/			
Was cooler temperature criteria met?	/			
III. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	/			
Were all samples analyzed within the 12 hour clock criteria?	/			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?			/	
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of > 0.990?	/			
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) > 0.05?			/	
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	/			
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	/			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	/			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?			/	
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	/			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	/			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	/			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.			/	
VI. Field blanks				
Were field blanks were identified in this SDG?	/			
Were target compounds detected in the field blanks?			/	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	/			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			/	

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.			<input checked="" type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?			<input checked="" type="checkbox"/>	
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?			<input checked="" type="checkbox"/>	
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	<input checked="" type="checkbox"/>			
Was an LCS analyzed per analytical batch?	<input checked="" type="checkbox"/>			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	<input checked="" type="checkbox"/>			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?		<input checked="" type="checkbox"/>		
Were target compounds detected in the field duplicates?			<input checked="" type="checkbox"/>	
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	<input checked="" type="checkbox"/>			
Were retention times within + 30 seconds of the associated calibration standard?	<input checked="" type="checkbox"/>			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	<input checked="" 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"/>			
XIII. Target compound identification				
Were relative retention times (RRT's) within + 0.06 RRT units of the standard?	<input checked="" type="checkbox"/>			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	<input checked="" type="checkbox"/>			
Were chromatogram peaks verified and accounted for?	<input checked="" type="checkbox"/>			
XIV. System performance				
System performance was found to be acceptable.	<input checked="" type="checkbox"/>			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	<input checked="" 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	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#: 3802347
 SDG#: see cover

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

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

Method: GRO (8260B)

Calibration Date	System	Compound	Standard	(Y) Response	(X) Concentration
1/12/2017	GCMS Loki	Gasoline Range Organics	1	10.22790007	0.8
			2	11.3350485	2
			3	13.2098067	4
			4	19.70700192	12
			5	29.05892957	24
			6	35.43328362	32
			7	42.58810881	40

Regression Output

Reported

Constant	9.740247	9.740000
Std Err of Y Est		
R Squared	0.999625	1.000000
Degrees of Freedom		
X Coefficient(s)	0.813400	0.813000
Std Err of Coef.		
Correlation Coefficient	0.999812	
Coefficient of Determination (r ²)	0.999625	1.000000

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:

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

$$\text{RRF} = (A_x)(C_{is}) / (A_{is})(C_x)$$

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	0113138 occa	1/14/17	GRU (IS1)	300.0	293.07	293.07	2.3	2.3
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
2			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					
3			(IS1)					
			(IS2)					
			(IS3)					
			(IS4)					
			(IS5)					

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 #: 38023A7

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

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

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	25.0	24.17	96.7	96.7	0

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 #: 38023A7

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

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

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: F0113BL - LCS

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
GR0 1,1-Dichloroethene	300	NA	293	NA	97.7	97.7	NA			
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 0053
LDC Report Date: February 27, 2017
Parameters: Total Petroleum Hydrocarbons as Extractables
Validation Level: Level C & D
Laboratory: APPL, Inc.
Sample Delivery Group (SDG): 81971

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH172**	AZ48915**	Water	01/11/17
ERH178	AZ48916	Water	01/11/17
ERH181	AZ48921	Water	01/12/17
ERH184	AZ48925	Water	01/12/17

**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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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.

The percent relative standard deviations (%RSD) were less than or equal to 20.0% for all compounds

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

Samples ERH191 and ERH192 (both from SDG 81936) were identified as equipment blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH192	01/06/17	Diesel (C10-C24)	42 ug/L	ERH184

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. 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -
SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data
Qualification Summary - SDG 81971**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification
Summary - SDG 81971**

No Sample Data Qualified in this SDG

LDC #: 38023A8
 SDG #: 81971
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET
 Level C/D

Date: 2/8/17
 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	% ASD / ICV ≤ 20
III.	Continuing calibration	Δ	CW ≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	SW	EB = * ERH191, ERH192 (81936)
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LC3
IX.	Field duplicates	N	
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
 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 was underwent Level D review

#	Client ID	Lab ID	Matrix	Date
1	ERH172**	AZ48915**	Water	01/11/17
2	ERH178	AZ48916	Water	01/11/17
3	ERH181	AZ48921	Water	01/12/17
4	ERH184	AZ48925	Water	01/12/17
5				
6				
7				
8				
9				
10				
11				

Notes:

170116A				

Method: GC HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
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"/>	
II. Initial calibration				
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"/>	
III. Initial calibration verification				
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% or percent recoveries (%R) 80-120%?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IV. Continuing calibration				
Was a continuing calibration analyzed daily?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all percent differences (%D) < 20% or percent recoveries (%R) 80-120%?	<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"/>	
V. Laboratory Blanks				
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? If yes, please see the Blanks validation completeness worksheet.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
VI. Field Blanks				
Were field blanks identified in this SDG?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Were target compounds detected in the field blanks?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
VII. Surrogate Spikes				
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"/>	
VIII. Matrix spike/matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Was a MS/MSD analyzed every 20 samples of each matrix?	<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"/>	

VALIDATION FINDINGS CHECKLIST

Validation Area	Yes	No	NA	Findings/Comments
VII. Laboratory control samples				
Was an LCS analyzed for this SDG?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was an LCS analyzed per 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"/>	
VIII. Field duplicates				
Were field duplicate pairs identified in this SDG?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Were target compounds detected in the field duplicates?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
IX. Compound Quantitation				
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"/>	
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

LDC #: 31023 A8

VALIDATION FINDINGS WORKSHEET Field Blanks

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

METHOD: GC

Y N N/A Field blanks were 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: 1/6/17

Field blank type: (circle one) Field Blank / Rinsate / Other: EB Associated Samples: 4

Compound	Blank ID	Sample Identification							
(SDG 81936)	ERH192								
Diesel (C10-C24)	42								

Blank units: _____ Associated sample units: _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification							

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 #: 3802398

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1

Reviewer: FT

2nd reviewer: KK

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	
octacosane	/	40.0	38.210	95.5	95.5	0
o-Terphenyl	/	↓	30.529	76.3	76.3	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 #: 38023AD

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: FT

2nd Reviewer: KK

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: 170116A - LC 9

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 [C10-C24] (8015)	1330	NA	1080	NA	81.0	81	NA			
Benzene (8021B)			(1082.681)							
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.

LDC #: 38023A8

VALIDATION FINDINGS WORKSHEET Sample Calculation Verification

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

METHOD: GC HPLC

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 within 10% of the reported results?

Concentration = $\frac{(A)(Fv)(Df)}{(RF)(Vs \text{ or } Ws)(\%S/100)}$

Example:

Sample ID: #1 Compound Name Diesel 40-24

- A= Area or height of the compound to be measured
- Fv= Final Volume of extract
- Df= Dilution Factor
- RF= Average response factor of the compound
in the initial calibration
- Vs= Initial volume of the sample
- Ws= Initial weight of the sample
- %S= Percent Solid

Concentration = $\frac{227275411 (2) (1000)}{1727130 (1500) (2)}$ = 88 ug/L

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____



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 Thach

February 23, 2017

SUBJECT: Red Hill Bulk Storage Facility, CTO 0053, Data Validation

Dear Ms. Thach,

Enclosed is the final validation report for the fractions listed below. This SDG was received on February 23, 2017. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #38127:

<u>SDG #</u>	<u>Fraction</u>
81936	Volatiles, Phenol, Polynuclear Aromatic Hydrocarbons, 2-(2-Methoxyethoxy)-ethanol, Wet Chemistry, TPH as Gasoline, TPH 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:

- Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam, O'ahu, Hawai'i, August 2016
- Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i, Revision 01, November 2016
- Project Procedures Manual Naval Facilities Engineering Command, Environmental Restoration Program, NAVFAC Pacific, DON 2015
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

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

Sincerely,

Stella Cuenco
Operations Manager/Senior Chemist

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 23, 2017

Parameters: Volatiles

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81936

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH166	AZ48676	Water	01/09/17
ERH165	AZ48677	Water	01/09/17
ERH191	AZ48678	Water	01/06/17
ERH192	AZ48679	Water	01/06/17
ERH193	AZ48680	Water	01/06/17

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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, r² 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 ERH165 and ERH193 were identified as trip blanks. No contaminants were found.

Samples ERH191 and ERH192 were identified as equipment 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Laboratory Blank Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Volatiles - Field Blank Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

LDC #: 38127A1
 SDG #: 81936
 Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET

Level C

Date: 1/21/17
 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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	
IV.	Continuing calibration	A	70% SD ≤ 15%. ICV ≤ 20%
V.	Laboratory Blanks	A	CCV ≤ 20/50%
VI.	Field blanks	ND	TB = 2.5, EB = 3.4
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	CS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	Not reviewed for Level C validation.
XIII.	Target compound identification	N	Not reviewed for Level C validation.
XIV.	System performance	N	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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH166	AZ48676	Water	01/09/17
2	ERH165	AZ48677	Water	01/09/17
3	ERH191*	AZ48678*	Water	01/06/17
4	ERH192	AZ48679	Water	01/06/17
5	ERH193	AZ48680	Water	01/06/17
6				
7				
8				
9				

Notes:

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

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 23, 2017

Parameters: Phenol

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81936

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH166	AZ48676	Water	01/09/17
ERH191	AZ48678	Water	01/06/17
ERH192	AZ48679	Water	01/06/17

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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) 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%.

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

Samples ERH191 and ERH192 were identified as equipment blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH191	01/06/17	Phenol	2.5 ug/L	No associated samples 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Laboratory Blank Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Phenol - Field Blank Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

LDC #: 38127A2a
 SDG #: 81936
 Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET

Level C ~~D~~

Date: 1/22/17
 Page: 1 of 1
 Reviewer: [Signature]
 2nd Reviewer: A

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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 15%, CV ≤ 20%
IV.	Continuing calibration <i>1/22/17</i>	A	CV ≤ 20/50%
V.	Laboratory Blanks	A	
VI.	Field blanks	W	EB = 2, 3
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CG
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	Not reviewed for Level C validation.
XIII.	Target compound identification	N	Not reviewed for Level C validation.
XIV.	System performance	N	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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH166	AZ48676	Water	01/09/17
2	ERH191	AZ48678**	Water	01/06/17
3	ERH192	AZ48679	Water	01/06/17
4				
5				
6				
7				
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9				

Notes:

VALIDATION FINDINGS WORKSHEET

Field Blanks

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

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: N/A Associated sample units: _____

Sampling date: 1/10/17

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: None

Compound	Blank ID	Sample Identification								
	2									
phenol	2.5									

Blank units: _____ Associated sample units: _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
 Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated field blank concentration were qualified as not detected, "U". Other contaminants within five times the field blank concentration were also qualified as not detected, "U".

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 23, 2017

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81936

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH166	AZ48676	Water	01/09/17
ERH191	AZ48678	Water	01/06/17
ERH192	AZ48679	Water	01/06/17

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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, r² 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.

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 ERH191 and ERH192 were identified as equipment 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification
Summary - SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -
SDG 81936**

No Sample Data Qualified in this SDG

LDC #: 38127A2b
 SDG #: 81936
 Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET

Level C ~~7~~

Date: 2/2/17
 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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD < 15/70.8% ² CV < 20/1
IV.	Continuing calibration / ending	A	CCV < 20/50%
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	EB = 2, 3
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LC9
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	Not reviewed for Level C validation.
XIII.	Target compound identification	N	Not reviewed for Level C validation.
XIV.	System performance	N	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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH166	AZ48676	Water	01/09/17
2	ERH191*	AZ48678*	Water	01/06/17
3	ERH192	AZ48679	Water	01/06/17
4				
5				
6				
7				
8				
9				

Notes:

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

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 23, 2017

Parameters: 2-(2-Methoxyethoxy)-ethanol

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81936

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH166	AZ48676	Water	01/09/17
ERH191	AZ48678	Water	01/06/17
ERH192	AZ48679	Water	01/06/17

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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

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, r² 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%.

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

Samples ERH191 and ERH192 were identified as equipment blanks. 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 percent recoveries were within QC limits. Additionally, all 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Laboratory Blank Data Qualification Summary -
SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
2-(2-Methoxyethoxy)-ethanol - Field Blank Data Qualification Summary - SDG
81936**

No Sample Data Qualified in this SDG

LDC #: 38127A2c
 SDG #: 81936
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET

Level C *C*

Date: 1/23/17
 Page: 1 of 1
 Reviewer: *Q*
 2nd Reviewer: *AT*

METHOD: GC/MS 2-(2-Methoxyethoxy)-Ethanol (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	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	RSD ≤ 15/70, 1CV ≤ 20/70
IV.	Continuing calibration <i>ending</i>	A	2CV ≤ 20/50/70
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	EB = 2, 3
VII.	Surrogate spikes	A	sur in with <i>hend</i> / LCS in
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	Not reviewed for Level C validation.
XIII.	Target compound identification	N	Not reviewed for Level C validation.
XIV.	System performance	N	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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH166	AZ48676	Water	01/09/17
2	ERH191*	AZ48678*	Water	01/06/17
3	ERH192	AZ48679	Water	01/06/17
4				
5				
6				
7				
8				
9				

Notes:

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 23, 2017

Parameters: Wet Chemistry

Validation Level: Level C

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81936

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH166	AZ48676	Water	01/09/17

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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

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. 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	Associated Samples
PB (prep blank)	Bicarbonate alkalinity Total alkalinity	1.6 mg/L 1.6 mg/L	All samples in SDG 81936

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) were analyzed as required by the methods. Percent recoveries (%R) 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. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Wet Chemistry - Field Blank Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

LDC #: 38127A6
 SDG #: 81936
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 2-23-17
 Page: 1 of 1
 Reviewer: MG
 2nd Reviewer: PL

METHOD: (Analyte) Alkalinity (SM2320B), Chloride, Nitrate, Sulfate (EPA Method 300.0), Ferrous Iron (SM3500-Fe B)

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	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	N	client specified
VII.	Duplicate sample analysis	N	" "
VIII.	Laboratory control samples	A	LCS
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	ERH166	AZ48676	Water	01/09/17
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15	PBW			

Notes: _____

VALIDATION FINDINGS WORKSHEET

Blanks

METHOD: Inorganics, Method See Cover

Conc. units: mg/L

Associated Samples: all (>5x)

Analyte	Blank ID	Blank ID	Blank Action Limit													
	PB	ICB/CCB (mg/L)		No Qual's.												
Bicarbonate Alkalinity	1.6		8.0													
Total Alkalinity	1.6		8.0													

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 0053

LDC Report Date: February 23, 2017

Parameters: Total Petroleum Hydrocarbons as Gasoline

Validation Level: Level C

Laboratory: APPL, Inc.

Sample Delivery Group (SDG): 81936

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH166	AZ48676	Water	01/09/17
ERH165	AZ48677	Water	01/09/17
ERH191	AZ48678	Water	01/06/17
ERH192	AZ48679	Water	01/06/17
ERH193	AZ48680	Water	01/06/17

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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 Gasoline 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, r² 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 ERH165 and ERH193 were identified as trip blanks. No contaminants were found.

Samples ERH191 and ERH192 were identified as equipment 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Data Qualification Summary - SDG
81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Laboratory Blank Data Qualification
Summary - SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Gasoline - Field Blank Data Qualification
Summary - SDG 81936**

No Sample Data Qualified in this SDG

LDC #: 38127A7
 SDG #: 81936
 Laboratory: APPL Labs

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 2/2/17
 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	
II.	GC/MS Instrument performance check	N	
III.	Initial calibration/ICV	A, A 7 ²	1 CV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 2.5. EB = 3.4
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	N	CS
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	N	
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	N	Not reviewed for Level C validation.
XIII.	Target compound identification	N	Not reviewed for Level C validation.
XIV.	System performance	N	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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH166	AZ48676	Water	01/09/17
2	ERH165	AZ48677	Water	01/09/17
3	ERH191*	AZ48678*	Water	01/06/17
4	ERH192	AZ48679	Water	01/06/17
5	ERH193	AZ48680	Water	01/06/17
6				
7				
8				
9				

Notes:

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

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053
LDC Report Date: February 23, 2017
Parameters: Total Petroleum Hydrocarbons as Extractables
Validation Level: Level C
Laboratory: APPL, Inc.
Sample Delivery Group (SDG): 81936

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH166	AZ48676	Water	01/09/17
ERH191	AZ48678	Water	01/06/17
ERH192	AZ48679	Water	01/06/17

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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, r² 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% for all compounds.

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

Samples ERH191 and ERH192 were identified as equipment blanks. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH192	01/06/17	Diesel (C10-C24)	42 ug/L	No associated samples 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) were analyzed as required by the method. Percent recoveries (%R) 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.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Data Qualification Summary -
SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Laboratory Blank Data
Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Total Petroleum Hydrocarbons as Extractables - Field Blank Data Qualification
Summary - SDG 81936**

No Sample Data Qualified in this SDG

LDC #: 38127A8
 SDG #: 81936
 Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET
 Level C

Date: 2/27/17
 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	
II.	Initial calibration/ICV	A, A	RSO ≤ 20%. ICV ≤ 20%
III.	Continuing calibration	A	CCV ≤ 20%
IV.	Laboratory Blanks	A	
V.	Field blanks	W	EB = 2, 3
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	N	CS
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	N	Not reviewed for Level C validation.
XI.	Target compound identification	N	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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH166	AZ48676	Water	01/09/17
2	ERH191	AZ48678	Water	01/06/17
3	ERH192*	AZ48679*	Water	01/06/17
4				
5				
6				
7				
8				
9				
10				
11				

Notes:

LDC #: 3812708

VALIDATION FINDINGS WORKSHEET Field Blanks

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

METHOD: GC

N/A Field blanks were identified in this SDG.
 N/A Were target compounds detected in the field blanks?

Blank units: 142 Associated sample units: —

Sampling date: 1/6/17

Field blank type: (circle one) Field Blank / Rinsate / Other: EB Associated Samples: None

Compound	Blank ID	Sample Identification							
	<u>3</u>								
<u>Diesel (C10-C24)</u>	<u>42</u>								

Blank units: _____ Associated sample units: _____

Sampling date: _____

Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification							

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".

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

Project/Site Name: Red Hill Bulk Storage Facility, CTO 0053

LDC Report Date: February 23, 2017

Parameters: Methane

Validation Level: Level C

Laboratory: APPL Labs

Sample Delivery Group (SDG): 81936

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH166	AZ48676	Water	01/09/17
ERH165	AZ48677	Water	01/09/17

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 Monitoring Well Installation Work Plan, Red Hill Bulk Fuel Storage Facility Joint Base Pearl Harbor-Hickam (JBPHH), O'ahu, Hawai'i (August 2016), Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i (Revision 01, November 2016), 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 5.0 (July 2013). 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, r² 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% with the following exceptions:

Date	Standard	Compound	%D	Associated Samples	Flag	A or P
01/16/17	17011603	Methane	25	All samples in SDG 81936	UJ (all non-detects)	A

IV. Laboratory Blanks

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

V. Field Blanks

Sample ERH165 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) were analyzed as required by the method. Percent recoveries (%R) 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.

Due to continuing calibration %D, data were qualified as estimated in two samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Data Qualification Summary - SDG 81936**

Sample	Compound	Flag	A or P	Reason (Code)
ERH166 ERH165	Methane	UJ (all non-detects)	A	Continuing calibration (%D) (C)

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Laboratory Blank Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

**Red Hill Bulk Storage Facility, CTO 0053
Methane - Field Blank Data Qualification Summary - SDG 81936**

No Sample Data Qualified in this SDG

LDC #: 38127A51
 SDG #: 81936
 Laboratory: APPL, Labs

VALIDATION COMPLETENESS WORKSHEET

Level C/D

Date: 2/2/17
 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	
II.	Initial calibration/ICV	A/A	$r^2, 1CV \leq 20\%$
III.	Continuing calibration	W	$CCV \leq 20\%$
IV.	Laboratory Blanks	A	
V.	Field blanks	ND	TB = 2
VI.	Matrix spike/Matrix spike duplicates	N	CG
VII.	Laboratory control samples	A	LCS
VIII.	Field duplicates	N	
IX.	Compound quantitation RL/LOQ/LODs	N	Not reviewed for Level C validation.
X.	Target compound identification	N	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 was underwent Level D review

	Client ID	Lab ID	Matrix	Date
1	ERH166 X	AZ48676**	Water	01/09/17
2	ERH165	AZ48677	Water	01/09/17
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

Notes:

**Red Hill Bulk Storage Facility, CTO 0053 - SDG 81936
LDC 38127**

AECOM

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 2320B													
ERH166	AZ48676	1	ALKALINITY, AS CaCO3	1/9/2017 10:00:00 AM	1/16/2017 12:15:00 PM	C	78.7	MG_L		2.0	1.70		
ERH166	AZ48676	1	ALKALINITY, BICARBONATE	1/9/2017 10:00:00 AM	1/16/2017 12:15:00 PM	C	78.7	MG_L		2.0	1.70		
ERH166	AZ48676	1	ALKALINITY, CARBONATE	1/9/2017 10:00:00 AM	1/16/2017 12:15:00 PM	C	1.70	MG_L	U	2.0	1.70		U
METHOD: 300.0													
ERH166	AZ48676	2	CHLORIDE	1/9/2017 10:00:00 AM	1/11/2017 5:26:00 PM	C	81.9	MG_L	D	2.0	0.40		
ERH166	AZ48676	1	NITRATE	1/9/2017 10:00:00 AM	1/11/2017 9:56:00 AM	C	2.4	MG_L		0.5	0.18		
ERH166	AZ48676	1	SULFATE	1/9/2017 10:00:00 AM	1/11/2017 9:56:00 AM	C	10.1	MG_L		1.0	0.20		
METHOD: 3500_FE_B													
ERH166	AZ48676	1	IRON, FERROUS	1/9/2017 10:00:00 AM	1/10/2017 11:42:00 AM	C	0.32	MG_L	U	1.0	0.32		U
METHOD: 8015B_E													
ERH166	AZ48676	1	TPH-DIESEL RANGE	1/9/2017 10:00:00 AM	1/17/2017 2:49:00 PM	C	25.00	UG_L	U	40.0	25.00		U
ERH166	AZ48676	1	TPH-OIL RANGE	1/9/2017 10:00:00 AM	1/17/2017 2:49:00 PM	C	40.00	UG_L	U	40.0	40.00		U
ERH191	AZ48678	1	TPH-DIESEL RANGE	1/6/2017 11:20:00 AM	1/17/2017 3:09:00 PM	C	25.00	UG_L	U	40.0	25.00		U
ERH191	AZ48678	1	TPH-OIL RANGE	1/6/2017 11:20:00 AM	1/17/2017 3:09:00 PM	C	40.00	UG_L	U	40.0	40.00		U
ERH192	AZ48679	1	TPH-DIESEL RANGE	1/6/2017 11:30:00 AM	1/17/2017 3:30:00 PM	C	42	UG_L	T4I	40.0	25.00		
ERH192	AZ48679	1	TPH-OIL RANGE	1/6/2017 11:30:00 AM	1/17/2017 3:30:00 PM	C	40.00	UG_L	U	40.0	40.00		U
METHOD: 8260B													
ERH166	AZ48676	1	BENZENE	1/9/2017 10:00:00 AM	1/12/2017 1:33:00 AM	C	0.30	UG_L	U	1.0	0.30		U
ERH166	AZ48676	1	ETHYLBENZENE	1/9/2017 10:00:00 AM	1/12/2017 1:33:00 AM	C	0.50	UG_L	U	1.0	0.50		U
ERH166	AZ48676	1	TOLUENE	1/9/2017 10:00:00 AM	1/12/2017 1:33:00 AM	C	0.30	UG_L	U	1.0	0.30		U
ERH166	AZ48676	1	TPH-GASOLINE RANGE C6-C10	1/9/2017 10:00:00 AM	1/12/2017 1:32:00 AM	C	18.0	UG_L	U	20	18.0		U
ERH166	AZ48676	1	XYLENES, TOTAL	1/9/2017 10:00:00 AM	1/12/2017 1:33:00 AM	C	0.30	UG_L	U	2.0	0.30		U
ERH165	AZ48677	1	BENZENE	1/9/2017 8:25:00 AM	1/12/2017 2:01:00 AM	C	0.30	UG_L	U	1.0	0.30		U
ERH165	AZ48677	1	ETHYLBENZENE	1/9/2017 8:25:00 AM	1/12/2017 2:01:00 AM	C	0.50	UG_L	U	1.0	0.50		U
ERH165	AZ48677	1	TOLUENE	1/9/2017 8:25:00 AM	1/12/2017 2:01:00 AM	C	0.30	UG_L	U	1.0	0.30		U
ERH165	AZ48677	1	TPH-GASOLINE RANGE C6-C10	1/9/2017 8:25:00 AM	1/12/2017 2:00:00 AM	C	18.0	UG_L	U	20	18.0		U

