

Final Second Quarter 2016 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells

**Red Hill Bulk Fuel Storage Facility
Joint Base Pearl Harbor-Hickam, Oahu, Hawaii**

DOH Facility ID No.: 9-102271

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

July 2016



Contract Number N62742-14-D-1884, CTO 0014

This Page Intentionally Left Blank.

Final Second Quarter 2016 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells

**Red Hill Bulk Fuel Storage Facility
Joint Base Pearl Harbor-Hickam, Oahu, Hawaii**

DOH Facility ID No.: 9-102271

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

July 2016

Prepared for:

**Naval Supply Systems Command
Fleet Logistics Center Pearl Harbor
1942 Gaffney Street, Building 475
JBPHH, HI 96860-4549**

Prepared by:

**Element Environmental, LLC
98-030 Hekaha Street, Unit 9
Aiea, HI 96701**

Prepared under:



Contract Number N62742-14-D-1884, CTO 0014

This Page Intentionally Left Blank.

Red Hill Bulk Fuel Storage Facility

Final

**Second Quarter 2016 - Quarterly Groundwater
Monitoring Report, Outside Tunnel Wells**

DOH Facility ID No.: 9-102271

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

Prepared for:

**Naval Supply Systems Command
Fleet Logistics Center Pearl Harbor
1942 Gaffney Street, Building 475
JBPHH, HI 96860-4549**

Prepared by:

**Element Environmental, LLC
98-030 Hekaha Street, Suite 9
Aiea, HI 96701**



Contract Number N62742-14-D-1884, CTO 0014

July 2016

Approval Signature:

13 July 2016

Matthew Neal, E2 Project Manager

Date

Approval Signature:

13 July 2016

Marvin Heskett, E2 QA Manager

Date

This Page Intentionally Left Blank.

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
ES	EXECUTIVE SUMMARY	ES-1
1	INTRODUCTION	1-1
1.1	Site Description	1-1
1.2	Physical Setting	1-2
1.3	Background	1-4
2	GROUNDWATER SAMPLING	2-1
2.1	Groundwater Sampling	2-1
2.2	Analytical Results	2-2
2.3	Groundwater Contaminant Trends	2-3
2.4	Waste Disposal	2-3
3	DATA QUALITY ASSESSMENT	3-1
3.1	Data Validation and Assessment	3-1
3.2	Data Assessment and Usability Conclusions	3-5
4	SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	4-1
5	FUTURE WORK	5-1
6	REFERENCES	6-1

LIST OF TABLES

<u>Number</u>	<u>Title</u>	<u>Page</u>
1.1	Current Status of the USTs	1-2
2.1	Analytical Results for Groundwater Sampling (19 April 2016)	2-5
3.1	Quality Control Results for Groundwater Sampling (19 April 2016)	3-7

LIST OF APPENDICES

<u>Appendix</u>	<u>Title</u>
A	Groundwater Sampling Logs
B	Field Notes
C	Laboratory Report
D	Data Validation Report
E	EPA/DOH Letter, Enclosure A, Analytes and Action Levels, February 4, 2016
F	Fact Sheet, Quantitation & Detection
G	Historical Groundwater Exceedance Trends
H	IDW Disposal Manifest

ACRONYMS AND ABBREVIATIONS

ACRONYMS/ ABBREVIATIONS	DEFINITION / MEANING
bgs	below ground surface
COC	Chain-of-Custody
COPC	Contaminant of Potential Concern
CTO	Contract Task Order
DLNR	State of Hawaii Department of Land and Natural Resources
DoD	Department of Defense
DOH	State of Hawaii Department of Health
DON	Department of the Navy
DQO	Decision Quality Objective
DVR	Data Validation Report
E2	Element Environmental, LLC
EAL	Environmental Action Level
EPA	Environmental Protection Agency
ER	Environmental Restoration
ESI	Environmental Science International, Inc.
F-76	Marine Diesel Fuel
ID	Identification
JBPHH	Joint Base Pearl Harbor-Hickam
JP-5	Jet Fuel Propellant-5
JP-8	Jet Fuel Propellant-8
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection
LOQ	Limit of Quantitation
µg/L	microgram per liter
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAVFAC	Naval Facilities Engineering Command
NAVSUP FLC	Naval Supply Systems Command Fleet Logistics Center
ND	ND
PAH	Polycyclic Aromatic Hydrocarbon
pH	potential of hydrogen
QC	Quality Control
QSM	Quality Systems Manual
RHSF	Red Hill Bulk Fuel Storage Facility
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SIM	Selective Ion Monitoring
TEC	The Environmental Company, Inc.
TPH	Total Petroleum Hydrocarbons
TPH-d	Total Petroleum Hydrocarbons as diesel
TPH-g	Total Petroleum Hydrocarbons as gasoline
TPH-o	Total Petroleum Hydrocarbons as oil
U.S.	United States
UST	Underground Storage Tank