EPA_NO	LAB_ID	DF	ANALYTE	COLL_DATE	ANAL_DATE	QCLev	RESULT	UNITS	LAB_Q	LOQ	LOD	REV	Q_C
METHOD: 8260B													
ERH165	AZ48677	1	XYLENES, TOTAL	1/9/2017 8:25:00 AM	1/12/2017 2:01:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH191	AZ48678	1	BENZENE	1/6/2017 11:20:00 AM	1/12/2017 2:29:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH191	AZ48678	1	ETHYLBENZENE	1/6/2017 11:20:00 AM	1/12/2017 2:29:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH191	AZ48678	1	TOLUENE	1/6/2017 11:20:00 AM	1/12/2017 2:29:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH191	AZ48678	1	TPH-GASOLINE RANGE C6-C10	1/6/2017 11:20:00 AM	1/12/2017 2:28:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH191	AZ48678	1	XYLENES, TOTAL	1/6/2017 11:20:00 AM	1/12/2017 2:29:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH192	AZ48679	1	BENZENE	1/6/2017 11:30:00 AM	1/12/2017 2:58:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH192	AZ48679	1	ETHYLBENZENE	1/6/2017 11:30:00 AM	1/12/2017 2:58:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH192	AZ48679	1	TOLUENE	1/6/2017 11:30:00 AM	1/12/2017 2:58:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH192	AZ48679	1	TPH-GASOLINE RANGE C6-C10	1/6/2017 11:30:00 AM	1/12/2017 2:57:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH192	AZ48679	1	XYLENES, TOTAL	1/6/2017 11:30:00 AM	1/12/2017 2:58:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
ERH193	AZ48680	1	BENZENE	1/6/2017 11:10:00 AM	1/12/2017 3:26:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH193	AZ48680	1	ETHYLBENZENE	1/6/2017 11:10:00 AM	1/12/2017 3:26:00 AM	C	0.50	UG_L	U	1.0	0.50	U	
ERH193	AZ48680	1	TOLUENE	1/6/2017 11:10:00 AM	1/12/2017 3:26:00 AM	C	0.30	UG_L	U	1.0	0.30	U	
ERH193	AZ48680	1	TPH-GASOLINE RANGE C6-C10	1/6/2017 11:10:00 AM	1/12/2017 3:25:00 AM	C	18.0	UG_L	U	20	18.0	U	
ERH193	AZ48680	1	XYLENES, TOTAL	1/6/2017 11:10:00 AM	1/12/2017 3:26:00 AM	C	0.30	UG_L	U	2.0	0.30	U	
METHOD: 8270D													
ERH166	AZ48676	1	2-(2-METHOXYETHOXY)-ETHANOL	1/9/2017 10:00:00 AM	1/16/2017 5:20:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH166	AZ48676	1	PHENOL	1/9/2017 10:00:00 AM	1/17/2017 12:12:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
ERH191	AZ48678	1	2-(2-METHOXYETHOXY)-ETHANOL	1/6/2017 11:20:00 AM	1/16/2017 5:50:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH191	AZ48678	1	PHENOL	1/6/2017 11:20:00 AM	1/17/2017 12:43:00 PM	C	2.5	UG_L	J	5.0	4.00	J	
ERH192	AZ48679	1	2-(2-METHOXYETHOXY)-ETHANOL	1/6/2017 11:30:00 AM	1/16/2017 6:20:00 PM	C	80.0	UG_L	U	100	80.0	U	
ERH192	AZ48679	1	PHENOL	1/6/2017 11:30:00 AM	1/17/2017 1:13:00 PM	C	4.00	UG_L	U	5.0	4.00	U	
METHOD: 8270D_SIM													
ERH166	AZ48676	1	1-METHYLNAPHTHALENE	1/9/2017 10:00:00 AM	1/16/2017 11:16:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH166	AZ48676	1	2-METHYLNAPHTHALENE	1/9/2017 10:00:00 AM	1/16/2017 11:16:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH166	AZ48676	1	NAPHTHALENE	1/9/2017 10:00:00 AM	1/16/2017 11:16:00 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
METHOD: 8270D_SIM													
ERH191	AZ48678	1	1-METHYLNAPHTHALENE	1/6/2017 11:20:00 AM	1/16/2017 11:44:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH191	AZ48678	1	2-METHYLNAPHTHALENE	1/6/2017 11:20:00 AM	1/16/2017 11:44:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH191	AZ48678	1	NAPHTHALENE	1/6/2017 11:20:00 AM	1/16/2017 11:44:00 PM	C	0.10	UG_L	U	0.2	0.10	U	
ERH192	AZ48679	1	1-METHYLNAPHTHALENE	1/6/2017 11:30:00 AM	1/17/2017 12:12:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH192	AZ48679	1	2-METHYLNAPHTHALENE	1/6/2017 11:30:00 AM	1/17/2017 12:12:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
ERH192	AZ48679	1	NAPHTHALENE	1/6/2017 11:30:00 AM	1/17/2017 12:12:00 AM	C	0.10	UG_L	U	0.2	0.10	U	
METHOD: RSK-175													
ERH166	AZ48676	1	METHANE	1/9/2017 10:00:00 AM	1/16/2017 10:50:00 AM	C	1.00	UG_L	U	5.0	1.00	UJ	c
ERH165	AZ48677	1	METHANE	1/9/2017 8:25:00 AM	1/16/2017 10:54:00 AM	C	1.00	UG_L	U	5.0	1.00	UJ	c

The attached zipped file contains two files:

<u>File</u>	<u>Format</u>	<u>Description</u>
1) Readme_RedHill_022317.docx	MS Word 2007	A "Readme" file (this document).
2) 81936_RH_COPC_dva.xlsx	MS Excel 2007	<u>A spreadsheet for the following SDGs:</u> 81936 38127A

No discrepancies were observed between the hardcopy data packages and the electronic data deliverables during verification.

Please contact Stella Cuenco or Judy Ecklund at (760) 827-1100 if you have any questions regarding this electronic data submittal.



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 Thach

March 10, 2017

**SUBJECT: Data Quality Assessment Report
January 2017
Investigation and Remediation of Releases and
Groundwater Protection and Evaluation
Red Hill Bulk Fuel Storage Facility
Joint Base Pearl Harbor-Hickam
Oahu, Hawaii
CTO 0053**

Dear Ms. Thach,

Enclosed is the Data Quality Assessment Report, January 2017, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, Oahu, Hawaii, CTO 0053

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,

Stella Cuenco
Operations Manager/Senior Chemist

DATA QUALITY ASSESSMENT REPORT

**JANUARY 2017
INVESTIGATION AND REMEDIATION OF RELEASES
AND GROUNDWATER PROTECTION AND EVALUATION**

**RED HILL BULK FUEL STORAGE FACILITY
JOINT BASE PEARL HARBOR-HICKAM
OAHU, HAWAII**

CTO 0053

March 10, 2017

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GLOSSARY

ASTM	American Society for Testing and Materials
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes, total
COPC	Compounds of Potential Concern
CTO	Contract Task Order
DCA	1,2-Dichloroethane
DQAR	Data Quality Assessment Report
DOD	Department of Defense
DL	Detection Limit
EB	Equipment Blank
EDB	Ethylene Dibromide
FB	Field Blank
FD	Field Duplicate
LCS	Laboratory Control Sample
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
RM	Reference Material
RRF	Relative Response Factor
SDG	Sample Delivery Group
SGCU	Silica Gel Clean-Up
SIM	Selected Ion Monitoring
TB	Trip Blank
TPH	Total Petroleum Hydrocarbons
%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 investigation and remediation of petroleum product releases and protection and evaluation of groundwater were conducted on January 2017 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 38 environmental and quality control (QC) samples. The analyses were performed by the following methods:

Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), and 1,2-Dichloroethane (DCA) by Environmental Protection Agency (EPA) SW-846 Method 8260B
Phenol by EPA SW-846 Method 8270D
2-(2-Methoxyethoxy)-ethanol (MEE) by EPA SW-846 Method 8270D Modified
Polynuclear Aromatic Hydrocarbons (PAH) by EPA SW-846 Method 8270D-Selected Ion Monitoring (SIM) mode
Total Petroleum Hydrocarbons (TPH) as Gasoline by EPA SW-846 Method 8260B
TPH as Extractables by EPA SW-846 Method 8015B
Ethylene Dibromide (EDB) by EPA SW-846 Method 8011
Methane by Method RSK 175

Wet Chemistry:

Alkalinity by Standard Method 2320B
Chloride, Nitrate and Sulfate (Anions) by EPA Method 300.0
Ferrous Iron by Standard Method 3500 Fe B

Analytical services were provided by APPL, Inc. whom performed analyses on the water samples. The samples were grouped into sample delivery groups (SDGs) as received by each 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 5.0 (DoD 2013)*.

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 11 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, laboratory control samples/ laboratory control sample duplicates (LCS/LCSD), laboratory duplicates (DUP), matrix spike/matrix spike duplicates (MS/MSD), equipment blanks (EB), field blanks (FB), trip blanks (TB) and field duplicates (FD).

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 5 times the concentration in any associated blank.
- 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. Non-aqueous LCSs are prepared using solid media approved by the American Society for Testing and Materials (ASTM) for their homogeneity. The LCS measures laboratory efficiency in recovering target analytes from either a solid or 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.

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, ambient blanks, equipment blanks, field 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 all BTEX, DCA, TPH as gasoline, EDB, and methane.

Ambient blanks are source water blanks collected by pouring store-bought distilled water directly into sampling containers on field. Ambient blanks are expected to capture any contamination in the ambient conditions at the potable water sampling location. Ambient blanks were collected and analyzed for BTEX, TPH as gasoline, and EDB.

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 all BTEX, MEE, phenol, PAH, TPH as gasoline and TPH as extractables.

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 all BTEX, phenol, PAH, MEE, TPH as gasoline, and TPH as extractables.

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 for contaminants.

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 BENZENE, TOLUENE, ETHYLBENZENE, XYLENES, TOTAL AND 1,2-DICHLOROETHANE

A total of 38 water samples were analyzed for BTEX and a total of 7 water samples were analyzed for DCA by EPA SW-846 Method 8260B. All BTEX and DCA data were assessed to be valid since none of the 159 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.

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 acceptance criteria of 0.05 in the initial and continuing calibrations.

The %RSDs met the acceptance criteria of 15 percent in the initial calibration. The %Ds in the continuing calibration verifications and closing continuing calibration verifications met the acceptance criteria of 20 and 50 percent, respectively.

The %Ds in the initial calibration verification were within the acceptance criteria of 20 percent.

2.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria.

2.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

2.1.4 LCS Samples

All LCS %Rs were within the acceptance criteria.

2.1.5 Internal Standards

All internal standard areas and retention times were within the acceptance criteria.

2.1.6 Field Duplicate Samples

No BTEX or DCA were detected in the field duplicate samples ERH161 and ERH162 and samples ERH169 and ERH170.

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 compound identification 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, ambient blanks, equipment blanks, field blanks and trip blanks 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 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 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 Trip Blanks

No data were qualified due to low level xylenes in one trip blank.

2.2.2.3 Ambient, Equipment and Field Blanks

No contaminants were detected in the equipment and field 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. Target analytes detected below the LOQs flagged (J) by the laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

2.4 Completeness

The completeness level attained for BTEX and DCA 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 work plan.

3.0 PHENOL AND 2-(2-METHOXYETHOXY)-ETHANOL

A total of 18 water samples were analyzed for phenol by EPA SW-846 Method 8270D and 18 water samples were analyzed for MEE by EPA SW-846 Method 8270D Modified. All phenol and MEE data were assessed to be valid since none of the 36 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.

3.1 Precision and Accuracy

3.1.1 Instrument Calibration

The RRFs met the acceptance criteria of 0.05 in the initial and continuing calibrations.

The %RSDs met the acceptance criteria of 15 percent in the initial calibration. The %Ds in the continuing calibration verifications and closing continuing calibration verifications met the acceptance criteria of 20 and 50 percent, respectively.

The %Ds in the initial calibration verification were within the acceptance criteria of 20 percent.

3.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria for the phenol analysis.

3.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

3.1.4 LCS Samples

All LCS %Rs 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 Field Duplicate Samples

No phenol or MEE were detected in the field duplicate samples ERH161 and ERH162 and samples ERH169 and ERH170.

3.1.7 Proficiency Testing Samples

Proficiency testing (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, equipment blanks and field blanks were collected and analyzed to evaluate representativeness.

3.2.2.1 Method Blanks

No contaminants were detected in the method blanks for this analysis.

3.2.2.2 Equipment and Field Blanks

No data were qualified due to a low level phenol in one equipment blank.

No contaminants were detected in the 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. Target analytes detected below the LOQs flagged (J) by the laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

3.4 Completeness

The completeness level attained for phenol and 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.

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 18 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 54 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 acceptance criteria of 0.05 in the initial and continuing calibrations.

The %RSDs met the acceptance criteria of 15 percent in the initial calibration. The %Ds in the continuing calibration verifications and closing continuing calibration verifications met the acceptance criteria of 20 and 50 percent, respectively.

The %Ds in the initial calibration verification were within the acceptance criteria of 20 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 Samples

All LCS %Rs 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

No PAH were detected in the field duplicate samples ERH161 and ERH162 and samples ERH169 and ERH170.

4.1.7 Proficiency Testing Samples

Proficiency testing (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, equipment blanks, and field blanks 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 Equipment and Field Blanks

No contaminants were detected in the equipment 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 TOTAL PETROLEUM HYDROCARBONS AS GASOLINE

A total of 38 water samples were analyzed for TPH as gasoline by EPA SW-846 Method 8260B. All TPH as gasoline data were assessed to be valid since none of the 38 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 coefficient of determination (r^2) was ≥ 0.990 in the initial calibration. The %Ds in the initial and continuing calibration verifications met the acceptance criteria of 20 percent.

5.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria.

5.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

5.1.4 LCS

All LCS %Rs were within the acceptance criteria.

5.1.5 Field Duplicate Samples

No TPH as gasoline was detected in the field duplicate samples ERH161 and ERH162 and samples ERH169 and ERH170.

5.1.6 Proficiency Testing Samples

PT samples were not performed for the sampling event.

5.1.7 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, ambient blanks, equipment blanks, field blanks and trip blanks 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 Trip Blanks

No contaminants were detected in the trip blanks for this analysis.

5.2.2.3 Ambient, Equipment and Field Blanks

No contaminants were detected in the equipment 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 TPH as gasoline 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 TOTAL PETROLEUM HYDROCARBONS AS EXTRACTABLES

A total of 18 water samples were analyzed for diesel and oil by EPA SW-846 Method 8015B. All TPH as extractable data were assessed to be valid since none of the 36 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 %RSDs met the acceptance criteria of 20 percent in the initial calibration. The %Ds in the initial and continuing calibration verifications met the acceptance criteria of 20 percent.

6.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria.

6.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

6.1.4 LCS Samples

All LCS %Rs were within the acceptance criteria.

6.1.5 Field Duplicate Samples

No TPH as extractables were detected in the field duplicate samples ERH161 and ERH162.

All RPDs for diesel and oil were within the acceptance criteria for field duplicate samples ERH169 and ERH170.

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, equipment blanks and field blanks 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 Equipment and Field Blanks

No data were qualified due to a low level diesel in one equipment blank.

No contaminants were detected in the field blanks for this analysis.

6.3 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 analytes detected below the LOQs flagged (J) by the laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

6.4 Completeness

The completeness level attained for TPH as extractable 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 ETHYLENE DIBROMIDE

A total of 7 water samples were analyzed for EDB by EPA SW-846 Method 8011. All EDB data were assessed to be valid since none of the 7 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 acceptance criteria of 20 percent.

7.1.2 Surrogates

All surrogate %Rs were within the acceptance criteria.

7.1.3 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

7.1.4 LCS Samples

All LCS %Rs were within the acceptance criteria.

7.1.5 Field Duplicate Samples

No EDB was detected in the field duplicate samples ERH169 and ERH170.

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. All holding times were met.

7.2.2 Blanks

Method blanks, ambient blanks, and trip blanks 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 Trip Blanks

No contaminants were detected in the trip blank for this analysis.

7.2.2.3 Ambient Blanks

No contaminants were detected in the ambient blank for this analysis.

7.3 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.

7.4 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.

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 METHANE

A total of 25 water samples were analyzed for methane by EPA Method RSK 175. All methane data were assessed to be valid since none of the 25 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 coefficient of determination (r^2) was ≥ 0.990 in the initial calibration. The %Ds in the initial calibration verifications met the acceptance criteria of 20 percent.

As a result of continuing calibration verification %D outside of the acceptance criteria of 20 percent, the 17 methane results were qualified as detected estimated (J) or non-detected estimated (UJ). Bias is indeterminate.

8.1.2 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

8.1.3 LCS Samples

All LCS %Rs were within the acceptance criteria.

8.1.4 Field Duplicate Samples

No methane was detected in the field duplicate samples ERH169 and ERH170.

8.1.5 Proficiency Testing Samples

PT samples were not performed for the sampling event.

8.1.6 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 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 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 and LODs attained were below the specified LOQs. The comparability of the data is regarded as acceptable.

8.4 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.

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 WET CHEMISTRY

A total of 12 water samples were analyzed for alkalinity by Standard Method 2320B, anions by EPA Method 300.0, ferrous iron by Standard Method 3500 Fe B. All wet chemistry data were assessed to be valid since none of the 84 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.

9.1 Precision and Accuracy

9.1.1 Instrument Calibration

The correlation coefficients in the initial calibrations and percent recoveries in the initial and continuing calibration verifications were within the acceptance criteria of ≥ 0.995 and 90-110 percent, respectively.

9.1.2 MS/MSD Samples

All MS/MSD %Rs and RPDs were within the acceptance criteria.

9.1.3 LCS Samples

All LCS %Rs were within the acceptance criteria.

9.1.4 Field Duplicate Samples

Field duplicates were not collected for these analyses.

9.1.5 Proficiency Testing Samples

PT samples were not performed for the sampling event.

9.1.6 Sample Result Verification

All sample results were found to be acceptable.

9.2 Representativeness

9.2.1 Holding Times

The evaluation of holding times to verify compliance with all wet chemistry methods was conducted. All water samples met the 28-day analysis holding time criteria for chloride, and sulfate, the 14-day analysis holding time criteria for alkalinity, and the 7-day analysis holding time criteria for ferrous iron.

Due to holding time exceedance, the nitrate results for samples ERH161, ERH164, ERH168, ERH172, ERH174, and ERH176 were qualified as detected estimated (J) or as non-detected estimated (UJ). The analysis holding time criteria is 48 hours.

9.2.2 Blanks

Method blanks were analyzed to evaluate representativeness.

9.2.2.1 Method Blanks

No data were qualified due to low level alkalinity in method blanks.

9.3 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 analytes detected below the LOQs flagged (J) by the laboratory should be considered estimated. The comparability of the data is regarded as acceptable.

9.4 Completeness

The completeness level attained for wet chemistry 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 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.

11.0 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.

11.1 Precision and Accuracy

Bias cannot be determined for associated methane results when continuing calibration verification %Ds are outside of the acceptance criteria.

Precision and accuracy were evaluated using data quality indicators such as calibration, surrogates, MS/MSD, LCS, 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.

11.2 Representativeness

All samples for each method and matrix were evaluated for holding time compliance. All holding times were met with the exception noted in Section 9.2.1. All samples were associated with a method blank in each individual SDG. The representativeness of the project data is considered acceptable after qualification for holding time.

11.3 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.

11.4 Completeness

Of the 439 total results reported, none of the results were rejected. The completeness for all SDGs is as follows:

Parameter	Total Analytes	No. of Rejects	% Completeness
BTEX and DCA	159	0	100
Phenol	18	0	100
MEE	18	0	100
PAHs	54	0	100
TPHG	38	0	100
TPHE	36	0	100
EDB	7	0	100
Methane	25	0	100
Wet chemistry	84	0	100
Total	439	0	100

The completeness percentage based on rejected data met the 90 percent PQO goal.

11.5 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, equipment and trip blanks did not affect sensitivity.

Table I. Validation Sample Table

SDG	Client Sample ID	Lab Sample ID	Matrix	QC Type	Sample Date	Validation Level	BTEX (8260B)	DCA (8260B)	Phenol (8270D)	MEE (8270D Mod)	PAH (8270D-SIM)	TPHG (8260B)	TPHE (8015B)	EDB (8011)
81936	ERH165	AZ48677	Water	TB	01/09/2017	Level C	X					X		
81936	ERH166	AZ48676	Water		01/09/2017	Level C	X		X	X	X	X	X	
81936	ERH191	AZ48678	Water	EB	01/06/2017	Level C	X		X	X	X	X	X	
81936	ERH192	AZ48679	Water	EB	01/06/2017	Level C	X		X	X	X	X	X	
81936	ERH193	AZ48680	Water	TB	01/06/2017	Level C	X					X		
81965	ERH161	AZ48866	Water	FD1	01/09/2017	Level D	X		X	X	X	X	X	
81965	ERH161	AZ48866	Water	FD1	01/09/2017	Level C								
81965	ERH162	AZ48867	Water	FD1	01/09/2017	Level C	X		X	X	X	X	X	
81965	ERH163	AZ48869	Water	TB	01/10/2017	Level C	X					X		
81965	ERH164	AZ48868	Water		01/10/2017	Level C	X		X	X	X	X	X	
81965	ERH167	AZ48870	Water	TB	01/09/2017	Level C	X					X		
81965	ERH168	AZ48871	Water		01/09/2017	Level C	X		X	X	X	X	X	
81965	ERH169	AZ48872	Water	FD2	01/11/2017	Level D	X	X	X	X	X	X	X	X
81965	ERH170	AZ48873	Water	FD2	01/11/2017	Level C	X	X	X	X	X	X	X	X
81965	ERH173	AZ48884	Water	TB	01/10/2017	Level C	X					X		
81965	ERH174	AZ48875	Water		01/10/2017	Level C	X		X	X	X	X	X	
81965	ERH175	AZ48876	Water	TB	01/10/2007	Level C	X					X		
81965	ERH176	AZ48877	Water		01/10/2017	Level C	X		X	X	X	X	X	
81965	ERH177	AZ48874	Water	TB	01/11/2017	Level C	X	X				X		X
81965	ERH179	AZ48878	Water		01/10/2017	Level C	X		X	X	X	X	X	
81965	ERH186	AZ48880	Water	FB	01/10/2017	Level C	X		X	X	X	X	X	
81965	ERH187	AZ48881	Water	EB	01/10/2017	Level C	X		X	X	X	X	X	
81965	ERH194	AZ48882	Water	TB	01/10/2017	Level C	X					X		
81965	ERH196	AZ48886	Water	TB	01/09/2017	Level C	X					X		
81965	ERH197	AZ48879	Water	AB	01/09/2017	Level C	X					X		
81965	ERH198	AZ48885	Water	AB	01/10/2017	Level C	X					X		
81971	ERH171	AZ48914	Water	TB	01/11/2017	Level C	X					X		
81971	ERH172	AZ48915	Water		01/11/2017	Level D	X		X	X	X	X	X	
81971	ERH178	AZ48916	Water		01/11/2017	Level D	X	X				X		
81971	ERH178	AZ48916	Water		01/11/2017	Level C	X		X	X	X		X	X
81971	ERH180	AZ48923	Water	TB	01/12/2017	Level C	X					X		
81971	ERH181	AZ48921	Water		01/12/2017	Level C	X		X	X	X	X	X	
81971	ERH183	AZ48924	Water	TB	01/12/2017	Level C	X					X		
81971	ERH184	AZ48925	Water		01/12/2017	Level C	X		X	X	X	X	X	
81971	ERH185	AZ48917	Water	TB	01/11/2017	Level C	X	X				X		X
81971	ERH199	AZ48918	Water	AB	01/11/2017	Level C	X	X				X		X
81971	ERH200	AZ48919	Water	AB	01/11/2017	Level C	X					X		
81971	ERH201	AZ48920	Water	AB	01/11/2017	Level C	X	X				X		X
81971	ERH202	AZ48926	Water	AB	01/12/2017	Level C	X					X		

Table I. Validation Sample Table

SDG	Client Sample ID	Lab Sample ID	Matrix	QC Type	Sample Date	Validation Level	BTEX (8260B)	DCA (8260B)	Phenol (8270D)	MEE (8270D Mod)	PAH (8270D-SIM)	TPHG (8260B)	TPHE (8015B)	EDB (8011)
81971	ERH203	AZ48922	Water	AB	01/12/2017	Level C	X					X		

Table I. Validation Sample Table

SDG	Client Sample ID	Lab Sample ID	Matrix	QC Type	Sample Date	Validation Level	Methane (RSK175)	Alkalinity (2320B)	Anions (300.0)	Fe II (3500 FeB)
81936	ERH165	AZ48677	Water	TB	01/09/2017	Level C	X			
81936	ERH166	AZ48676	Water		01/09/2017	Level C	X	X	X	X
81936	ERH191	AZ48678	Water	EB	01/06/2017	Level C				
81936	ERH192	AZ48679	Water	EB	01/06/2017	Level C				
81936	ERH193	AZ48680	Water	TB	01/06/2017	Level C				
81965	ERH161	AZ48866	Water	FD1	01/09/2017	Level D	X			
81965	ERH161	AZ48866	Water	FD1	01/09/2017	Level C		X	X	X
81965	ERH162	AZ48867	Water	FD1	01/09/2017	Level C				
81965	ERH163	AZ48869	Water	TB	01/10/2017	Level C	X			
81965	ERH164	AZ48868	Water		01/10/2017	Level C	X	X	X	X
81965	ERH167	AZ48870	Water	TB	01/09/2017	Level C	X			
81965	ERH168	AZ48871	Water		01/09/2017	Level C	X	X	X	X
81965	ERH169	AZ48872	Water	FD2	01/11/2017	Level D	X	X	X	X
81965	ERH170	AZ48873	Water	FD2	01/11/2017	Level C	X			
81965	ERH173	AZ48884	Water	TB	01/10/2017	Level C	X			
81965	ERH174	AZ48875	Water		01/10/2017	Level C	X	X	X	X
81965	ERH175	AZ48876	Water	TB	01/10/2007	Level C	X			
81965	ERH176	AZ48877	Water		01/10/2017	Level C	X	X	X	X
81965	ERH177	AZ48874	Water	TB	01/11/2017	Level C	X			
81965	ERH179	AZ48878	Water		01/10/2017	Level C	X	X	X	X
81965	ERH186	AZ48880	Water	FB	01/10/2017	Level C				
81965	ERH187	AZ48881	Water	EB	01/10/2017	Level C				
81965	ERH194	AZ48882	Water	TB	01/10/2017	Level C	X			
81965	ERH196	AZ48886	Water	TB	01/09/2017	Level C	X			
81965	ERH197	AZ48879	Water	AB	01/09/2017	Level C				
81965	ERH198	AZ48885	Water	AB	01/10/2017	Level C				
81971	ERH171	AZ48914	Water	TB	01/11/2017	Level C	X			
81971	ERH172	AZ48915	Water		01/11/2017	Level D	X	X	X	X
81971	ERH178	AZ48916	Water		01/11/2017	Level D				
81971	ERH178	AZ48916	Water		01/11/2017	Level C	X	X	X	X
81971	ERH180	AZ48923	Water	TB	01/12/2017	Level C	X			
81971	ERH181	AZ48921	Water		01/12/2017	Level C	X	X	X	X
81971	ERH183	AZ48924	Water	TB	01/12/2017	Level C	X			
81971	ERH184	AZ48925	Water		01/12/2017	Level C	X	X	X	X
81971	ERH185	AZ48917	Water	TB	01/11/2017	Level C	X			
81971	ERH199	AZ48918	Water	AB	01/11/2017	Level C				
81971	ERH200	AZ48919	Water	AB	01/11/2017	Level C				
81971	ERH201	AZ48920	Water	AB	01/11/2017	Level C				
81971	ERH202	AZ48926	Water	AB	01/12/2017	Level C				

Table I. Validation Sample Table

SDG	Client Sample ID	Lab Sample ID	Matrix	QC Type	Sample Date	Validation Level	Methane (RSK175)	Alkalinity (2320B)	Anions (300.0)	Fe II (3500 FeB)
81971	ERH203	AZ48922	Water	AB	01/12/2017	Level C				

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**Appendix F:
Fact Sheet, Quantitation and Detection
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As a Project Manager or decision-maker, you may use environmental data to accomplish one or more of the following tasks:

- Determine whether a chemical substance is present in an environmental sample at or above some threshold value or action level;
- Verify that a pollutant concentration remains below a permit limit;
- Evaluate potential risks to human health or the environment;
- Monitor changes in concentrations of contaminants; or
- Determine the effectiveness of remediation activities.

Making correct decisions in these cases often depends on the ability of an analytical method to detect and measure extremely low concentrations of a substance.

This fact sheet has been prepared to: 1) provide Project Managers and data users with basic information about detection and quantitation concepts; and 2) acquaint the reader with detection and quantitation terminology and requirements contained in the *DoD Quality Systems Manual for Environmental Laboratories (DoD QSM)*, Version 4.1. This information should help clarify the uncertainty associated with reporting low-concentration data. It should also help project teams understand the importance of selecting analytical methods that are sensitive enough for their intended uses, i.e., capable of generating reliable data (data of known precision and bias) at the project-specific decision levels.

Measures of Sensitivity — Basic Concepts

The following terms are used to describe the routine sensitivity of analytical procedures:

- DL – Detection Limit
- LOD – Limit of Detection
- LOQ – Limit of Quantitation

All measures of sensitivity are specific to the analyte, sample matrix, test method, instrumentation, and analyst/laboratory performance. Therefore, analytical performance must be demonstrated for each variable (e.g., it is possible that two “identical” instruments from the same manufacturer may exhibit different sensitivities).

The Detection Limit (DL) is the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. In other words, if a substance is detected at or above the DL, it can be reliably stated (with 99% confidence) that the analyte is present (there is a 1% chance that the analyte is not present (a false positive)). Note that for reporting purposes, any result at or above the DL must also meet qualitative identification criteria required by the test method. Although a result at or above the DL indicates that the analyte is present, the absence of a result at or above the DL is inconclusive (i.e., one cannot confidently state whether the analyte is present or absent), because the false negative rate at the DL is 50%.

The Limit of Detection (LOD) is the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a 99% confidence level. In other words, if a sample has a true concentration at the LOD, there is a minimum probability of 99% of reporting a “detection” (a measured value \geq DL) and a 1% chance of reporting a non-detect (a false negative).

The failure to obtain a “detection” should be reported as “<LOD,” because the false negative rate at the LOD is 1%. Reporting the sample result as “<DL” is inappropriate because, as stated above, the false negative rate at the DL is 50%.

The Limit of Quantitation (LOQ) is the lowest concentration of a substance that produces a quantitative result within specified limits of precision and bias. The LOQ is typically larger than the LOD (but may be equal to the LOD, depending upon the acceptance limits for precision and bias); therefore, the following is true:

$$DL < LOD \leq LOQ$$

Quantitative results can only be achieved at or above the LOQ. Measurements between the DL and the LOQ assure the *presence* of the analyte with confidence, but their numeric values are estimates.

Types of Procedures for Estimating Sensitivity

Numerical estimates of the DL, LOD, or LOQ for a specific analyte, matrix, and method can be calculated using various statistical procedures, which involve spiking reagent water or other specific matrix with low concentrations of the analyte of interest. At this time, unfortunately, universally accepted statistical procedures do not exist.

The estimator that has been most commonly used by environmental laboratories is the EPA Method Detection Limit (MDL), which is an approximation of the DL. EPA has defined the MDL as the “minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero, and is determined from analysis of a sample in a given matrix containing the analyte.”¹ Calculating the MDL at 99% confidence means there is a 1% probability that a sample having a result at or above the MDL is a false positive. The EPA MDL was designed to protect against false positives.

Uses and Limitations of the MDL

When performed correctly and consistently, MDLs determined using the EPA procedure can be useful for comparing different laboratories’ performance using the same methods, or the performance of different methods within the same laboratory. Laboratories typically determine the MDL in reagent water, resulting in a “best-case” MDL, which provides limited information about method performance on real-world samples.

The EPA MDL procedure has been criticized as a poor estimator of the DL for the following reasons:

1. It is a single laboratory, short-term estimator that fails to account for analytical bias, changing instrument conditions, or analyst skill.
2. It assumes uniform variance across all possible spike concentrations, failing to account for the fact that variance increases at higher concentrations.
3. It assumes that measured values at the spike concentration are normally distributed. By using this procedure and spiking at very low concentrations, laboratories have been able to calculate MDLs that cannot be achieved in practice.

DoD QSM Requirements

For the reasons discussed in the previous paragraph, the DoD QSM requires that laboratories verify measures of method sensitivity, in terms of the LOD and LOQ, at least quarterly. Requirements for the LOD and the LOQ are contained in DoD QSM Boxes D-13 and D-14, respectively, which follow:

¹ 40 Code of Federal Regulations (CFR) Part 136, Appendix B, rev. 1.11.

Box D-13

Limit of Detection (LOD): Determination and Verification (Requirement)

A laboratory shall establish a detection limit (DL) using a scientifically valid and documented procedure for each suite of analyte-matrix-method, including surrogates. The detection limit shall be used to determine the LOD for each analyte and matrix as well as for all preparatory and cleanup methods routinely used on samples, as follows:

After each detection limit determination, the laboratory must immediately establish the LOD by spiking a quality system matrix at approximately two to three times the detection limit (for a single-analyte standard) or one to four times the detection limit (for a multi-analyte standard). This spike concentration establishes the LOD. It is specific to each combination of analyte, matrix, method (including sample preparation), and instrument configuration. The LOD must be verified quarterly. The following requirements apply to the initial detection limit/LOD determinations and to the quarterly LOD verifications.

- The apparent signal to noise ratio at the LOD must be at least three and the results must meet all method requirements for analyte identification (e.g., ion abundance, second-column confirmation, or pattern recognition.) For data systems that do not provide a measure of noise, the signal produced by the verification sample must produce a result that is at least three standard deviations greater than the mean method blank concentrations.
- If a laboratory uses multiple instruments for a given method the LOD must be verified on each.
- If the LOD verification fails, then the laboratory must repeat the detection limit determination and LOD verification at a higher concentration or perform and pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration.
- The laboratory shall maintain documentation for all detection limit determinations and LOD verifications.

Box D-14

Limit of Quantitation (LOQ): Establishment and Verification of LOQ (Requirement)

For DoD projects, the LOQ must be set within the calibration range prior to sample analysis. At a minimum, the LOQ must be verified quarterly.

The laboratory procedure for establishing the LOQ must empirically demonstrate precision and bias at the LOQ. The LOQ and associated precision and bias must meet client requirements and must be reported. If the method is modified, precision and bias at the new LOQ must be demonstrated and reported.

Establishing Project-Specific Requirements for Method Sensitivity

Project teams should establish their project-specific requirements for method sensitivity in terms of a Reporting Limit (RL) for each analyte and matrix. As defined in the DoD QSM, the RL is the lowest concentration value specified by the client that meets project requirements for reporting quantitative data with known precision and bias for a specific analyte in a specific matrix. The LOQ cannot be greater than the RL, if precision and bias of the RL and LOQ are the same. If the LOQ for a particular analytical method or laboratory cannot meet the RL, then a project team has three options:

1. Improve analyst performance or modify the method to achieve a lower LOQ.
2. Select a different method with an LOQ less than or equal to the RL.
3. Raise the RL.

Please note that precision and bias must be taken into consideration when assessing the LOQ versus the RL. Also note that data below the RL can be reported; however they are estimated values if less than the LOQ.

Reporting and Flagging Analytical Data

Although data reporting and flagging requirements are project-specific, all reported LOD and LOQ shall be adjusted for the size of sample aliquots, concentration/dilution factors, and percent solids. In addition, the following example (based on Box 47 of DoD QSM Version 4.1) illustrates the proper use of the “U” and “J” data qualifier flags for non-detect and estimated analytical results, respectively.

- U – Analyte was not detected and is reported as less than the LOD or as defined by the client. The LOD has been adjusted for any dilution or concentration of the sample (* see Example, below).
- J – The reported result is an estimated value (e.g., matrix interference was observed or the analyte was detected at a concentration outside the quantitation range, see Box 33).

Example: DL = 2, LOD = 4, LOQ = 20, and RL = 30 with the precision and bias of the LOQ meeting those of the RL and all samples are undiluted.

Sample #1: Analytical result: Non-detect	Reported result: <4 U
Sample #2: Analytical result: 3	Reported result: 3 J
Sample #3: Analytical result: 10	Reported result: 10 J
Sample #4: Analytical result: 20	Reported result: 20
Sample #5: Analytical result: 30	Reported result: 30

Understanding and Documenting Uncertainty for Low-Concentration Data

As mentioned above, detection and quantitation limits are laboratory specific. Following are some steps Project Managers can take to document measurement uncertainty for low concentration data.

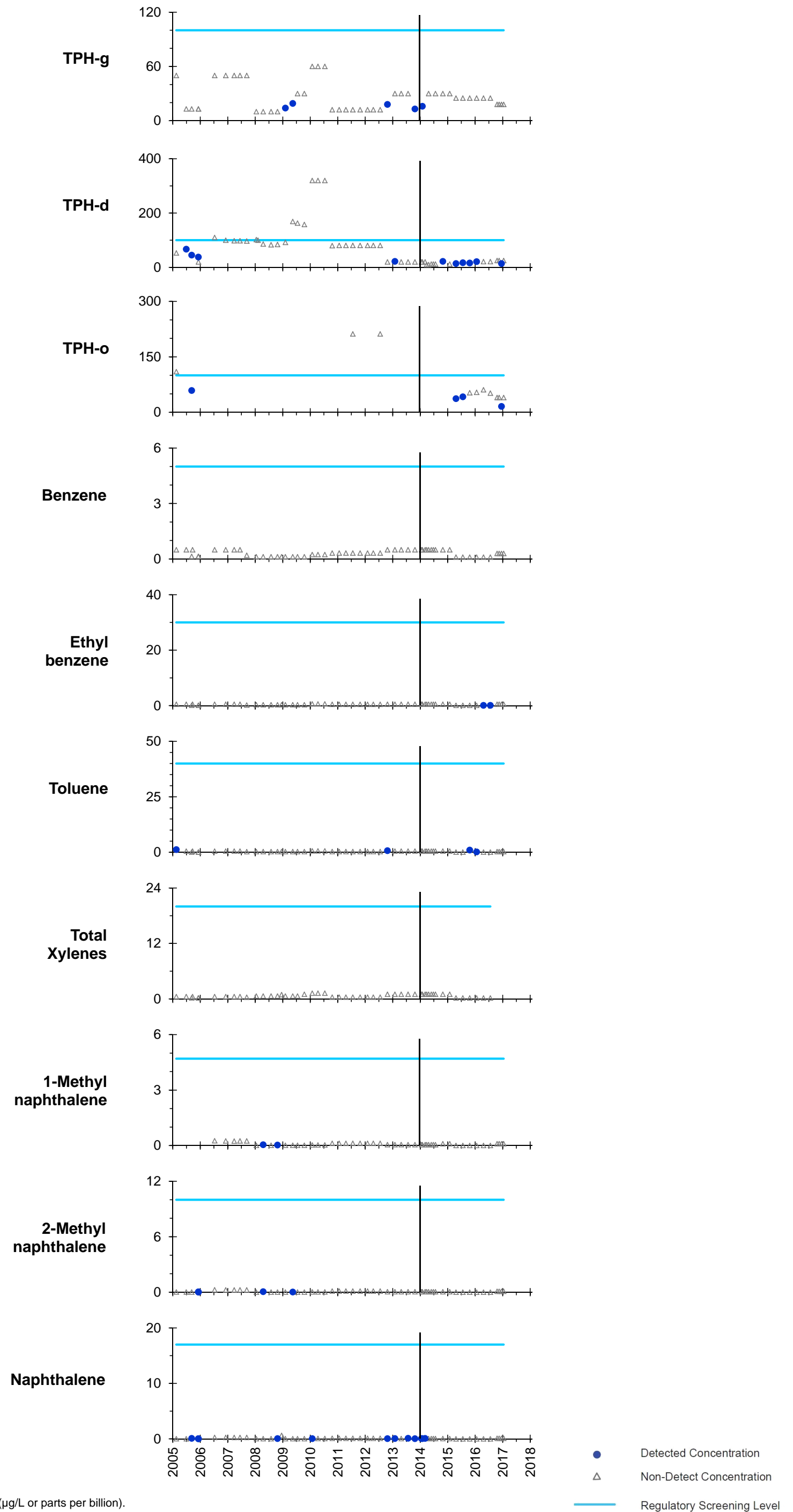
- As part of the laboratory selection process, provide the laboratory with project-specific RLs, including precision and bias, for each analyte and matrix. Ask the laboratory to provide its DL, LOD, and LOQ with associated precision and bias for each target analyte, in each matrix of concern (e.g., reagent water, clean sand, etc.), and verify that these values meet project-specific RLs. Request laboratory SOPs for establishing the DL and for establishing and verifying the LOD and LOQ.
- Ask the laboratory to verify the LOD by processing an LOD verification check sample with each batch of samples. This is a quality control sample that is spiked at a concentration at or slightly above the LOD to evaluate whether the analyte of interest is in fact “detectable” in the matrix of interest. To confidently report non-detects, set the reporting for non-detects to less than the LOD.
- If the project involves the collection of unusual or difficult matrices, or if the project-specific RL is near the LOQ, ask the laboratory to verify the LOQ in the project-specific matrix by analyzing a minimum of four replicate samples with known concentrations at the LOQ.
- Review the raw data (e.g., chromatograms) for low-concentration data. If a result is reported above the DL, make sure that the signal-to-noise ratio is at least 3.
- Compare sample results with blank results. If sample results (including chromatograms) cannot be distinguished from blank results, then they are not meaningful.

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**Appendix G:
Historical Groundwater COPC Concentrations**

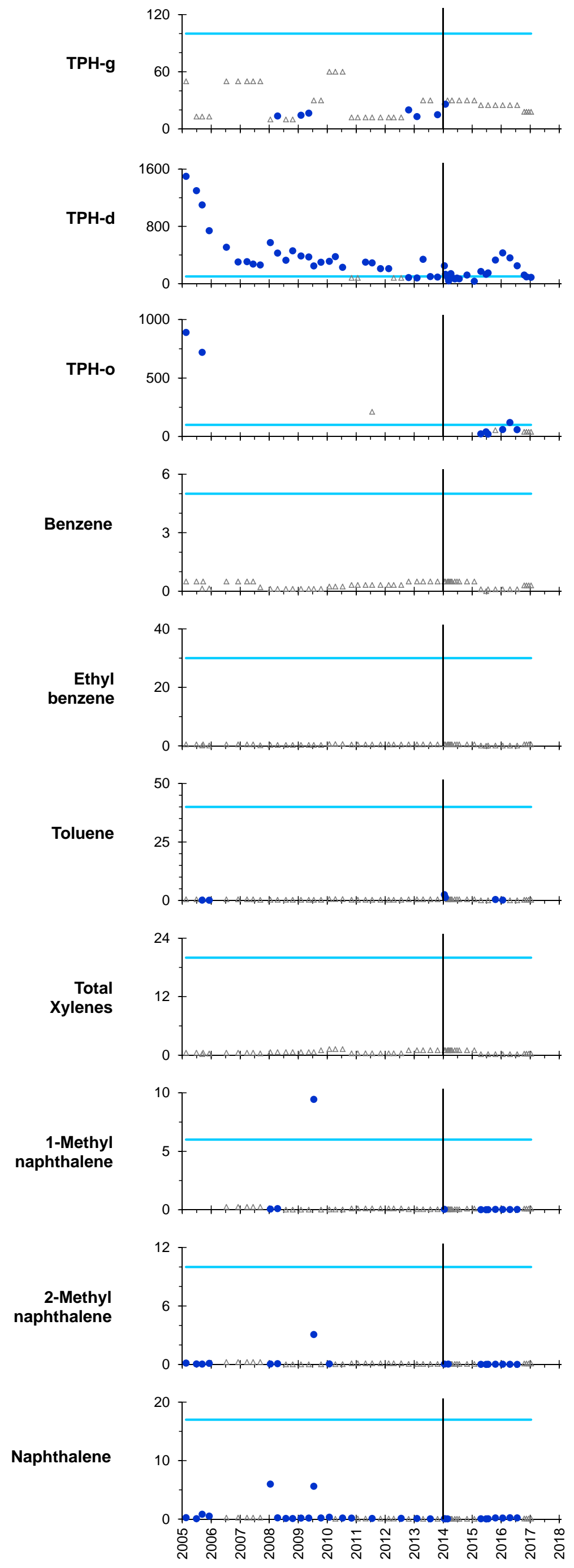
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RHMW2254-01



All units in micrograms per liter (µg/L or parts per billion).

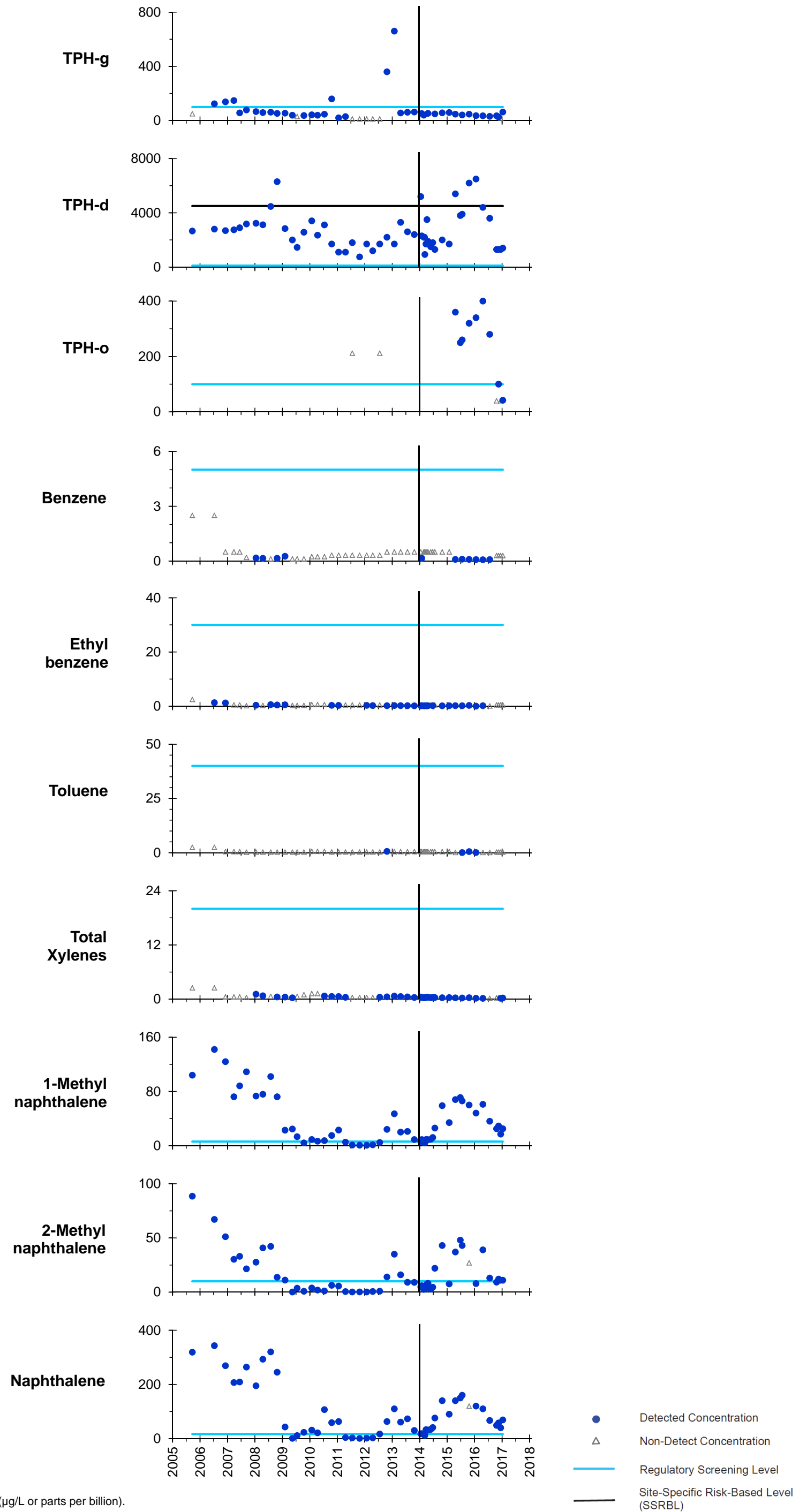
RHMW01



All units in micrograms per liter (µg/L or parts per billion).