VOC
WP

Volatile Organic Compound
Work Plan

This page intentionally left blank.

EXECUTIVE SUMMARY

This quarterly groundwater monitoring report presents the results of the Second Quarter 2016 groundwater sampling event, conducted on 19 April 2016, at the outside tunnel wells of the Red Hill Bulk Fuel Storage Facility (RHSF), Joint Base Pearl Harbor-Hickam (JBPHH), Hawaii. The RHSF is located in Halawa Heights on the island of Oahu. There are 18 active and 2 inactive underground storage tanks (USTs) located at the RHSF. The State of Hawaii Department of Health (DOH) Facility Identification (ID) number is 9-102271. The DOH Release ID numbers are 990051, 010011, 020028, and 140010.

The groundwater sampling was conducted as part of the long-term groundwater and soil vapor monitoring program at the RHSF and concurrent with release response activities initiated at Tank 5 in January 2014, for Naval Supply Systems Command Fleet Logistics Center (NAVSUP FLC) Pearl Harbor (formerly Fleet and Industrial Supply Center), under Naval Facilities Engineering Command (NAVFAC) Contract Number N62742-14-D-1884, Contract Task Order (CTO) 0014. The sampling was conducted in accordance with the approved *Work Plan/Sampling and Analysis Plan (WP/SAP)* prepared by Element Environmental, LLC (E2) with the following exceptions:

- The low-flow sampling technique was implemented during this, April 2016 event for wells OWDFMW01 and HDMW2253-03 and will continue to be used for collection of groundwater samples from all wells during future monitoring events.
- Third party data validation was conducted for laboratory analyses.

The analyte list for the RHSF groundwater monitoring has been reduced to ten contaminants of potential concern (COPCs) as documented in the United States (U.S.) Environmental Protection Agency (EPA)/DOH letter, Enclosure A, Analytes and Action Levels, dated February 4, 2016 (Appendix E). Groundwater samples from existing wells are no longer going to be analyzed for analytes that have not been detected at significant concentrations during previous events, including lead scavengers 1,2-dibromoethane and 1,2-dichloroethane.

On 19 April 2016, E2 personnel collected groundwater samples from the five outside tunnel monitoring wells (OWDFMW01, HDMW2253-03, RHMW04, RHMW06, and RHMW07). In addition, one duplicate groundwater sample was collected from well OWDFMW01. All groundwater samples were analyzed for petroleum constituents. Analytical results were compared to the DOH Tier 1 Environmental Action Levels (EALs) listed in the U.S. EPA/DOH letter, Enclosure A, Analytes and Action Levels, dated February 4, 2016 (Appendix E). A summary of the analytical results is provided below.

- **OWDFMW01** – No analytes were detected in groundwater above the laboratory limits of quantification (LOQ) or the applicable DOH Tier 1 EALs. Total petroleum hydrocarbons as gasoline (TPH-g), TPH as diesel (TPH-d) and TPH as oil (TPH-o) were positively identified

by the laboratory at levels below the LOQ but are considered not detected (ND) at these concentrations due to the presence of these contaminants in the associated source blank and, subsequently equipment rinseate (TPH-g) and laboratory method blank (TPH-d and TPH-o). No other contaminants were detected above the laboratory detection limits. Though elevated potential of hydrogen (pH) has historically been detected in well OWDFMW01 (approximately 11), the pH level measured during this round was not as elevated (approximately 8). The sampling method was revised to low-flow sampling using a bladder pump during this sampling event, while prior to this event, samples had been collected using hand bailers.