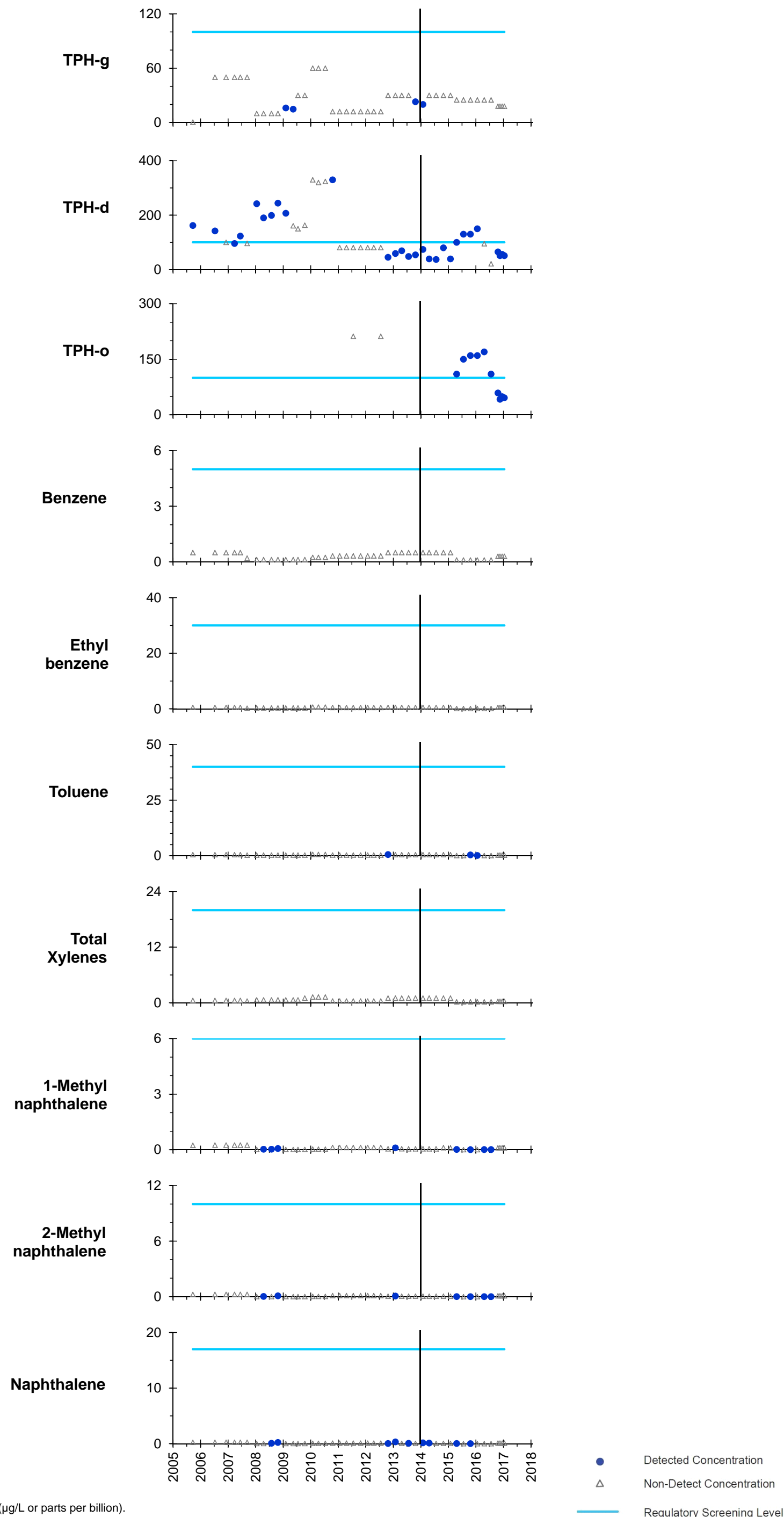
● Detected Concentration
△ Non-Detect Concentration
— Regulatory Screening Level

RHMW02



All units in micrograms per liter (µg/L or parts per billion).

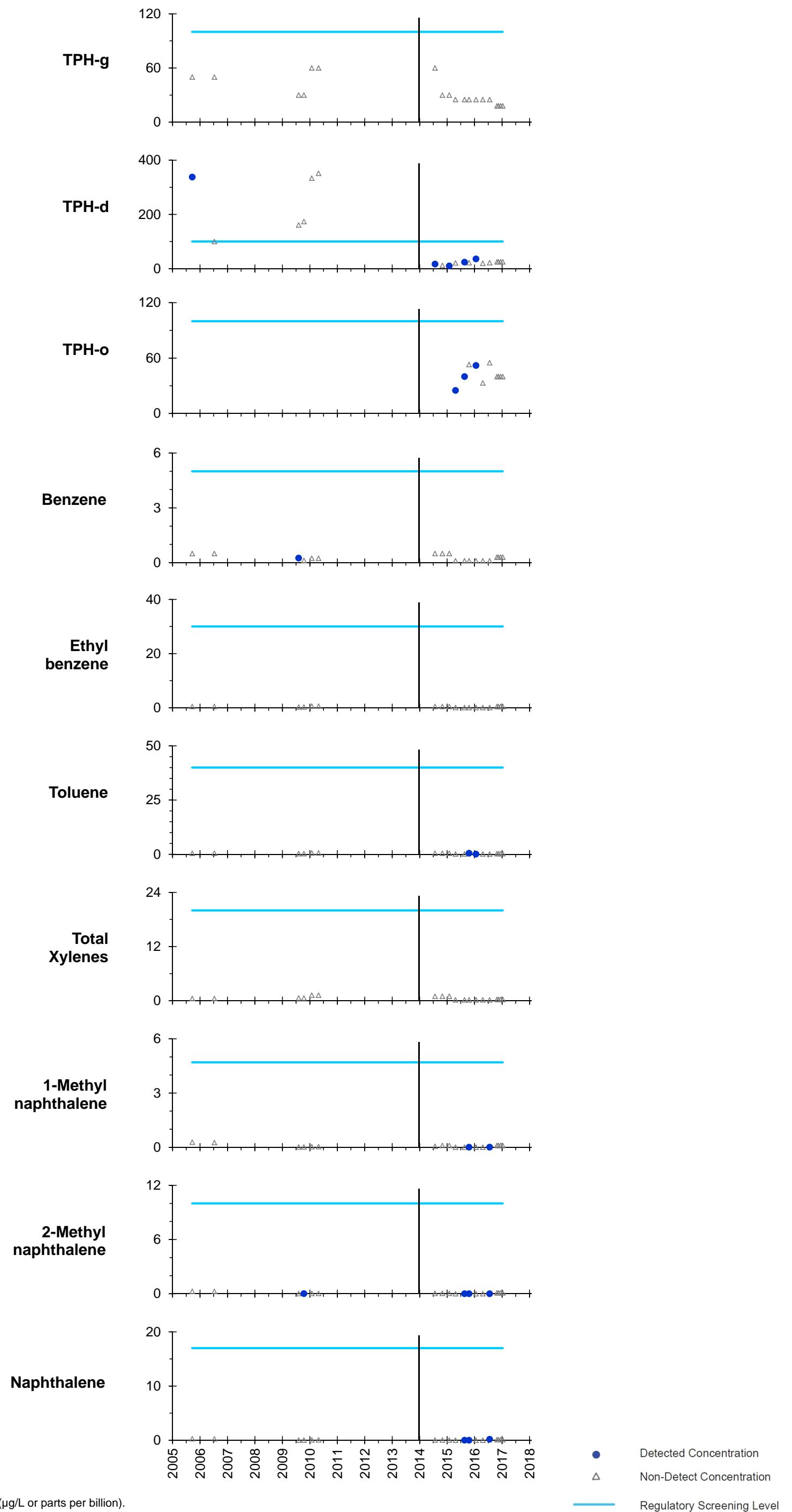
RHMW03



All units in micrograms per liter (µg/L or parts per billion).

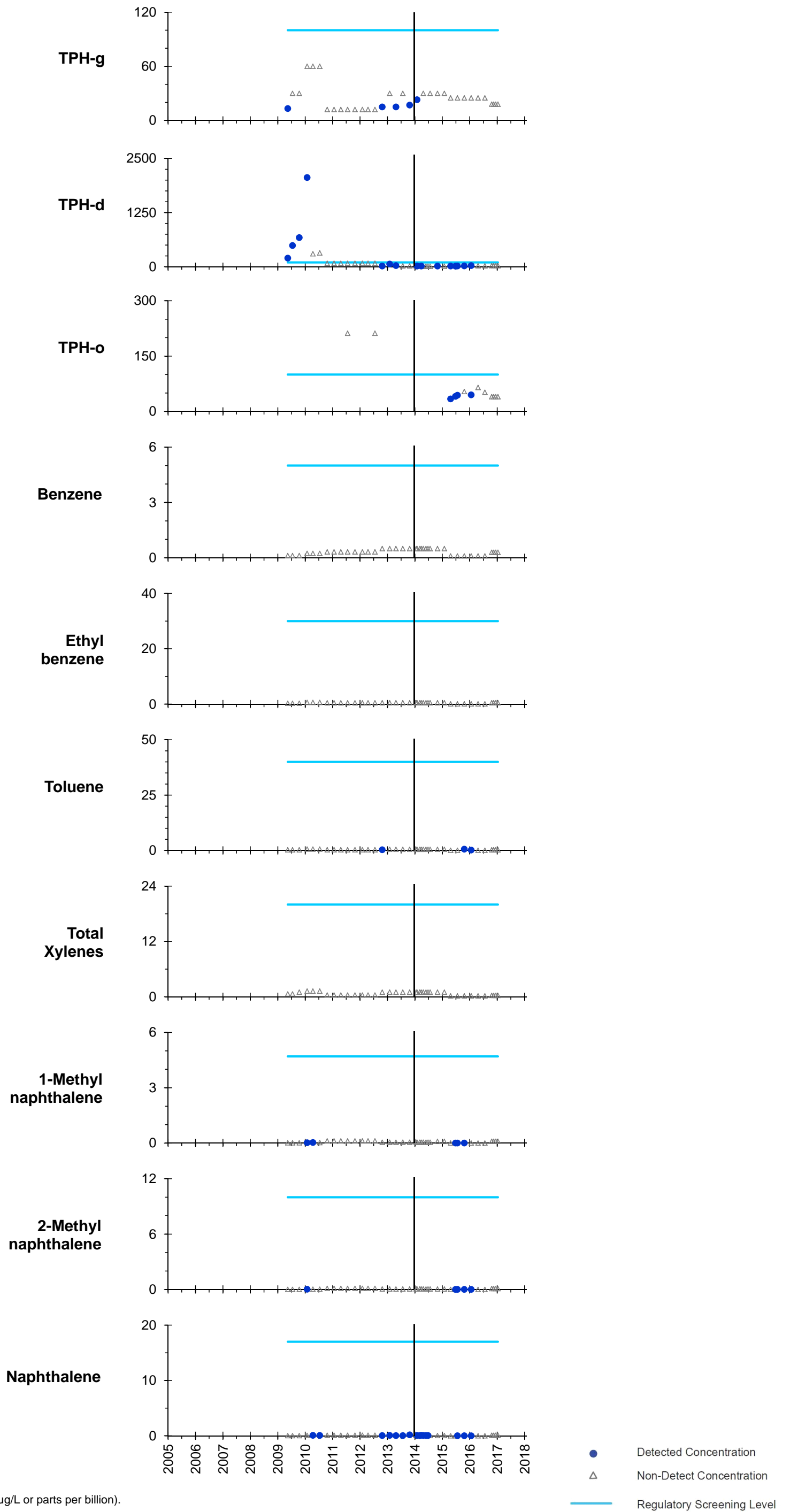
- Detected Concentration
- △ Non-Detect Concentration
- Regulatory Screening Level

RHMW04



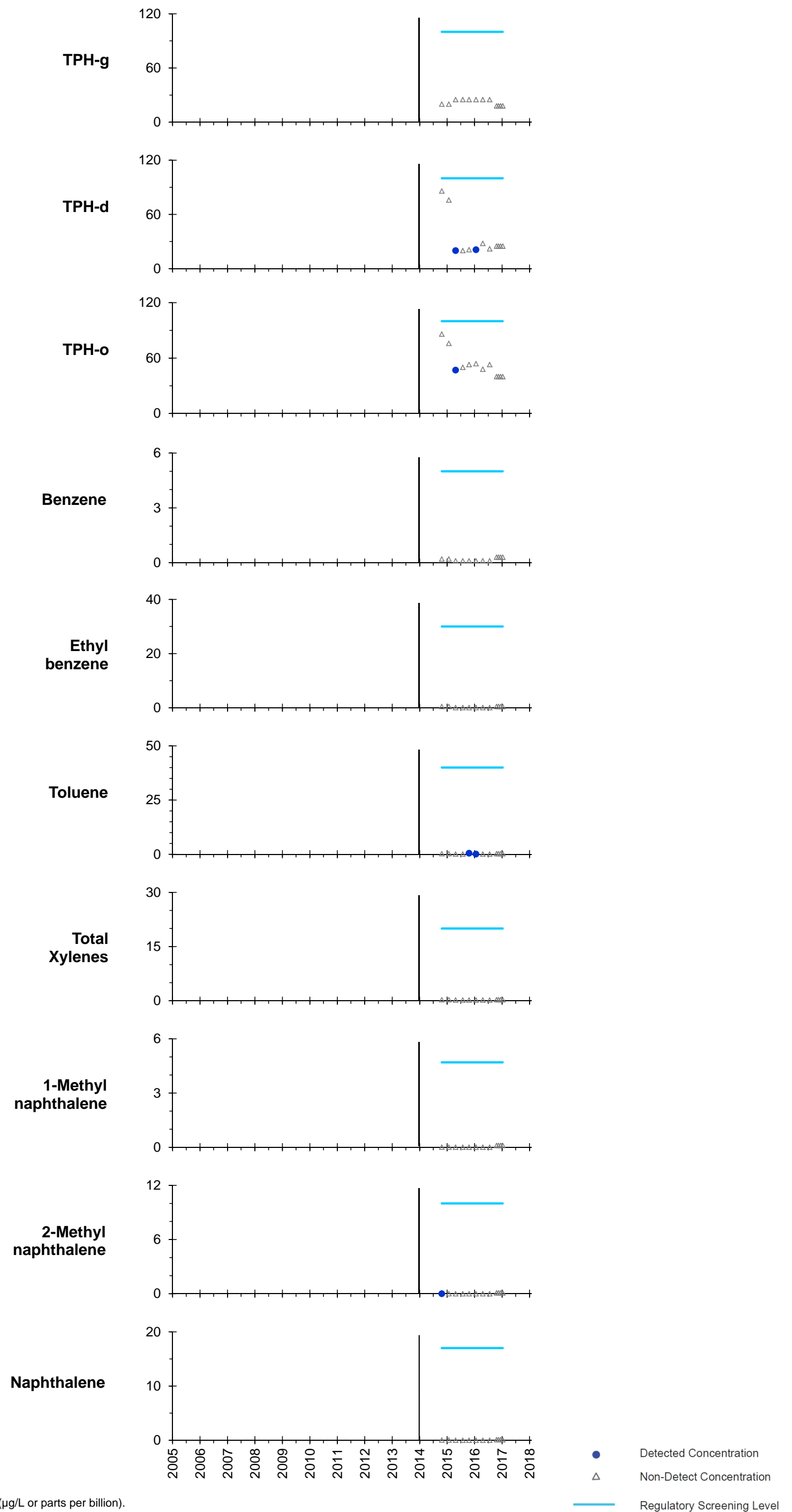
All units in micrograms per liter (µg/L or parts per billion).

RHMW05



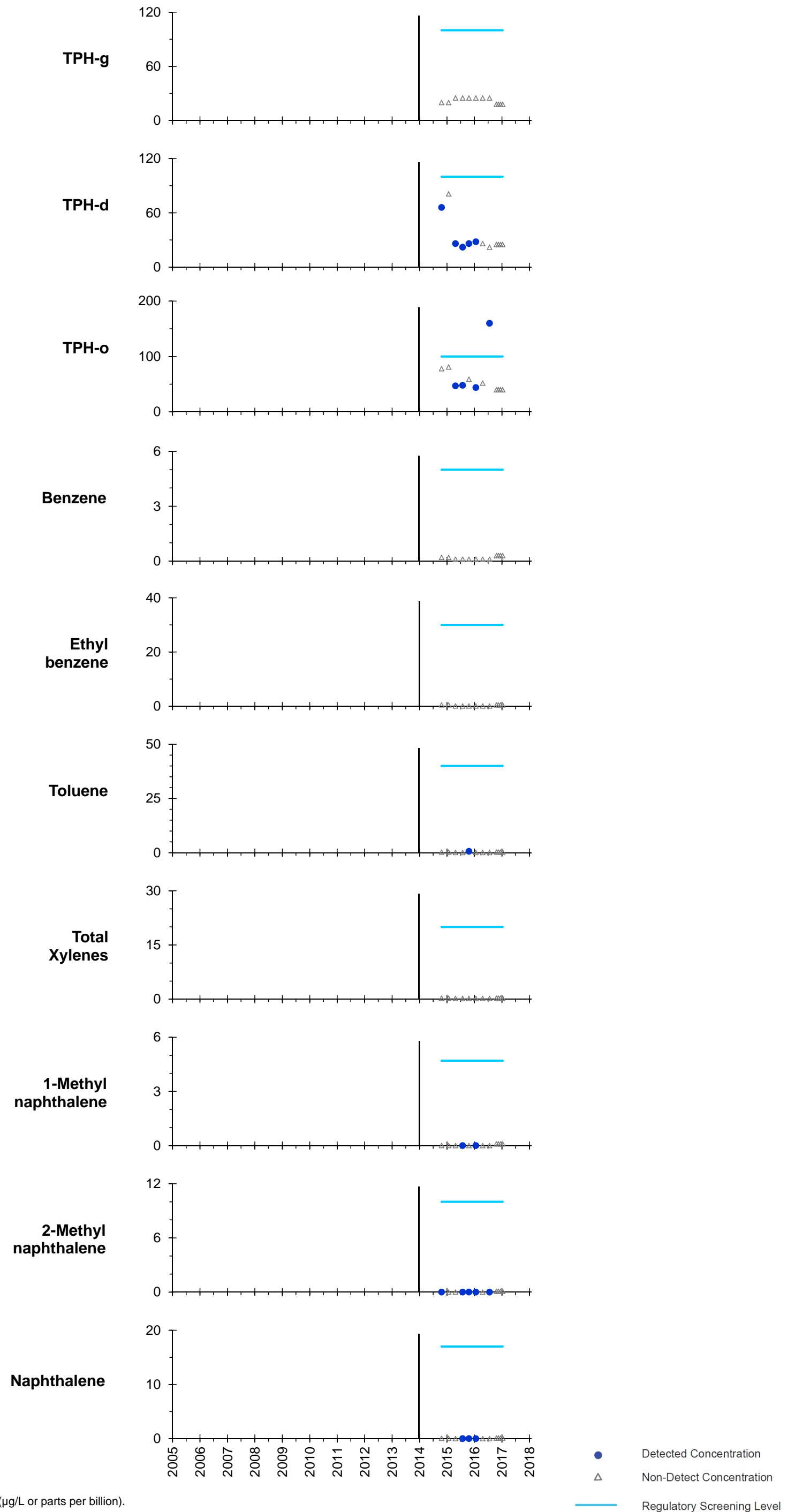
All units in micrograms per liter (µg/L or parts per billion).

RHMW06



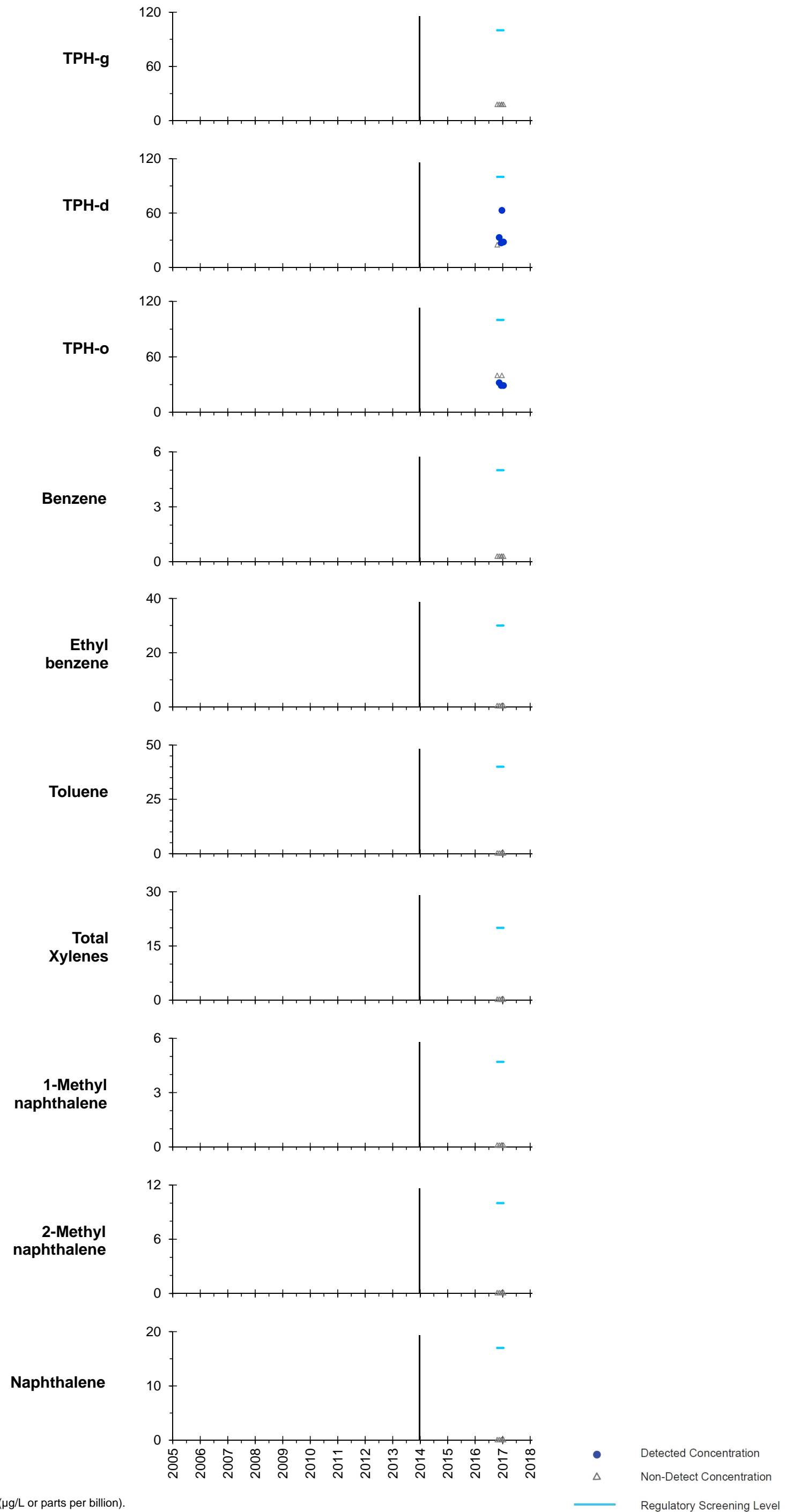
All units in micrograms per liter (µg/L or parts per billion).

RHMW07



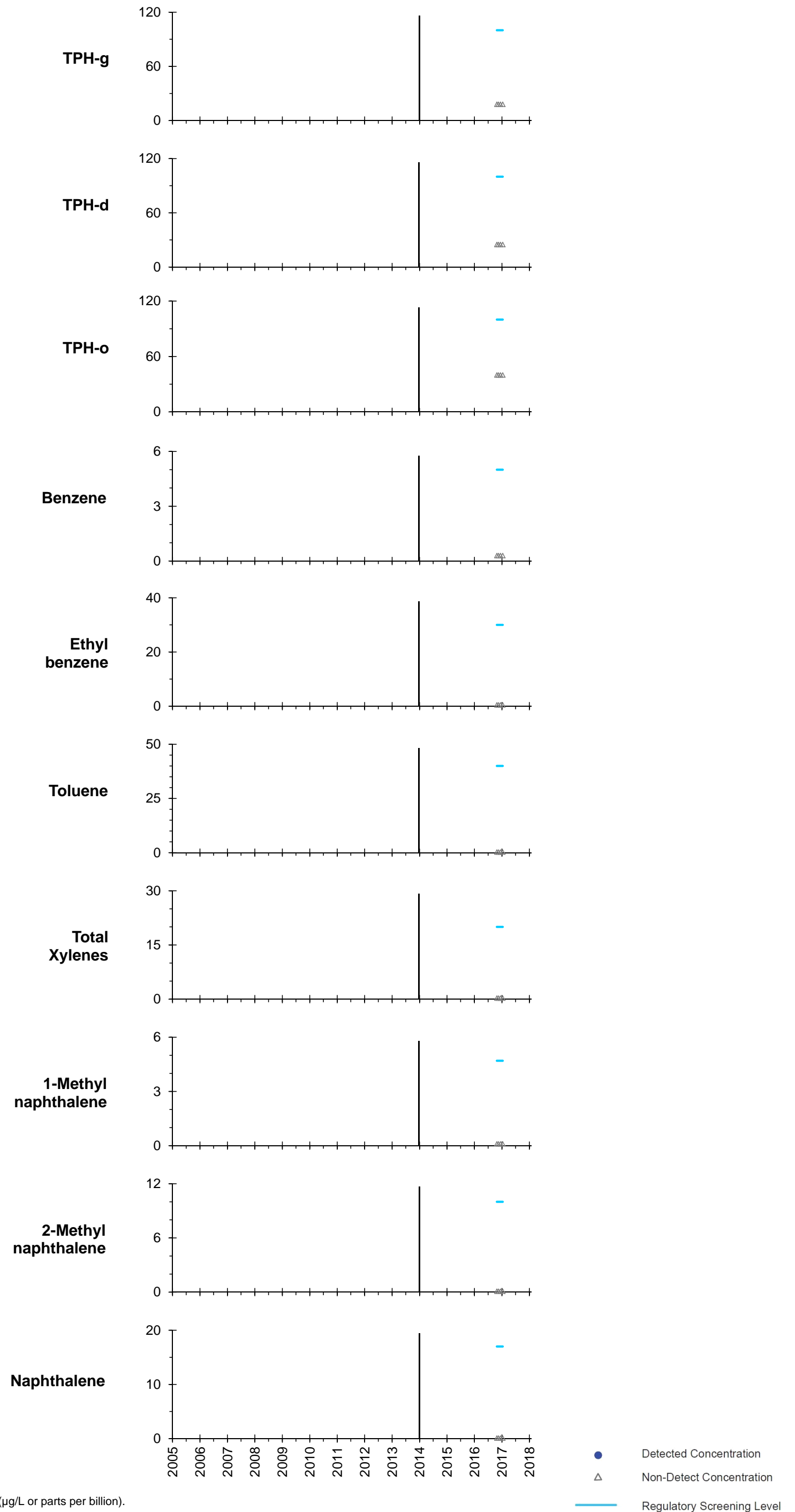
All units in micrograms per liter (µg/L or parts per billion).

RHMW08



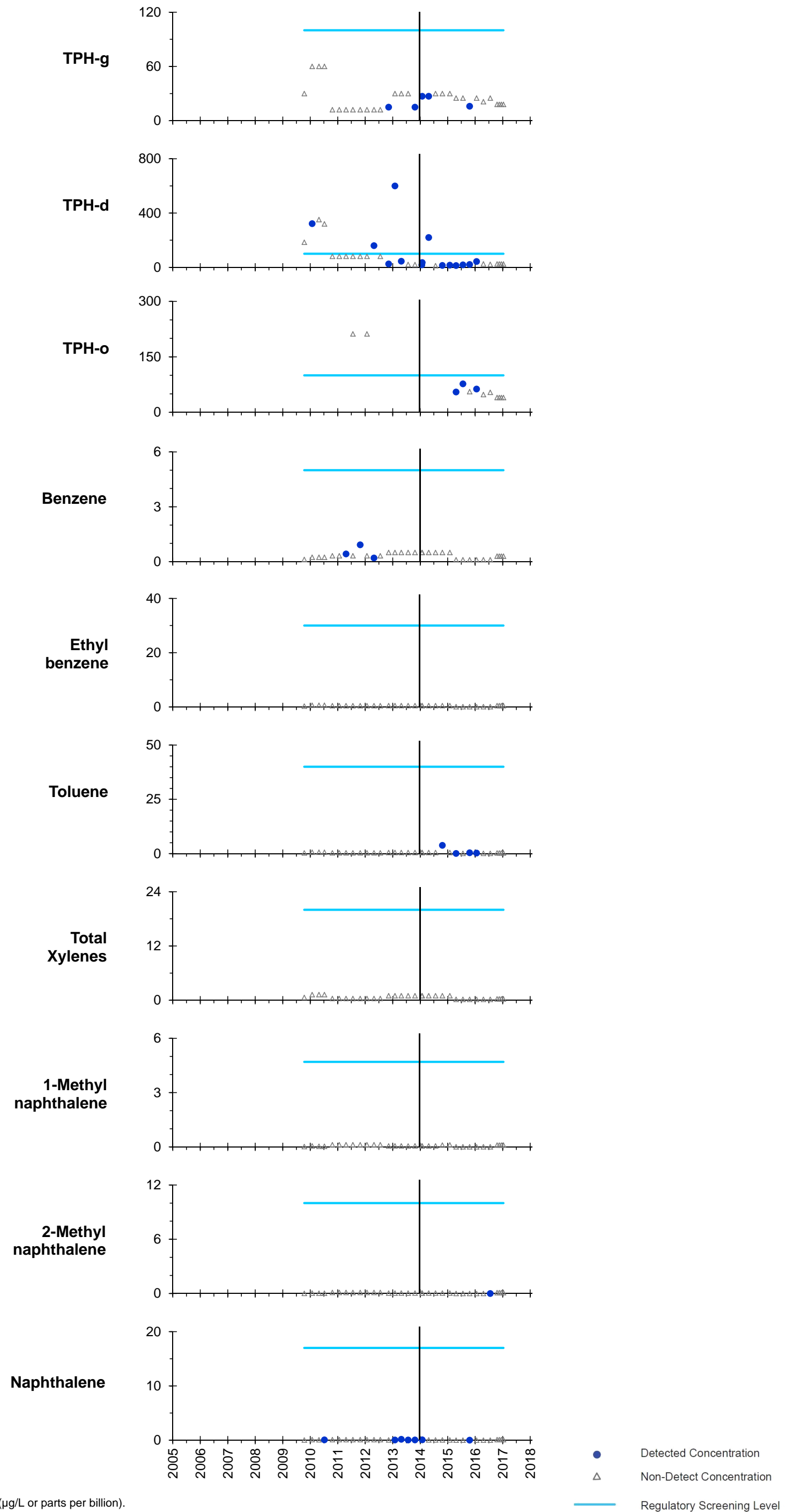
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RHMW09



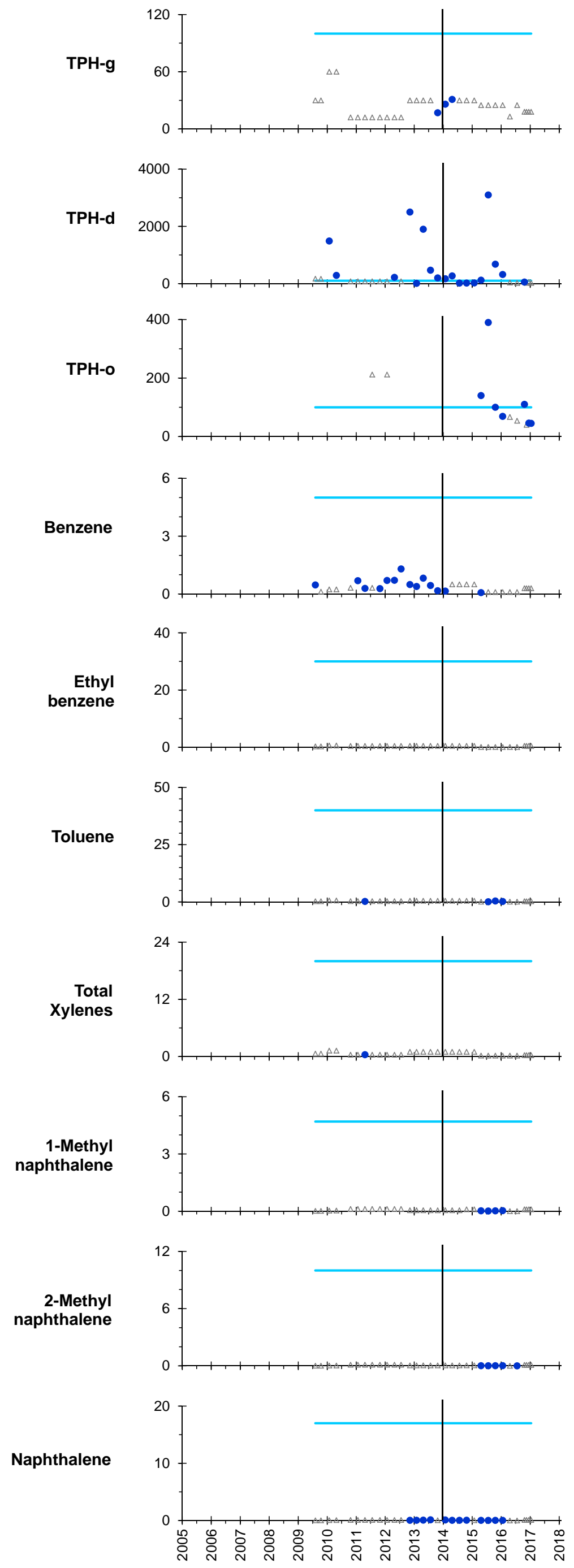
All units in micrograms per liter (µg/L or parts per billion).

HDMW2253-03

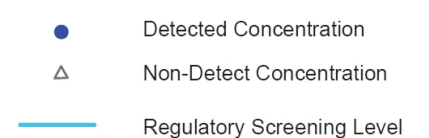


All units in micrograms per liter (µg/L or parts per billion).

OWDFMW01



All units in micrograms per liter (µg/L or parts per billion).

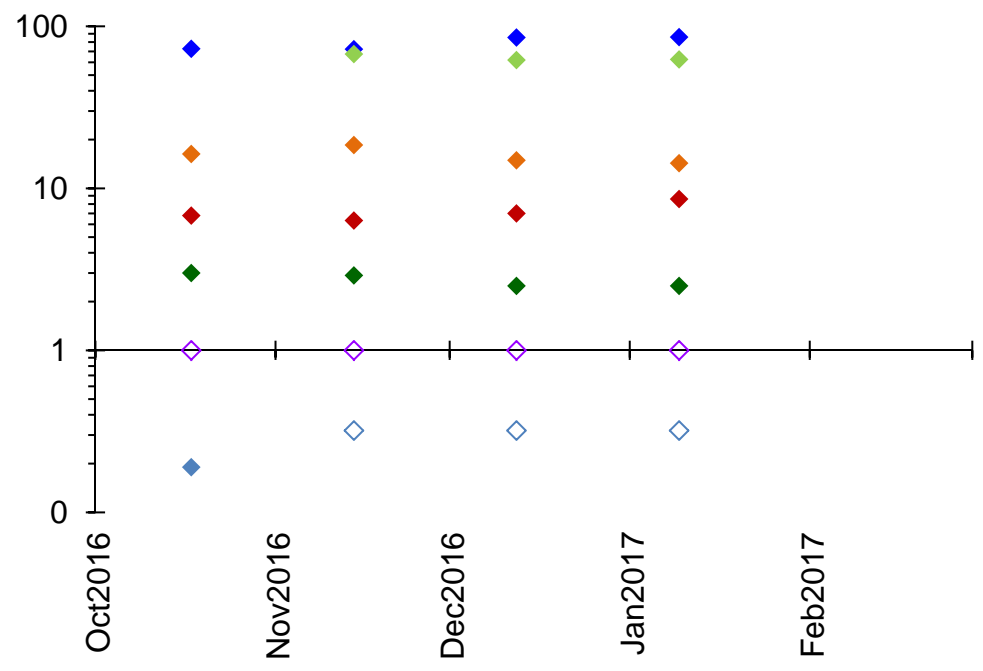


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**Appendix H:
Natural Attenuation Parameter Trends**

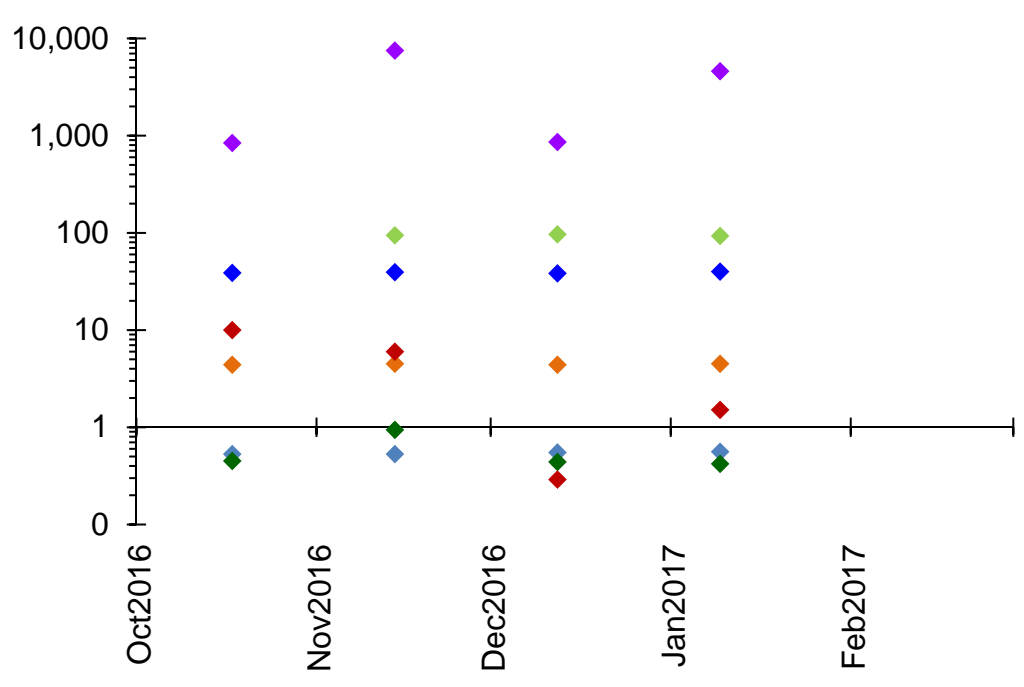
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RHMW2254-01 NAPs



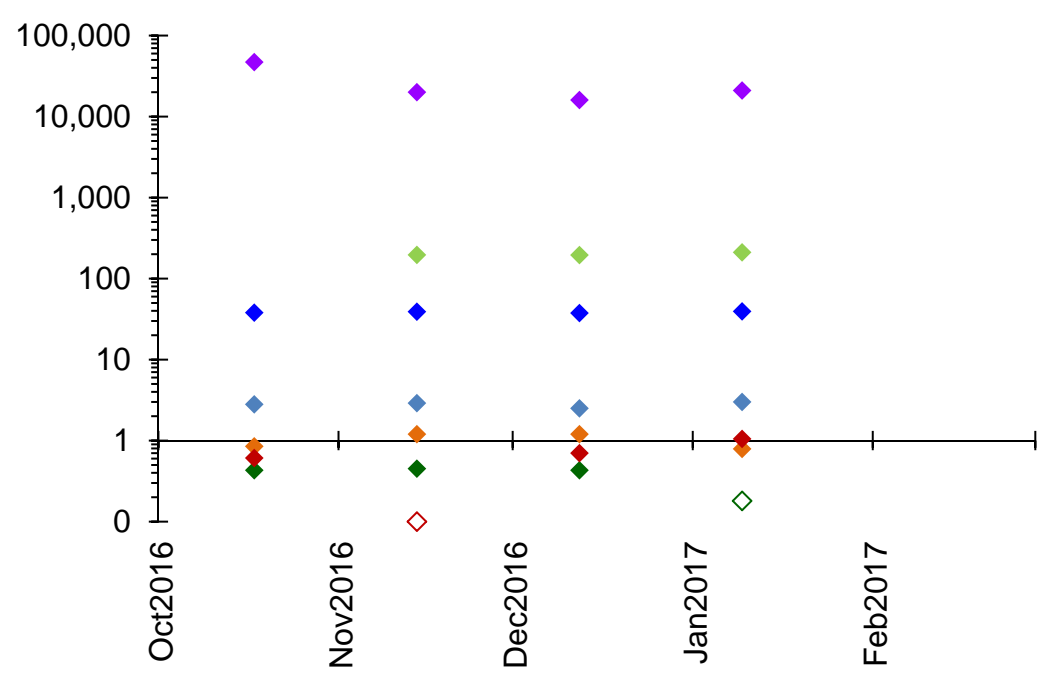
- ◆ Methane (D)
- ◇ Methane (ND)
- ◆ Ferrous Iron (D)
- ◇ Ferrous Iron (ND)
- ◆ Nitrate (D)
- ◇ Nitrate (ND)
- ◆ Sulfate (D)
- ◇ Sulfate (ND)
- ◆ Chloride (D)
- ◇ Chloride (ND)
- ◆ DO (D)
- ◇ DO (ND)
- ◆ Alkalinity, Total (D)
- ◇ Alkalinity, Total (ND)

RHMW01 NAPs



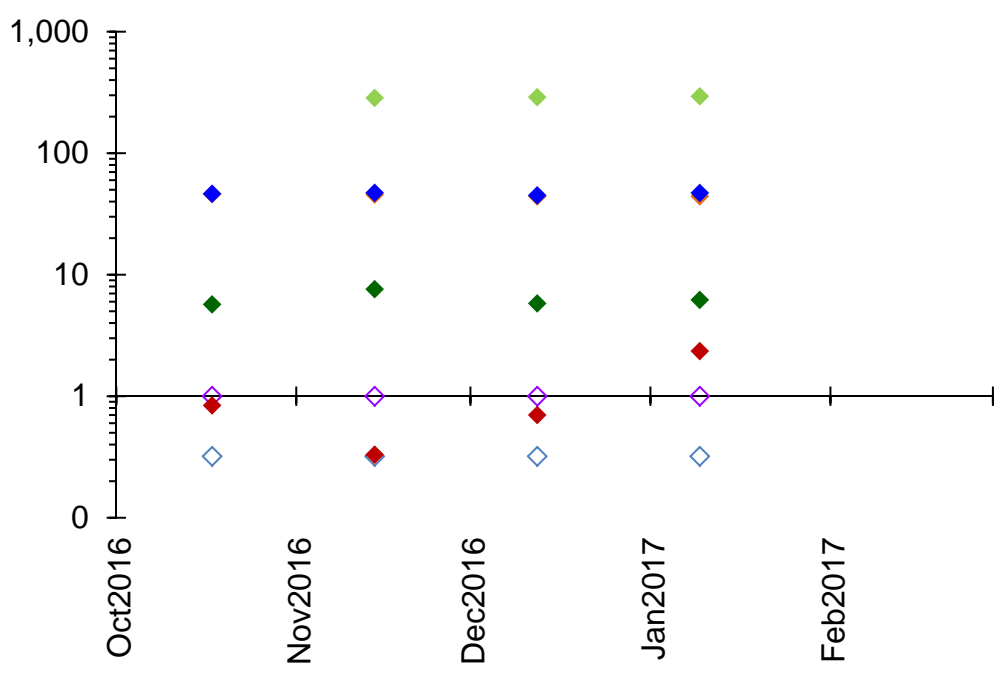
- ◆ Methane (D)
- ◇ Methane (ND)
- ◆ Ferrous Iron (D)
- ◇ Ferrous Iron (ND)
- ◆ Nitrate (D)
- ◇ Nitrate (ND)
- ◆ Sulfate (D)
- ◇ Sulfate (ND)
- ◆ Chloride (D)
- ◇ Chloride (ND)
- ◆ DO (D)
- ◇ DO (ND)
- ◆ Alkalinity, Total (D)
- ◇ Alkalinity, Total (ND)

RHMW02 NAPs



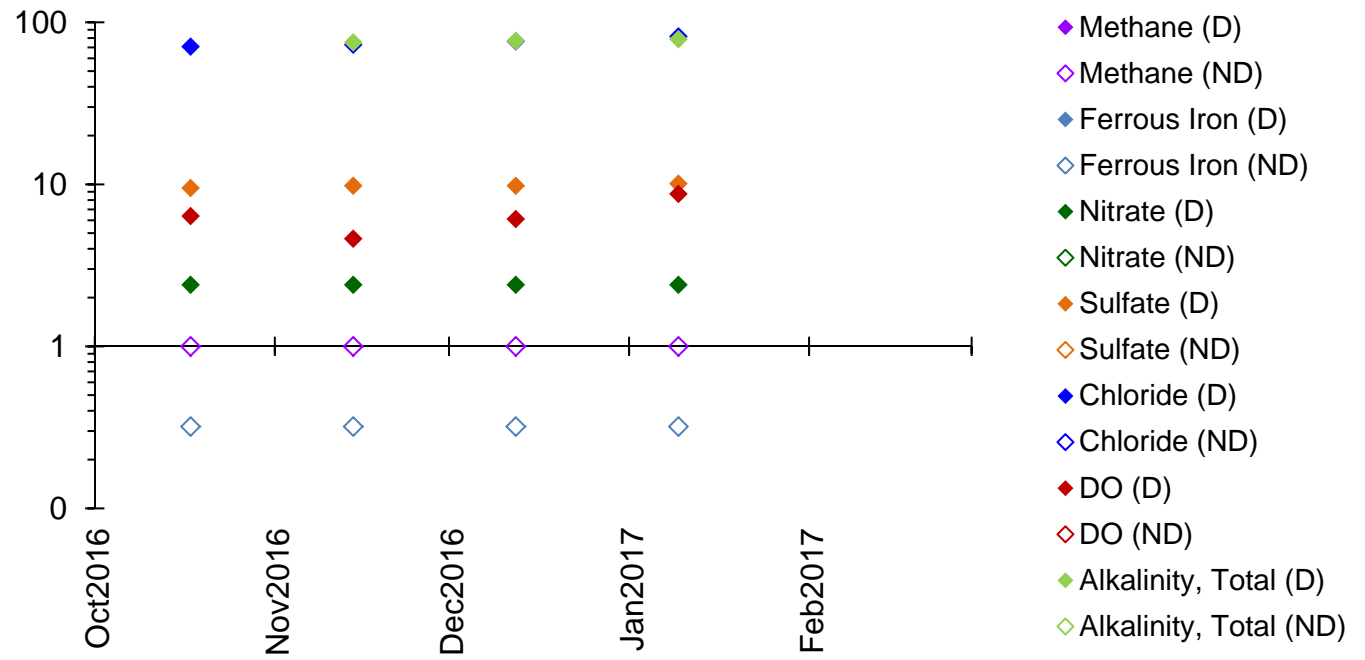
- ◆ Methane (D)
- ◇ Methane (ND)
- ◆ Ferrous Iron (D)
- ◇ Ferrous Iron (ND)
- ◆ Nitrate (D)
- ◇ Nitrate (ND)
- ◆ Sulfate (D)
- ◇ Sulfate (ND)
- ◆ Chloride (D)
- ◇ Chloride (ND)
- ◆ DO (D)
- ◇ DO (ND)
- ◆ Alkalinity, Total (D)
- ◇ Alkalinity, Total (ND)

RHMW03 NAPs

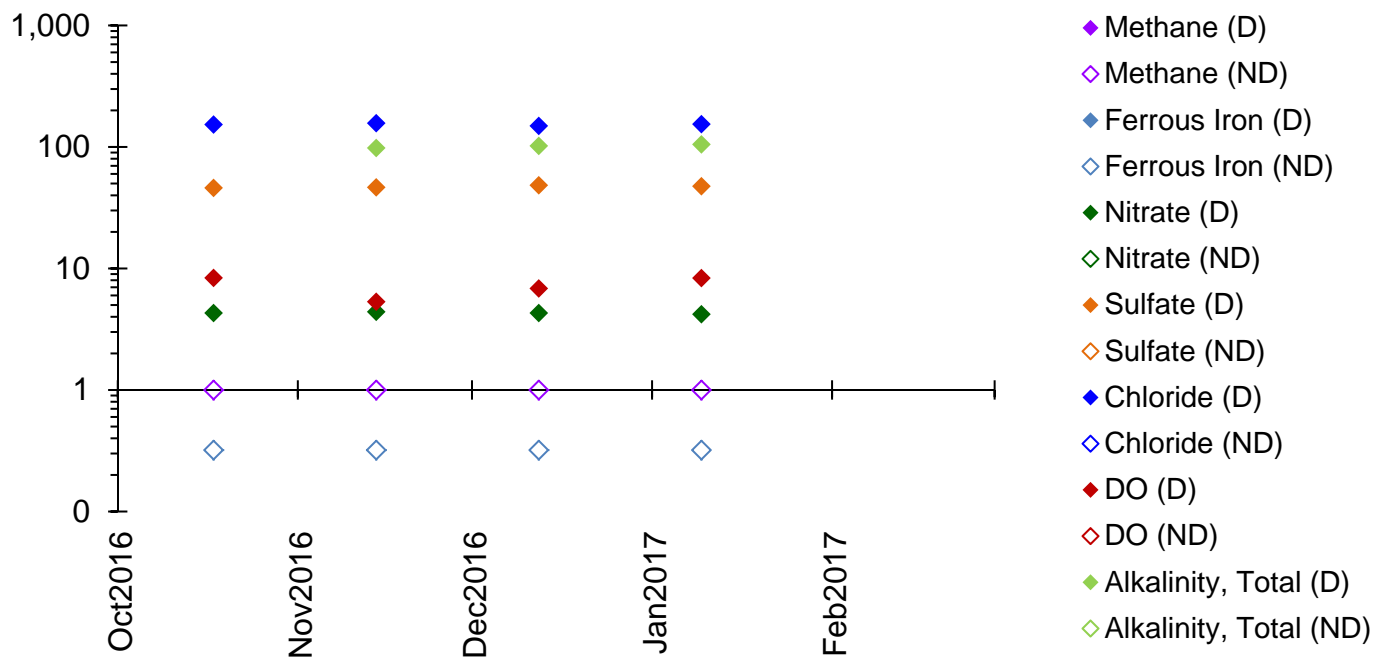


- ◆ Methane (D)
- ◇ Methane (ND)
- ◆ Ferrous Iron (D)
- ◇ Ferrous Iron (ND)
- ◆ Nitrate (D)
- ◇ Nitrate (ND)
- ◆ Sulfate (D)
- ◇ Sulfate (ND)
- ◆ Chloride (D)
- ◇ Chloride (ND)
- ◆ DO (D)
- ◇ DO (ND)
- ◆ Alkalinity, Total (D)
- ◇ Alkalinity, Total (ND)