- **HDMW2253-03** – No analytes were detected in groundwater above the laboratory LOQs or the applicable DOH Tier 1 EALs. TPH-g, TPH-d and TPH-o were positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated source blank and, subsequently equipment rinseate (TPH-g) and laboratory method blank (TPH-d and TPH-o). No other contaminants were detected above the laboratory detection limits. The sampling method was revised to low-flow sampling using a bladder pump during this sampling event, while prior to this event, samples had been collected using hand bailers.
- **RHMW04** – No analytes were detected in groundwater above the laboratory LOQs or the applicable DOH Tier 1 EALs. TPH-d and TPH-o were both positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated laboratory method blank. No other contaminants were detected above the laboratory detection limits.
- **RHMW06** – No analytes were detected in groundwater above the laboratory LOQs or the applicable DOH Tier 1 EALs. TPH-d and TPH-o were positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated laboratory method blank. No other contaminants were detected above the laboratory detection limits.
- **RHMW07** – No analytes were detected in groundwater above the laboratory LOQs or the applicable DOH Tier 1 EALs. TPH-d, TPH-o and 2-methylnaphthalene were positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated laboratory method blank (TPH-d and TPH-o) and the source blank and, subsequently equipment rinseate (2-methylnaphthalene). No other contaminants were detected above the laboratory detection limits.

During the April 2016 sampling event, the TPH-d and TPH-o concentrations found in well OWDFMW01 were their lowest since April 2015. Contaminants detected in the other four wells remained at low concentrations and did not change significantly compared to the previous sampling event (January 2016), or were ND. No COPCs were detected at concentrations above their respective laboratory LOQs or DOH Tier 1 EALs in any of the wells sampled.

Based on a suspected 2014 release at the RHSF and the results of the recent groundwater sampling and analysis, continued groundwater monitoring at the RHSF is recommended. If the TPH-d concentrations significantly increase, the monitoring frequency should be increased to monthly, even though wells OWDFMW01, HDMW2253-03, RHMW04, RHMW06 and RHMW07 are not included in the *RHSF Groundwater Protection Plan (HDR, 2014)*.

This page intentionally left blank.

SECTION 1 – INTRODUCTION

This quarterly groundwater monitoring report presents the results of the Second Quarter 2016 groundwater sampling event conducted on 19 April 2016, at the outside tunnel wells of the Red Hill Bulk Fuel Storage Facility (RHSF), Joint Base Pearl Harbor-Hickam (JBPHH), Hawaii. The RHSF is located in Halawa Heights on the island of Oahu. The purpose of the sampling is to (1) assess the condition of groundwater beneath and in the vicinity of the RHSF with respect to chemical constituents associated with jet fuel propellant and marine diesel fuel, and (2) to ensure the Navy remains in compliance with State of Hawaii Department of Health (DOH) underground storage tank (UST) release response requirements as described in Hawaii Administrative Rules 11-281 Subchapter 7, *Release Response Action* (DOH, 2013). The DOH Facility identification (ID) number for the RHSF is 9-102271. The DOH Release ID numbers are 990051, 010011, 020028, and 140010.

The groundwater sampling was conducted as part of the long-term groundwater and soil vapor monitoring program at the RHSF for the Naval Supply Systems Command Fleet Logistics Center (NAVSUP FLC) Pearl Harbor, under Naval Facilities Engineering Command (NAVFAC) Contract Number N62742-14-D-1884, Contract Task Order (CTO) 0014. The sampling was conducted in accordance with the approved *Work Plan/Sampling and Analysis Plan (WP/SAP)* prepared by Element Environmental, LLC (E2) (E2, 2015) with the following exceptions:

- The project Work Plan indicates that groundwater samples will be collected from wells OWDFMW01 and HDMW2252-03 with disposable bailers. During this, April 2016, sampling event, the sampling technique for wells OWDFMW01 and HDMW2253-03 was changed to the low-flow technique, as per the DOH Hazard Evaluation and Emergency Response (HEER) *Technical Guidance Manual For The Implementation Of The Hawai'i State Contingency Plan* (TGM) (2009).
- Analytical data generated during the April 2016 event was validated by a professional third party data validator.