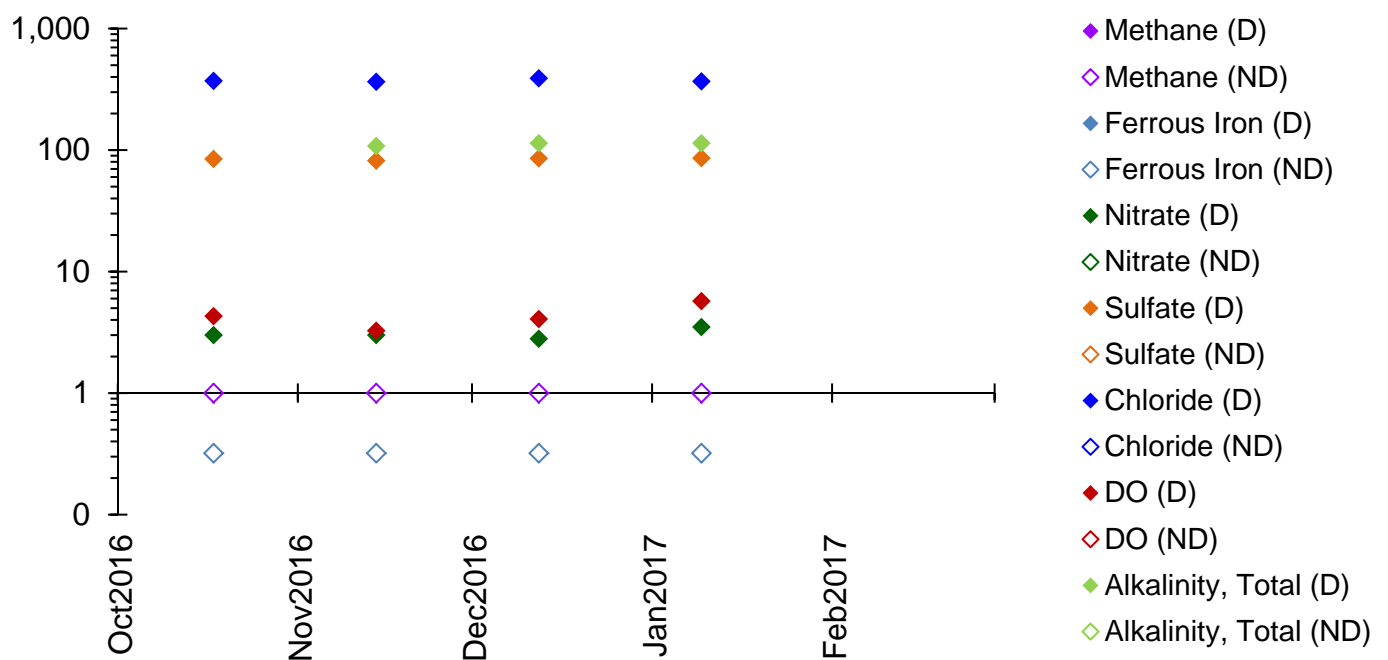
RHMW04 NAPs



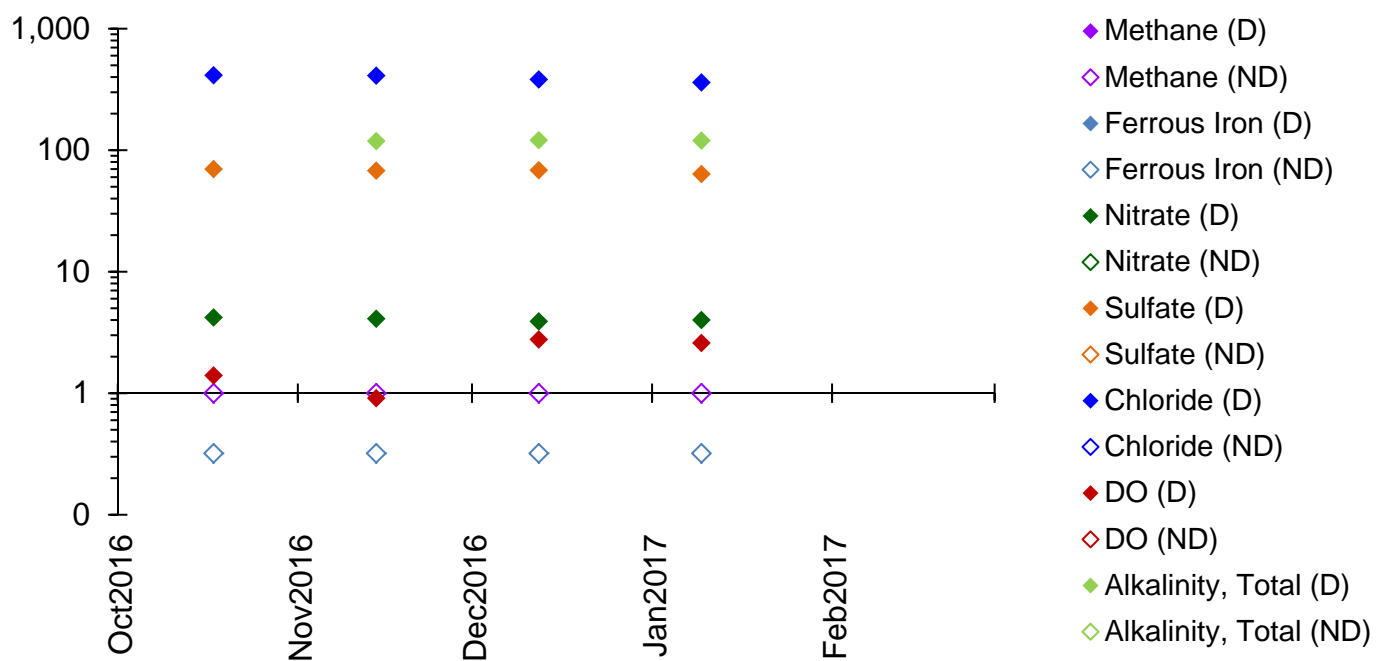
RHMW05 NAPs



RHMW06 NAPs



RHMW07 NAPs



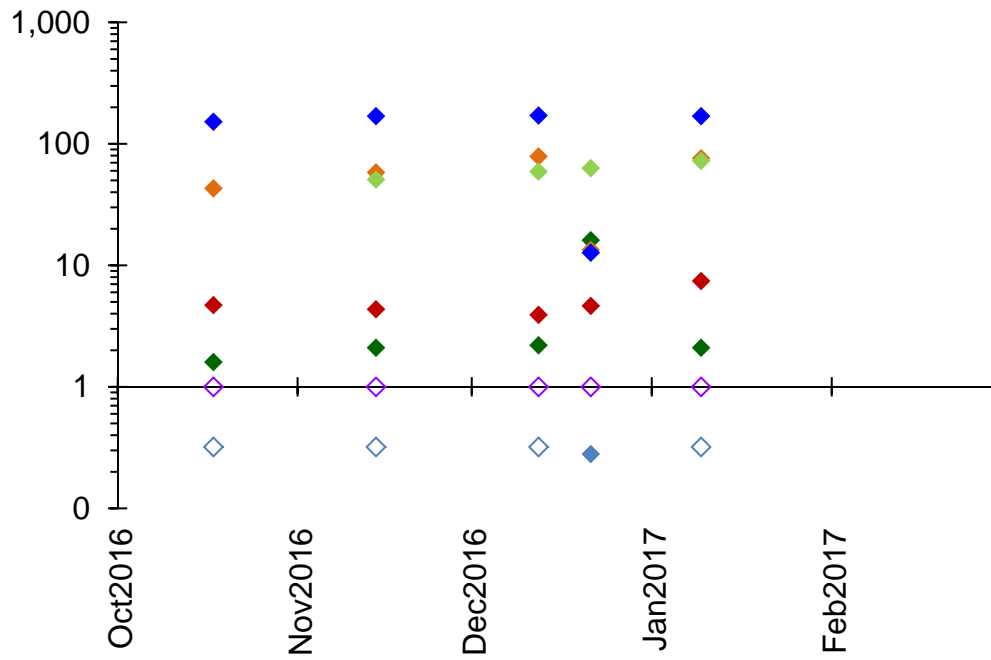
D = detected value

DO = dissolved oxygen

ND = not detected at the laboratory limit of detection

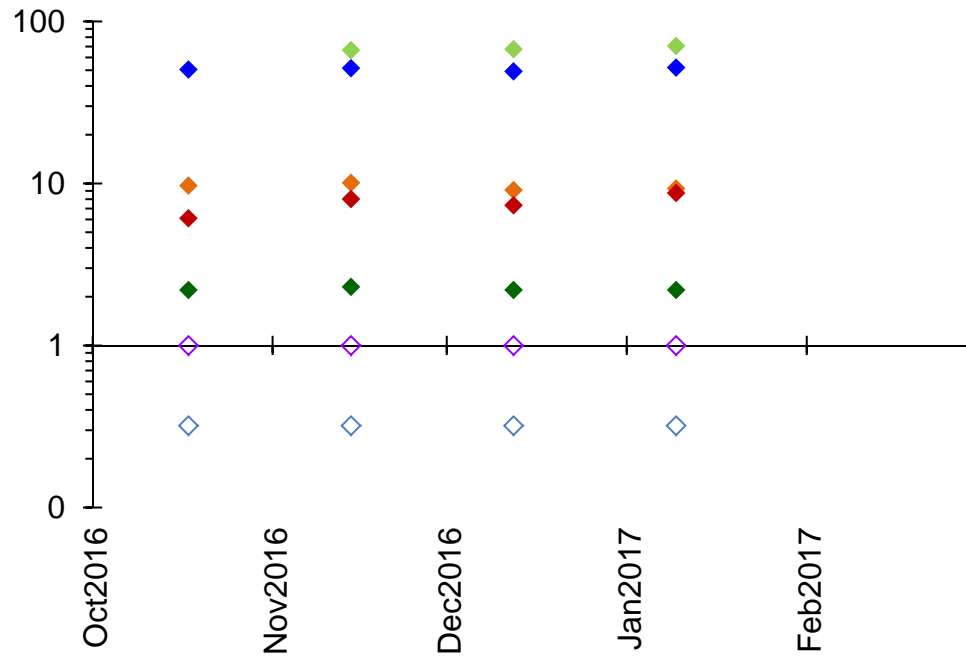
Methane in parts per billion (ppb or micrograms per liter). All others in parts per million (ppm or milligrams per liter).

RHMW08 NAPs



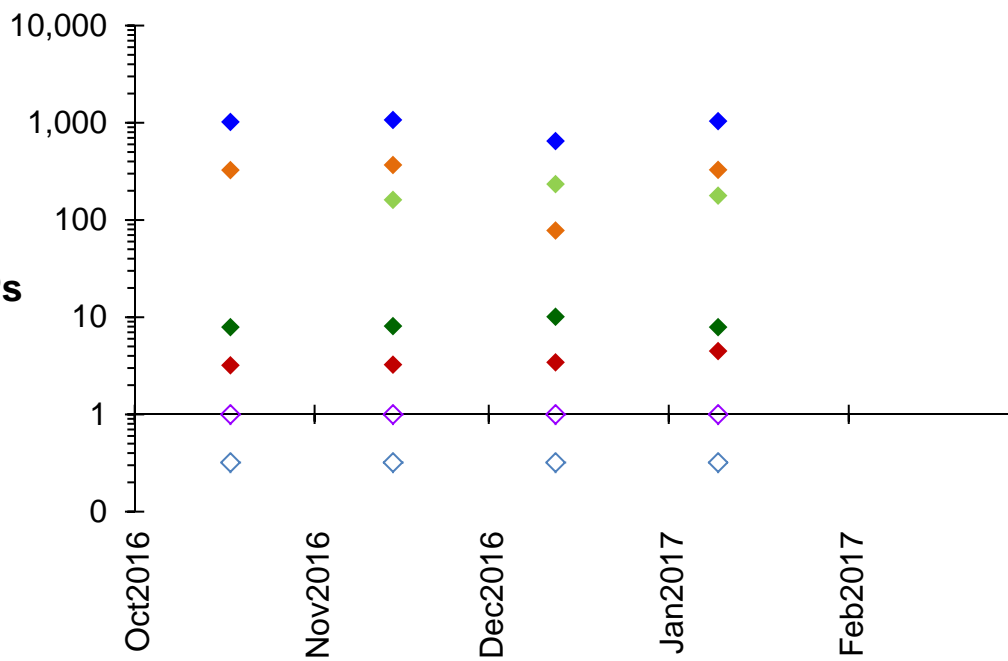
- ◆ Methane (D)
- ◇ Methane (ND)
- ◆ Ferrous Iron (D)
- ◇ Ferrous Iron (ND)
- ◆ Nitrate (D)
- ◇ Nitrate (ND)
- ◆ Sulfate (D)
- ◇ Sulfate (ND)
- ◆ Chloride (D)
- ◇ Chloride (ND)
- ◆ DO (D)
- ◇ DO (ND)
- ◆ Alkalinity, Total (D)
- ◇ Alkalinity, Total (ND)

RHMW09 NAPs



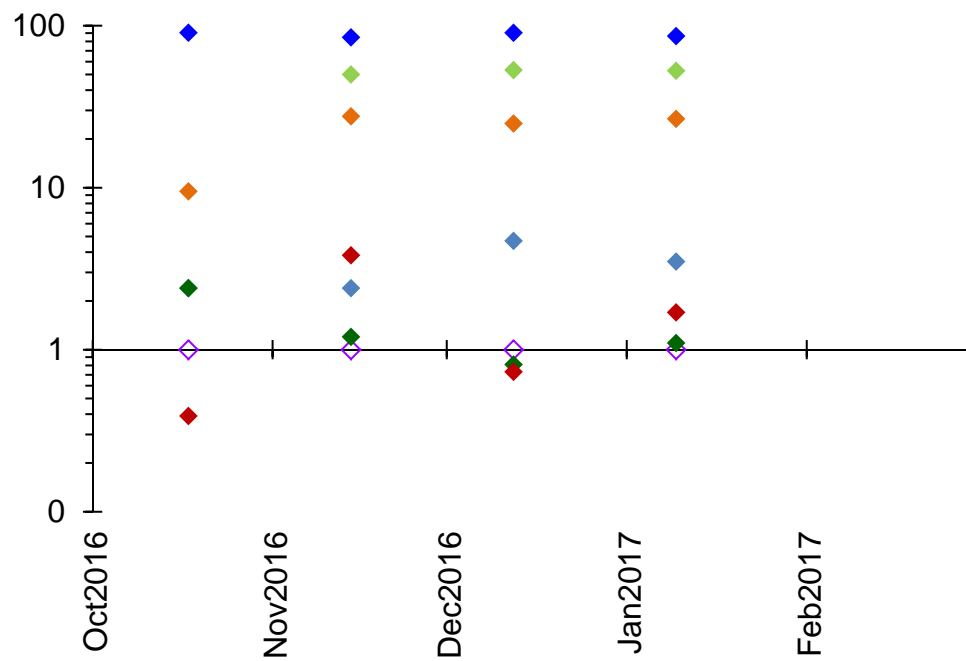
- ◆ Methane (D)
- ◇ Methane (ND)
- ◆ Ferrous Iron (D)
- ◇ Ferrous Iron (ND)
- ◆ Nitrate (D)
- ◇ Nitrate (ND)
- ◆ Sulfate (D)
- ◇ Sulfate (ND)
- ◆ Chloride (D)
- ◇ Chloride (ND)
- ◆ DO (D)
- ◇ DO (ND)
- ◆ Alkalinity, Total (D)
- ◇ Alkalinity, Total (ND)

OWDFMW01 NAPs



- ◆ Methane (D)
- ◇ Methane (ND)
- ◆ Ferrous Iron (D)
- ◇ Ferrous Iron (ND)
- ◆ Nitrate (D)
- ◇ Nitrate (ND)
- ◆ Sulfate (D)
- ◇ Sulfate (ND)
- ◆ Chloride (D)
- ◇ Chloride (ND)
- ◆ DO (D)
- ◇ DO (ND)
- ◆ Alkalinity, Total (D)
- ◇ Alkalinity, Total (ND)

HDMW2253-03 NAPs



- ◆ Methane (D)
- ◇ Methane (ND)
- ◆ Ferrous Iron (D)
- ◇ Ferrous Iron (ND)
- ◆ Nitrate (D)
- ◇ Nitrate (ND)
- ◆ Sulfate (D)
- ◇ Sulfate (ND)
- ◆ Chloride (D)
- ◇ Chloride (ND)
- ◆ DO (D)
- ◇ DO (ND)
- ◆ Alkalinity, Total (D)
- ◇ Alkalinity, Total (ND)

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1
2
3

**Appendix I:
Depth to Groundwater Time-Series Charts
for Red Hill Groundwater Monitoring Wells**

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Table 1. Depth to Groundwater (ft btoc) in Red Hill Groundwater Monitoring Wells ^a

Sample Date	RHMMW01	RHMMW02	RHMMW03	RHMMW04	RHMMW05	RHMMW06	RHMMW07	RHMMW08	RHMMW09	RHMMW2254-01	HDMW2253-03	OWDFMW01
1/12/2017	—	—	101.59	—	—	—	—	—	—	—	—	118.93
1/11/2017	82.7	—	—	—	—	—	—	291.26	376.1	—	—	—
1/10/2017	—	85.29	—	—	82.1	—	197.02	—	—	—	206.12	—
1/9/2017	—	—	—	292.48	—	239.76	—	—	—	80.39	—	—
12/21/2016	—	—	—	—	—	—	—	291.69	—	—	—	—
12/20/2016	82.67	85.36	101.61	—	82.01	—	—	—	—	—	—	—
12/14/2016	—	—	101.81	—	—	—	—	—	—	—	—	119.09
12/13/2016	82.88	85.51	—	292.61	—	—	197.13	—	—	—	206.33	—
12/12/2016	—	—	—	—	82.12	240.04	—	291.42	376.28	80.49	—	—
11/18/2016	82.85	85.55	101.78	293.11	82.19	240.17	197.45	291.63	376.74	80.45	—	119.07
11/17/2016	82.92	85.56	101.82	—	82.24	—	—	—	—	—	—	—
11/16/2016	—	—	—	—	—	—	—	—	—	—	206.83	—
11/15/2016	—	85.35	101.87	—	82.25	—	—	291.81	377.05	—	—	119.29
11/14/2016	82.87	—	—	293.22	—	240.31	197.56	—	—	80.52	—	—
10/29/2016	—	—	—	—	—	—	—	—	—	—	—	—
10/25/2016	—	—	—	293.33	—	—	—	—	377.09	—	—	—
10/20/2016	—	—	—	—	—	—	—	—	—	80.68	—	119.39
10/19/2016	83.01	85.69	101.95	—	82.39	—	—	—	—	—	—	—
10/19/2016	—	85.69	102.02	—	82.37	240.47	197.68	291.94	—	—	—	—
10/18/2016	—	—	—	—	—	—	—	—	—	80.68	207.02	—
10/17/2016	83	—	—	—	—	—	—	—	—	—	—	—
9/21/2016	83.13	85.74	102.06	—	82.44	—	—	—	—	—	—	—
8/23/2016	83.27	85.96	102.2	—	82.63	—	—	—	—	—	—	—
7/20/2016	83.32	85.99	102.31	—	82.63	—	—	—	—	80.96	—	—
7/19/2016	—	—	—	293.6	—	240.7	197.79	—	—	—	207.42	119.65
6/21/2016	83.16	85.77	102.03	—	82.54	—	—	—	—	—	—	—
5/23/2016	83.14	85.81	102.03	—	82.5	—	—	—	—	—	—	—
4/20/2016	82.97	85.63	101.91	—	82.31	—	—	—	—	80.57	—	—
4/19/2016	—	—	—	293.21	—	240.35	197.76	—	—	—	206.97	119.28
3/15/2016	82.89	85.6	101.82	—	82.26	—	—	—	—	—	—	—
2/17/2016	83.17	85.81	102.1	—	—	—	—	—	—	—	—	—
1/20/2016	83.31	85.97	102.21	—	—	—	—	—	—	81	—	—
1/19/2016	—	—	—	293.61	—	240.69	198.24	—	—	—	207.42	119.82
12/17/2015	83.76	86.36	102.56	—	83.18	—	—	—	—	—	—	—
11/18/2015	84.25	86.93	103.24	—	84.62	—	—	—	—	—	—	—
10/20/2015	84	86.38	103.38	—	—	—	—	—	—	82.34	—	—
10/19/2015	—	—	—	294.61	—	241.69	198.88	—	—	—	208.4	120.88
9/23/2016	84.26	86.91	103.21	—	83.63	—	—	—	—	—	—	—
8/27/2015	84.44	87.13	103.41	—	83.69	—	—	—	—	—	—	—
8/20/2015	—	—	—	295.1	—	—	—	—	—	—	—	—
7/28/2015	—	—	—	—	—	241.98	—	—	—	—	—	—
7/27/2015	—	—	—	—	—	—	198.61	—	—	—	—	—
7/22/2015	—	—	—	—	—	—	—	—	—	—	208.69	120.99
7/21/2015	—	—	—	—	83.76	—	—	—	—	82.24	—	—
7/20/2015	84.58	87.24	103.44	—	—	—	—	—	—	—	—	—
6/25/2015	84.58	87.28	103.57	—	83.75	—	—	—	—	—	—	—
5/28/2015	84.29	86.97	103.24	—	83.95	—	—	—	—	—	—	—
5/26/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/25/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/24/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/23/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/22/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/21/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/20/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/19/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/18/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/17/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/16/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/15/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/14/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/13/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/12/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/11/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/10/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/9/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/8/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/7/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/6/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/5/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/4/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/3/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/2/2015	—	—	—	—	—	—	—	—	—	—	—	—
5/1/2015	—	—	—	—	—	—	—	—	—	—	—	—
4/30/2015	—	—	—	—	—	—	—	—	—	—	—	—
4/29/2015	—	—	—	—	—	—	—	—	—	—	—	—
4/23/2015	—	—	—	—	—	—	198.4	—	—	—	—	—
4/22/2015	—	—	—	294.43	—	241.59	—	—	—	—	—	120.68
4/21/2015	—	—	—	—	83.72	—	—	—	—	82.99	—	—
4/20/2015	84.33	86.97	103.18	—	—	—	—	—	—	—	—	—
3/26/2015	83.83	86.04	102.79	—	83.24	—	—	—	—	—	—	—
2/2/2015	83.68	86.28	102.52	—	83.06	—	—	—	—	—	—	—
1/29/2015	—	—	—	293.91	—	—	—	—	—	—	206.67	—
1/28/2015	—	86.35	102.63	—	—	—	—	—	—	—	—	—
1/27/2015	83.63	—	—	—	83.03	—	—	—	—	81.37	—	—
1/26/2015	—	—	—	—	—	—	—	—	—	—	—	120.54
12/23/2014	83.67	86.37	102.64	—	83.05	—	—	—	—	—	—	—
11/20/2014	83.87	86.56	102.78	—	83.35	—	—	—	—	—	—	—
10/28/2014	—	—	—	—	83.21	—	—	—	—	83.44	—	—
10/27/2014	83.79	86.51	102.78	—	—	—	—	—	—	—	—	—
10/22/2014	—	—	—	—	—	—	—	—	—	—	207.99	120.49
9/25/2014	84.64	87.27	103.51	—	84.1	—	—	—	—	—	—	—
8/27/2014	84.01	86.65	102.87	—	83.04	—	—	—	—	—	—	—
7/24/2014	—	—	—	—	—	—	—	—	—	—	—	120.57
7/23/2014	—	—	—	294.33	—	—	—	—	—	—	208.08	—
7/22/2014	—	—	102.98	—	83.49	—	—	—	—	82.19	—	—
7/21/2014	84.13	86.8	—	—	—	—	—	—	—	—	—	—
6/23/2016	84.06	86.72	103.99	—	83.54	—	—	—	—	—	—	—
6/10/2014	83.93	86.55	—	—	83.34	—	—	—	—	—	—	—
5/27/2014	83.91	86.6	102.85	—	83.31	—	—	—	—	—	—	—
5/22/2014	83.81	86.47	—	—	83.15	—	—	—	—	—	—	—
5/8/2014	84.03	86.68	—	—	83.46	—	—	—	—	—	—	—
4/21/2014	83.93	86.58	102.8	—	83.27	—	—	—	—	—	—	—
4/7/2014	83.42	86.43	—	—	83.21	—	—	—	—	—	—	—
3/28/2014	83.76	86.42	102.65	—	83.18	—	—	—	—	—	—	—
2/24/2014	83.54	86.24	102.47	—	82.97	—	—	—	—	—	—	—
2/10/2014	84.49	86.16	102.47	—	82.83	—	—	—	—	—	—	—
2/4/2014	83.54	86.2	—	—	82.89	—	—	—	—	—	—	—
2/3/2014	83.54	86.2	—	—	82.91	—	—	—	—	—	—	—
1/31/2014	83.53	86.19	—	—	82.88	—	—	—	—	—	—	—
1/30/2014	83.53	86.21	—	—	82.93	—	—	—	—	—	—	—
1/29/2014	83.56	86.22	—	—	82.94	—	—	—	—	—	—	—
1/28/2014	83.56	86.25	102.52	—	82.94	—	—	—	—	—	—	—
1/27/2014	83.55	86.23	—	—	82.93	—	—	—	—	—	—	—
1/24/2014	83.57	86.23	—	—	82.93	—	—	—	—	—	—	—
1/23/2014	83.58	86.24	—	—	82.94	—	—	—	—	—	—	—

Table 1. Depth to Groundwater (ft btoc) in Red Hill Groundwater Monitoring Wells (cont.)^a

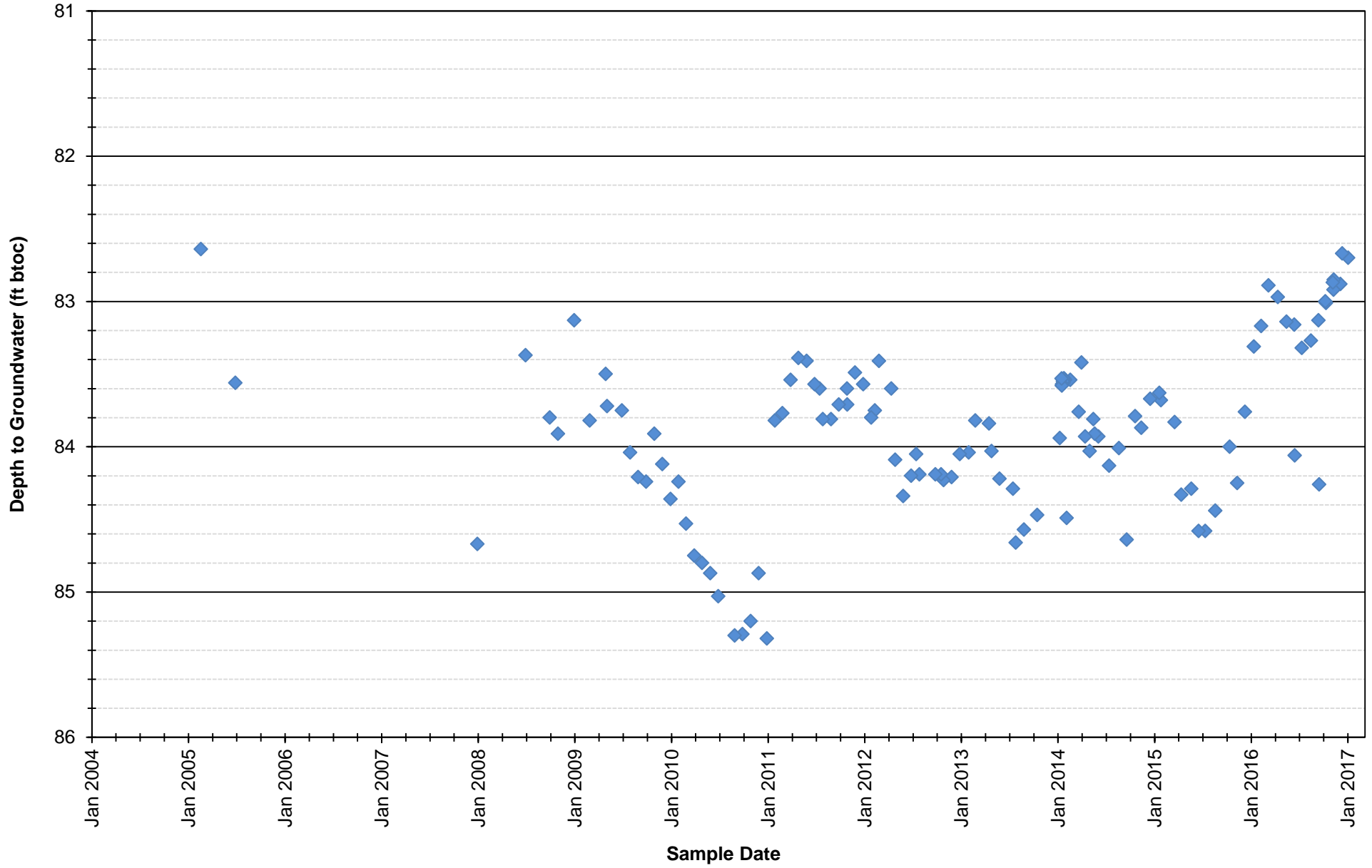
Sample Date	RHMMW01	RHMMW02	RHMMW03	RHMMW04	RHMMW05	RHMMW06	RHMMW07	RHMMW08	RHMMW09	RHMMW2254-01	HDMW2253-03	OWDFMW01
1/22/2014	83.53	86.2	—	—	82.87	—	—	—	—	—	—	—
1/16/2014	—	—	—	—	83.09	—	—	—	—	—	—	—
1/15/2014	83.94	86.62	—	—	—	—	—	—	—	—	—	—
10/23/2013	—	—	—	—	—	—	—	—	—	—	—	120.74
10/22/2013	—	—	—	—	83.81	—	—	—	—	—	—	—
10/21/2013	84.47	87.08	103.31	—	—	—	—	—	—	—	—	—
9/1/2013	84.57	87.2	103.43	—	84	—	—	—	—	—	—	—
8/1/2013	84.66	86.28	103.5	—	84.09	—	—	—	—	—	—	—
7/24/2013	—	—	—	—	—	—	—	—	—	—	—	120.72
7/23/2013	—	—	—	—	83.85	—	—	—	—	82.56	—	—
7/23/2013	—	—	—	—	—	—	—	—	—	—	—	—
7/22/2013	84.29	86.96	103.23	—	—	—	—	—	—	—	—	—
7/1/2013	—	—	—	—	—	—	—	—	—	—	—	—
6/1/2013	84.22	86.86	103.12	—	83.66	—	—	—	—	—	—	—
5/1/2013	84.03	86.69	102.95	—	83.41	—	—	—	—	—	—	—
4/30/2013	—	—	—	—	—	—	—	—	—	—	—	—
4/29/2013	—	—	—	—	—	—	—	—	—	—	—	—
4/24/2013	—	—	—	—	—	—	—	—	—	—	208.03	120.15
4/23/2013	—	—	—	—	83.41	—	—	—	—	82.61	—	—
4/22/2013	83.84	86.5	102.78	—	—	—	—	—	—	—	—	—
4/1/2013	—	—	—	—	—	—	—	—	—	—	—	—
3/1/2013	83.82	86.48	102.75	—	83.19	—	—	—	—	—	—	—
2/4/2013	84.04	—	—	—	—	—	—	—	—	—	—	—
2/1/2013	—	86.62	102.87	—	83.43	—	—	—	—	—	—	—
1/30/2013	—	—	—	—	—	—	—	—	—	—	208.15	120.55
1/29/2013	—	—	—	—	83.61	—	—	—	—	82.78	—	—
1/28/2013	—	86.75	102.98	—	—	—	—	—	—	—	—	—
1/1/2013	84.05	86.87	103.14	—	83.7	—	—	—	—	—	—	—
1/1/2013	—	—	—	—	—	—	—	—	—	—	—	—
12/1/2012	84.21	86.87	103.14	—	83.7	—	—	—	—	—	—	—
11/7/2012	—	—	—	—	—	—	—	—	—	—	208.2	—
11/1/2012	84.23	86.85	103.1	—	83.7	—	—	—	—	—	—	—
10/23/2012	—	—	—	—	83.72	—	—	—	—	83.05	—	—
10/22/2012	84.19	86.81	103.05	—	—	—	—	—	—	—	—	—
10/1/2012	84.19	86.81	103.5	—	83.72	—	—	—	—	—	—	—
8/1/2012	84.19	86.81	103.3	—	83.62	—	—	—	—	—	—	—
7/20/2012	84.05	—	—	—	—	—	—	—	—	—	—	—
7/19/2012	—	—	—	—	—	—	—	—	—	—	207.87	120.15
7/18/2012	—	86.7	103.09	—	—	—	—	—	—	—	—	—
7/17/2012	—	—	—	—	83.5	—	—	—	—	—	—	—
7/1/2012	84.2	86.64	102.89	—	83.41	—	—	—	—	—	—	—
6/1/2012	84.34	86.95	103.17	—	83.97	—	—	—	—	—	—	—
5/1/2012	84.09	86.71	102.98	—	83.53	—	—	—	—	—	—	—
4/26/2012	—	—	—	—	—	—	—	—	—	—	207.76	120.29
4/17/2012	83.6	—	—	—	—	—	—	—	—	—	—	—
4/16/2012	—	86.34	102.71	—	83.17	—	—	—	—	—	—	—
3/1/2012	83.41	86.51	102.45	—	82.79	—	—	—	—	—	—	—
2/14/2012	83.75	—	—	—	—	—	—	—	—	—	—	—
2/1/2012	—	—	—	—	83.15	—	—	—	—	—	—	—
2/1/2012	83.8	86.41	102.71	—	83.2	—	—	—	—	—	—	—
1/26/2012	—	86.31	102.56	—	—	—	—	—	—	—	—	—
1/24/2012	—	—	—	—	—	—	—	—	—	—	207.6	120.02
1/1/2012	83.57	86.18	102.56	—	82.9	—	—	—	—	—	—	—
12/1/2011	83.49	86.1	102.36	—	82.85	—	—	—	—	—	—	—
11/2/2011	83.71	—	—	—	—	—	—	—	—	—	—	—
11/1/2011	83.6	86.25	102.47	—	83	—	—	—	—	—	—	—
10/26/2011	—	—	—	—	—	—	—	—	—	—	207.73	120.12
10/25/2011	—	—	—	—	83.15	—	—	—	—	—	—	—
10/24/2011	—	86.38	102.9	—	—	—	—	—	—	—	—	—
10/1/2011	83.71	—	—	—	—	—	—	—	—	—	—	—
9/1/2011	83.81	86.44	102.69	—	83.21	—	—	—	—	—	—	—
8/1/2011	83.81	86.42	102.66	—	83.21	—	—	—	—	—	—	—
7/20/2011	83.6	—	—	—	—	—	—	—	—	—	—	—
7/19/2011	—	86.28	102.49	—	83.08	—	—	—	—	—	—	—
7/1/2011	83.57	86.22	102.44	—	82.99	—	—	—	—	—	—	—
6/1/2011	83.41	86.11	102.33	—	82.81	—	—	—	—	—	—	—
5/1/2011	83.39	86.05	102.69	—	82.72	—	—	—	—	—	—	—
4/1/2011	83.54	86.18	102.39	—	82.9	—	—	—	—	—	—	—
3/1/2011	83.77	86.39	102.87	—	83.2	—	—	—	—	—	—	—
2/1/2011	83.82	86.48	103.02	—	83.2	—	—	—	—	—	—	—
1/1/2011	85.32	86.91	103.41	—	83.65	—	—	—	—	—	—	—
12/1/2010	84.87	87.55	103.98	—	84.22	—	—	—	—	—	—	—
11/1/2010	85.2	87.84	104.3	—	84.6	—	—	—	—	—	—	—
10/1/2010	85.29	87.91	104.13	—	84.75	—	—	—	—	—	—	—
9/1/2010	85.3	87.92	104.13	—	84.71	—	—	—	—	—	—	—
7/1/2010	85.03	87.66	103.89	—	84.48	—	—	—	—	—	—	—
6/1/2010	84.87	87.51	103.74	—	84.3	—	—	—	—	—	—	—
5/1/2010	84.8	87.43	103.66	—	84.23	—	—	—	—	—	—	—
4/1/2010	84.75	87.37	103.6	—	84.17	—	—	—	—	—	—	—
3/1/2010	84.53	87.15	103.38	—	83.96	—	—	—	—	—	—	—
2/1/2010	84.24	86.89	103.14	—	83.6	—	—	—	—	—	—	—
1/1/2010	84.36	87	103.22	—	83.75	—	—	—	—	—	—	—
12/1/2009	84.12	86.75	103	—	83.53	—	—	—	—	—	—	—
11/1/2009	83.91	86.56	102.81	—	83.25	—	—	—	—	—	—	—
10/1/2009	84.24	86.87	103.07	—	83.62	—	—	—	—	—	—	—
9/1/2009	84.21	86.84	103.07	—	83.61	—	—	—	—	—	—	—
8/1/2009	84.04	86.71	102.84	—	83.51	—	—	—	—	—	—	—
7/1/2009	83.75	86.42	102.67	—	83.09	—	—	—	—	—	—	—
5/1/2009	83.5	86.15	102.41	—	—	—	—	—	—	—	—	—
5/6/2009	83.72	86.37	102.59	—	—	—	—	—	—	—	—	—
3/1/2009	83.82	86.44	102.64	—	—	—	—	—	—	—	—	—
2/1/2009	—	86.35	102.56	—	—	—	—	—	—	—	—	—
1/1/2009	83.13	85.79	102.04	—	—	—	—	—	—	—	—	—
11/1/2008	83.91	86.56	102.8	—	—	—	—	—	—	—	—	—
10/1/2008	83.8	86.45	102.49	—	—	—	—	—	—	—	—	—
7/1/2008	83.37	86.1	102.45	—	—	—	—	—	—	—	—	—
1/1/2008	84.67	86.23	—	—	—	—	—	—	—	—	—	—
9/1/2007	—	86.8	103.44	—	—	—	—	—	—	—	—	—
6/28/2005	83.56	—	—	—	—	—	—	—	—	87	—	—
2/17/2005	82.64	—	—	—	—	—	—	—	—	86.48	—	—

^a Depth to groundwater values from Appendix A Groundwater Tables GW-9, GW-10, GW-14, GW-15, and GW-17 through GW-24 in:

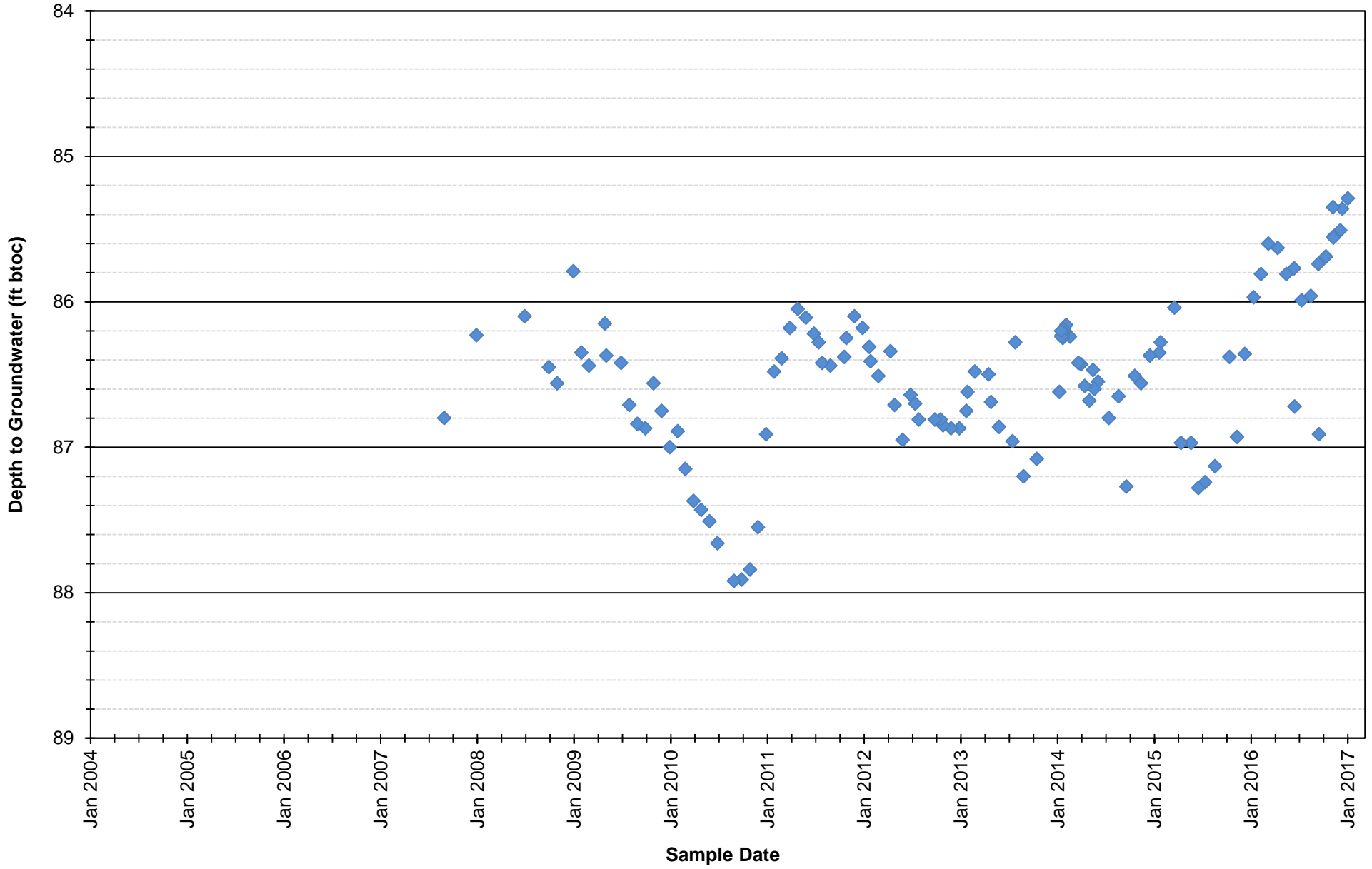
Department of the Navy. 2007. *Existing Data Summary and Evaluation Report for Groundwater Flow and Contaminant Fate and Transport Modeling, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O'ahu, Hawaii*; March 5, 2017 [Revision 00]. Prepared by AECOM Technical Services, Inc., Honolulu, HI. Prepared for Defense Logistics Agency Energy, Fort Belvoir, VA, under Naval Facilities Engineering Command, Hawaii, JBPHH HI.

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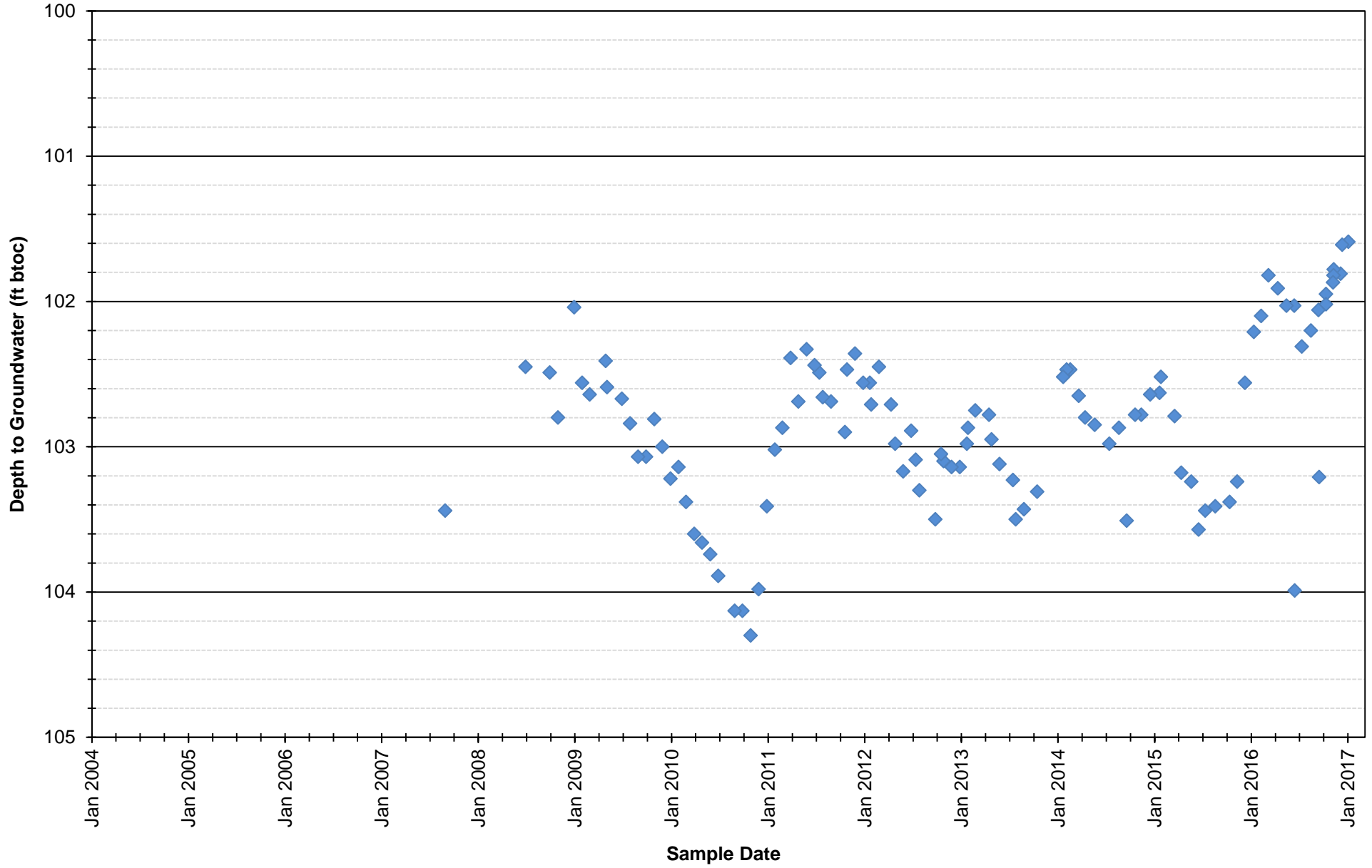
Depth to Groundwater Time Series - RHMW01