1.1 SITE DESCRIPTION

The RHSF is located on federal government land (zoned F-1 Military and Federal Preservation), located in Halawa Heights, approximately 2.5 miles northeast of Pearl Harbor. It is located on a low ridge on the western edge of the Koolau Mountain Range that divides Halawa Valley from Moanalua Valley. The RHSF is bordered on the north by Halawa Correctional Facility and private businesses, on the southwest by the United States (U.S.) Coast Guard reservation, on the south by residential neighborhoods, and on the east by Moanalua Valley. A quarry is located less than a quarter mile away to the northwest. The RHSF occupies 144 acres of land and the majority of the site is at an elevation ranging from approximately 200 to 500 feet above mean sea level.

The RHSF contains 18 active and 2 inactive USTs, which are operated by NAVSUP FLC Pearl Harbor. Each UST has a capacity of approximately 12.5 million gallons. The RHSF is located approximately 100 feet above the basal aquifer. The USTs contain Jet Fuel Propellant-5 (JP-5), Jet Fuel Propellant-8 (JP-8), and Marine Diesel Fuel (F-76). The current status of each of the USTs is summarized in Table 1.1.

TABLE 1.1
Current Status of the USTs
Red Hill Bulk Fuel Storage Facility

Tank Identification	Fuel Type	Status	Capacity
F-1	None	Inactive	12.5 million gallons
F-2	JP-8	Active	12.5 million gallons
F-3	JP-8	Active	12.5 million gallons
F-4	JP-8	Active	12.5 million gallons
F-5	JP-8	Active	12.5 million gallons
F-6	JP-8	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	F-76	Active	12.5 million gallons
F-14	F-76	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	JP-5	Active	12.5 million gallons
F-18	JP-5	Active	12.5 million gallons
F-19	None	Inactive	12.5 million gallons
F-20	JP-5	Active	12.5 million gallons

F-76 Marine Diesel Fuel
JP-5 Jet Fuel Propellant-5
JP-8 Jet Fuel Propellant-8

Five groundwater monitoring wells (OWDFMW01, HDMW2253-03, RHMW04, RHMW06, and RHMW07) are located outside of the RHSF tunnel system. Well HDMW2253-03 is located at the Halawa Correctional Facility (outside the RHSF); well OWDFMW01 is located at the former Oily Waste Disposal Facility near Adit 3; and wells RHMW04, RHMW06, and RHMW07 are located on the north side of the RHSF along the road to the Navy Firing Range. Four groundwater monitoring wells (RHMW01, RHMW02, RHMW03, and RHMW05) are located within the RHSF lower access tunnel, and one sampling point (RHMW2254-01) is located at the Red Hill Shaft. Monitoring data for the four wells located inside the tunnel and one sampling point at Red Hill Shaft are included in a separate report.

As noted, monitoring wells RHMW01, RHMW02, RHMW03, and RHMW05 are located inside the underground tunnels. Sampling point RHMW2254-01 is located inside the infiltration gallery

of the Department of the Navy (DON) drinking water supply Well 2254-01, which is located approximately 2,400 feet down-gradient of the USTs. It provides potable water to the JBPHH Water System, which serves approximately 65,200 military customers. NAVFAC Hawaii Public Works Department operates and maintains the infiltration gallery and DON Well 2254-01.

1.2 PHYSICAL SETTING

Climatological conditions in the area of the RHSF consist of warm to moderate temperatures and low to moderate rainfall. The RHSF is leeward of the prevailing northeasterly trade winds. The average annual precipitation is approximately 40 inches, which occurs mainly between November and April (State of Hawaii Department of Land and Natural Resources (DLNR), 1986). Annual pan evaporation is approximately 75 inches (DLNR, 1985). Average temperatures range from the low 60s to high 80s (degrees Fahrenheit) (Atlas of Hawaii, 1983).

Oahu consists of the eroded remnants of two shield volcanoes, Waianae and Koolau. The RHSF is located on the southwest flank of the Koolau Volcanic Shield. Lavas erupted during the shield-building phase of the volcano belong to the *Koolau Volcanic Series* (Stearns and Vaksvik, 1935). Following formation of the Koolau Shield, a long period of volcanic quiescence occurred, during which the shield was deeply eroded. Following this erosional period, eruptive activity resumed. Lavas and pyroclastic material erupted during this period belong to the *Honolulu Volcanic Series* (Stearns and Vaksvik, 1935).