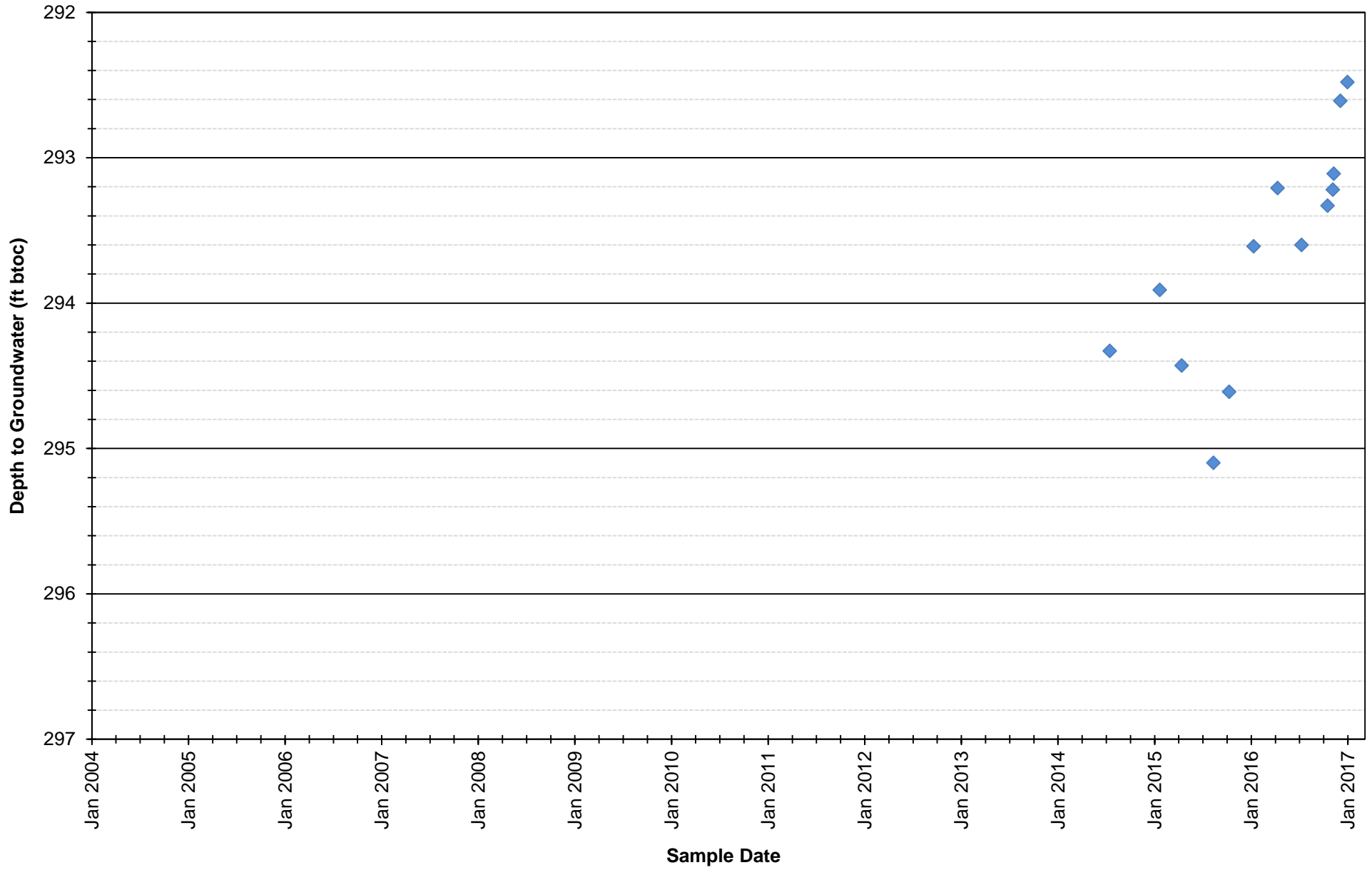
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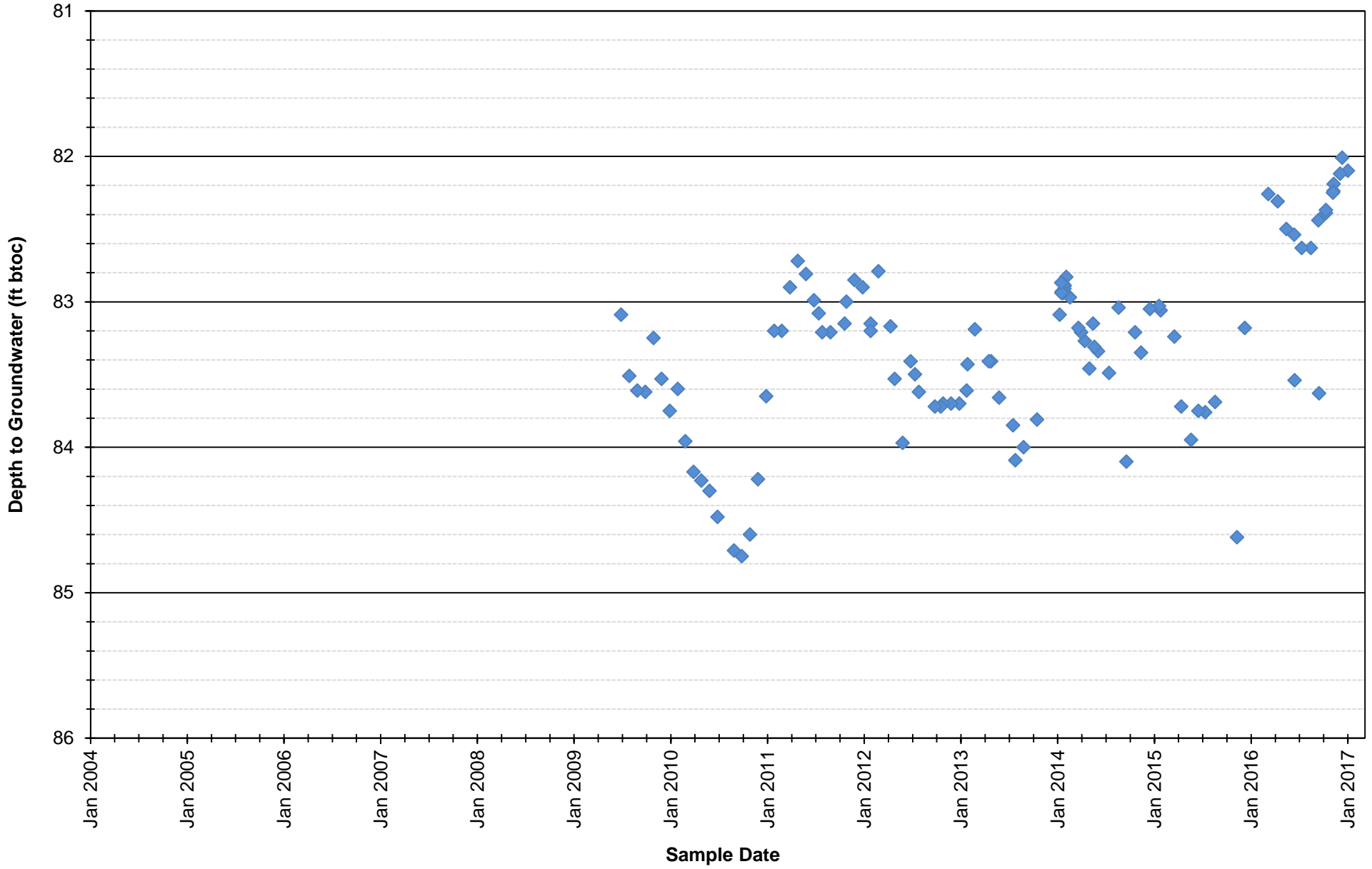
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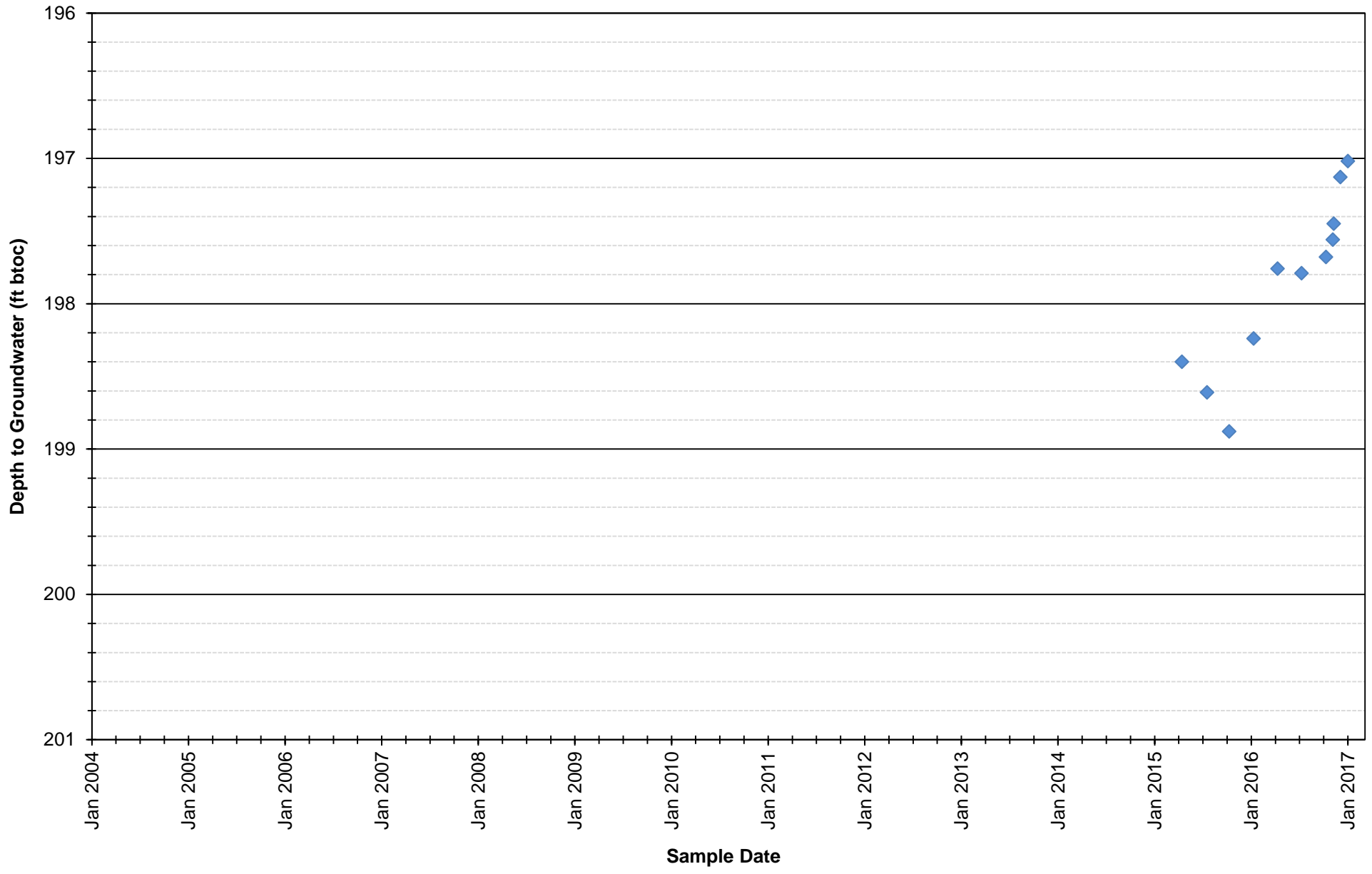
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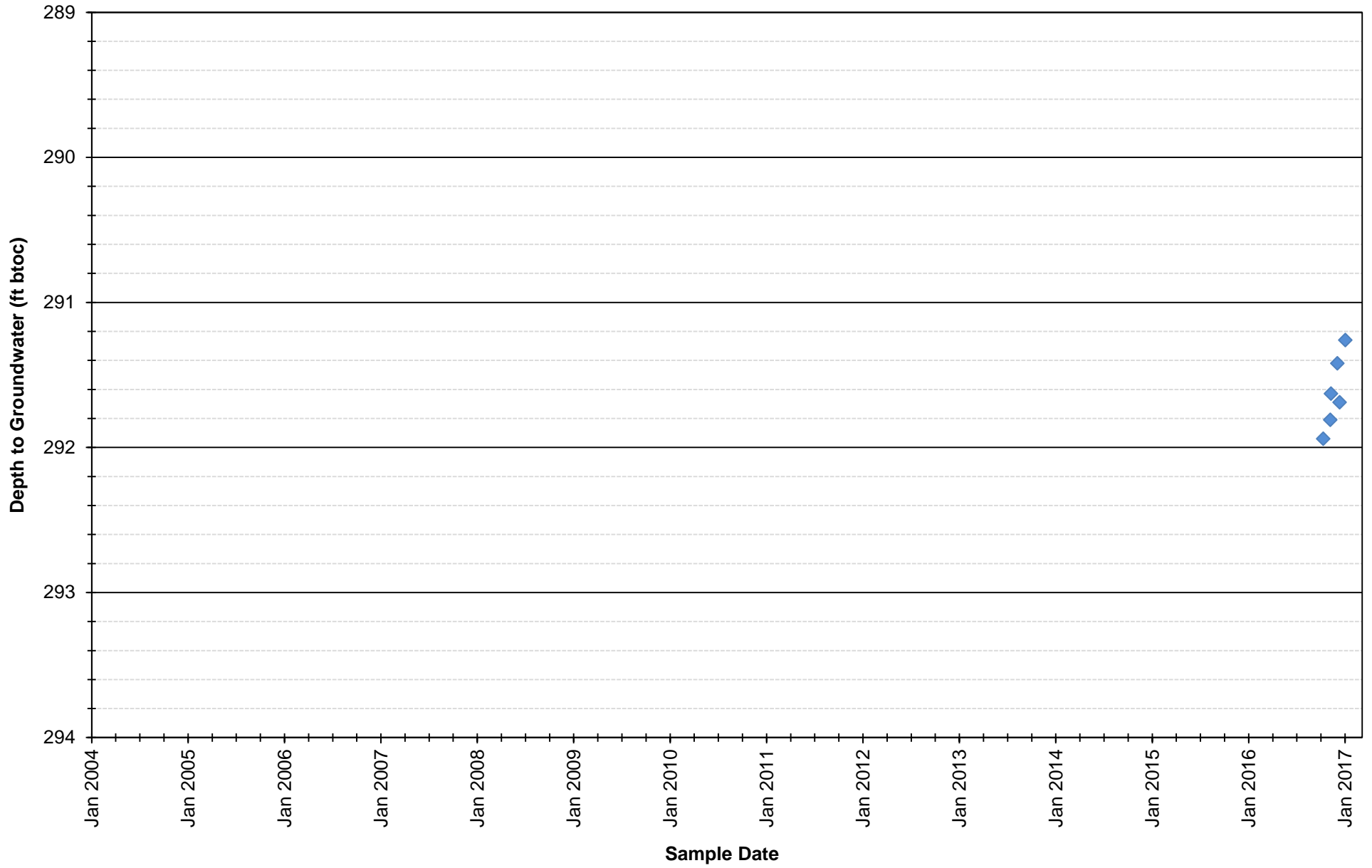
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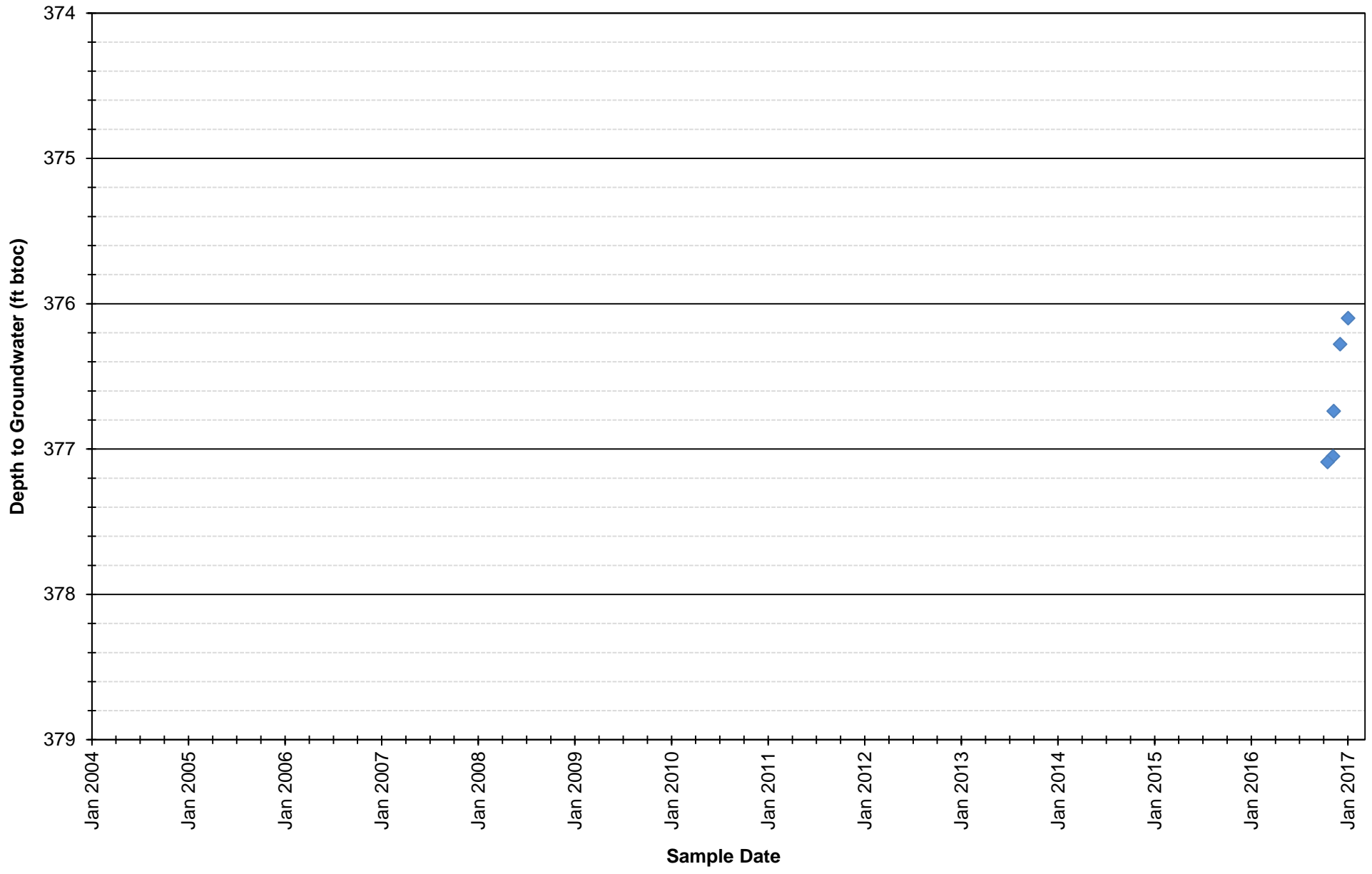
Depth to Groundwater Time Series - RHMW07



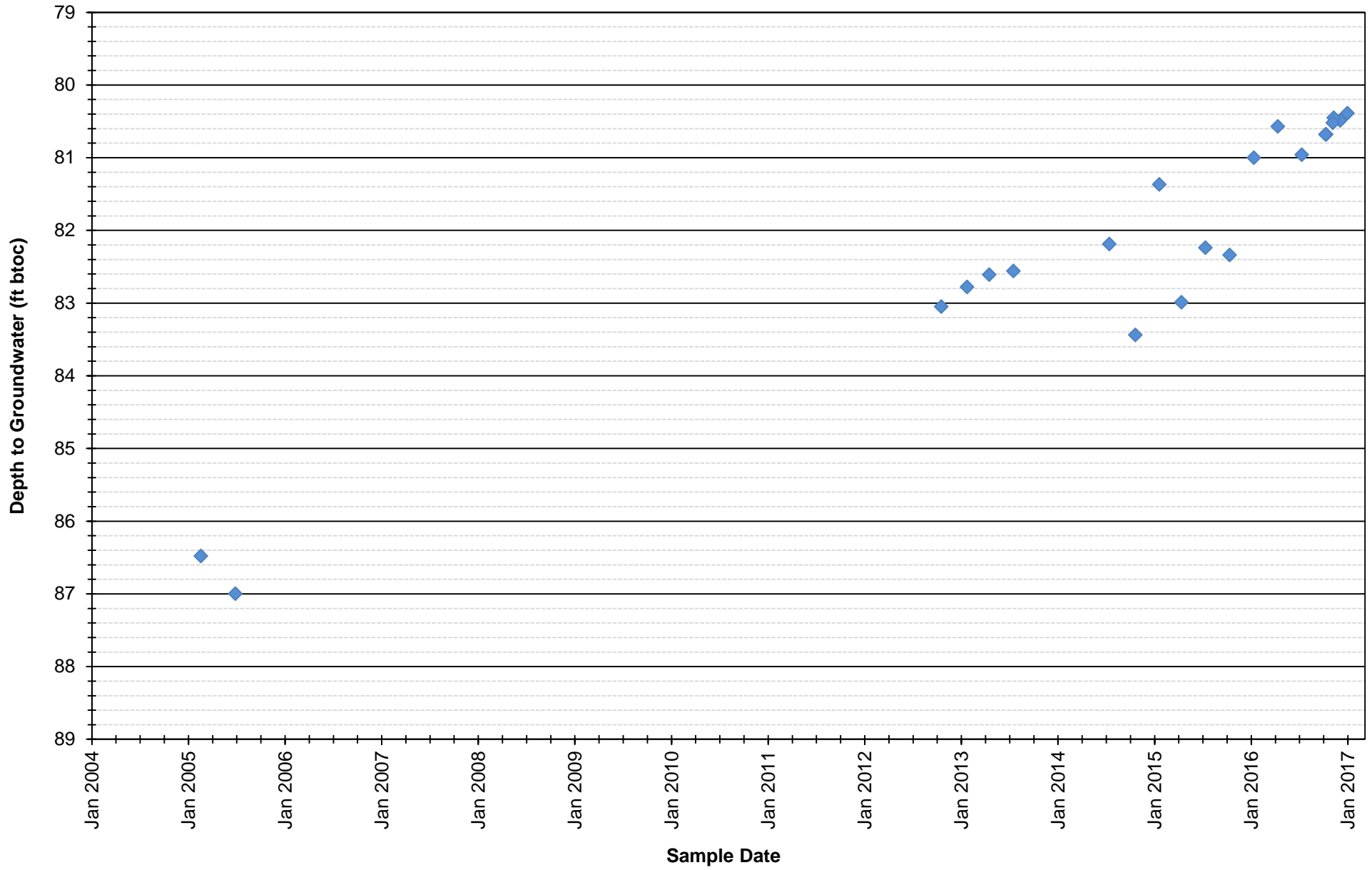
Depth to Groundwater Time Series - RHMW08



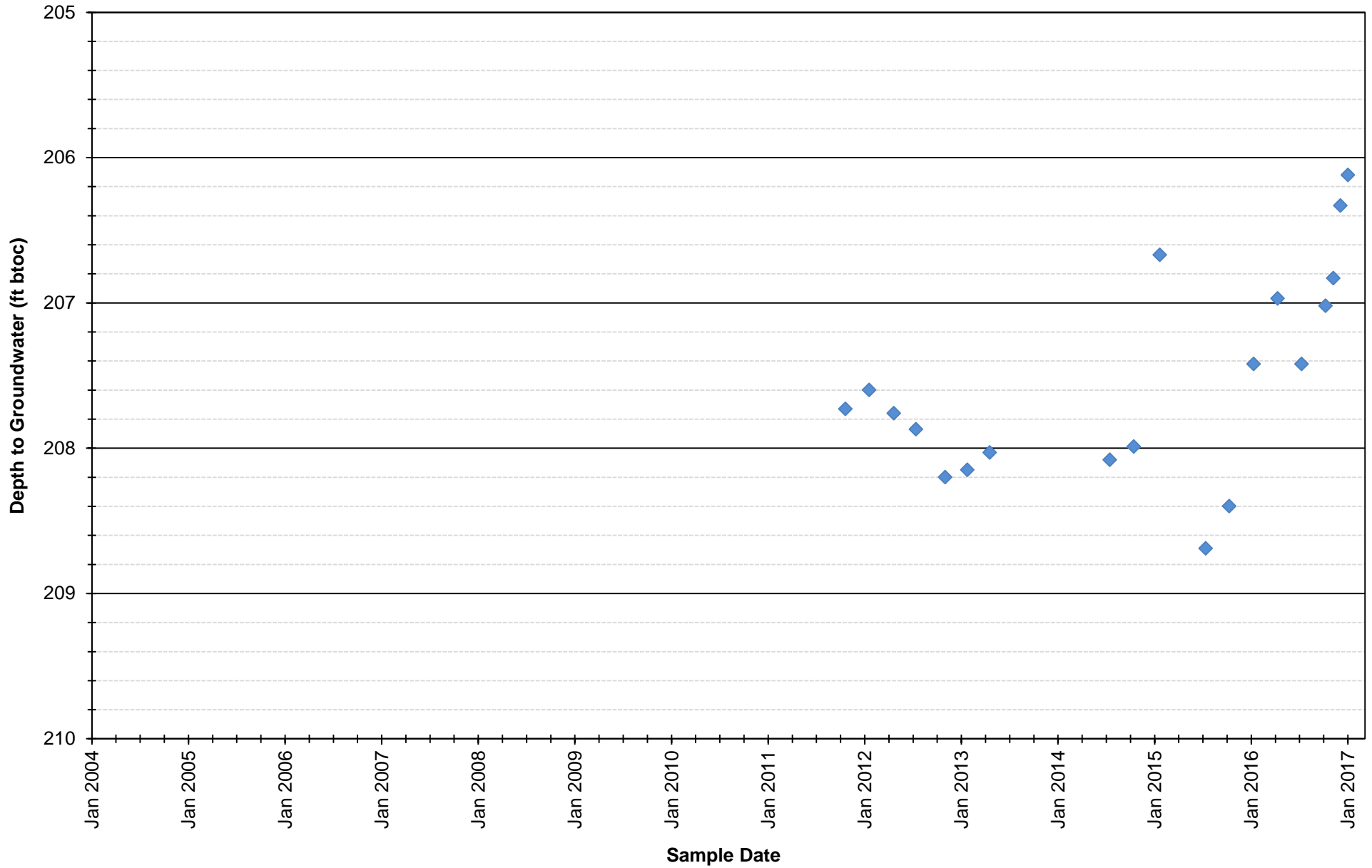
Depth to Groundwater Time Series - RHMW09



Depth to Groundwater Time Series - RHMW2254-01



Depth to Groundwater Time Series - HDMW2253-03



Depth to Groundwater Time Series - OWDFMW01