In the immediate area of the RHSF, Koolau Volcanic Series lavas dominate, although there are consolidated and unconsolidated non-calcareous deposits in the vicinity that consist of alluvium generated during erosion of the Koolau Volcanic Shield. South-southwest of the RHSF, and in isolated exposures to the west, are pyroclastic deposits formed during eruptions from three *Honolulu Volcanic Series* vents – Salt Lake, Aliamanu, and Makalapa (Stearns and Vaksvik, 1935). Based on established geology and records of wells drilled at the RHSF (Stearns and Vaksvik, 1938), the RHSF is underlain by *Koolau Volcanic Series* basalts. The area of the RHSF is classified as *Rock Land*, where 25 to 90% of the land surface is covered by exposed rock and there are only shallow soils (Foote, et al., 1972).

Groundwater in Hawaii exists in two principal aquifer types. The first and most important type, in terms of drinking water resources, is the basal aquifer. The basal aquifer exists as a lens of fresh water floating on and displacing seawater within the pore spaces, fractures, and voids of the basalt that forms the underlying mass of each Hawaiian island. In parts of Oahu, groundwater in the basal aquifer is confined by the overlying caprock and is under pressure. Waters that flow freely to the surface from wells that tap the basal aquifer are referred to as *artesian*.

The second type of aquifer is the caprock aquifer, which consists of various kinds of unconfined and semi-confined groundwater. Commonly, the caprock consists of a thick sequence of nearly

impermeable clays, coral, and basalt that separates the caprock aquifer from the basal aquifer. The impermeable nature of these materials and the artesian nature of the basal aquifer severely restrict the downward migration of groundwater from the upper caprock aquifer. However, in the area of the RHSF, there is no discernible caprock.

Groundwater in the area of the RHSF is primarily part of the *Moanalua Aquifer System* of the *Pearl Harbor Aquifer Sector*. The aquifer is classified as a basal, unconfined, flank-type; and is currently used as a drinking water source. The aquifer is considered fresh, with less than 250 milligrams per liter of chloride, and is considered an irreplaceable resource with a high vulnerability to contamination (Mink and Lau, 1990).

The nearest drinking water supply well is the Red Hill Shaft Well 2254-01, located in the infiltration gallery within the RHSF. The Well 2254-01 is located approximately 2,400 feet down-gradient of the USTs.

The nearest body of surface water is Halawa Stream, an ephemeral stream that is present along the north side of the RHSF. Except for the portion to the east of the Halawa Correctional Facility, the stream is contained by a concrete culvert. The stream is usually dry, but flows after periods of significant rainfall.

1.3 BACKGROUND

The RHSF, consisting of twenty USTs and a series of tunnels, was constructed by the U.S. Government in the early 1940s to supply fuel to the Navy. The USTs were constructed of steel and they currently contain JP-5, JP-8, and F-76. Several tanks in the past have stored DON special fuel oil, DON distillate, aviation gasoline, and motor gasoline (Environet, 2010). The fueling system is a self-contained underground unit that was installed into native rock comprised primarily of basalt with some interbedded tuffs and breccias (Environet, 2010). Each UST measures approximately 250 feet in height and 100 feet in diameter. The upper domes of the tanks lie at depths varying between 100 feet and 200 feet below ground surface (bgs).

In response to increasing concentrations of contaminants of potential concern (COPCs) in the groundwater monitoring wells within the facility (specifically RHMW02) during the 2008 sampling events, quarterly groundwater monitoring was initiated in 2009 at the outside tunnel wells.

In 2009, groundwater samples were collected from wells RHMW04, OWDFMW01, and HDMW2253-03. Samples were collected in August and October 2009. None of the COPCs were detected at concentrations exceeding the current gross contamination or drinking water toxicity DOH Environmental Action Levels (EALs).

In 2010, groundwater samples were collected from wells RHMW04, OWDFMW01, and HDMW2253-03. Samples were collected from well RHMW04 in January and April 2010. Samples were collected from well OWDFMW01 in January, April, and October 2010. Samples

were collected from well HDMW2253-03 in January, April, July, and October 2010. The COPCs with concentrations that exceeded current DOH EALs are summarized below.

- **HDMW2253-03** – Total petroleum hydrocarbons as diesel (TPH-d) was detected at a concentration above the DOH EALs for gross contamination and drinking water toxicity in January 2010 (The Environmental Company, Inc. [TEC], 2010a).
- **OWDFMW01** – TPH-d was detected at concentrations above the DOH EALs for gross contamination and drinking water toxicity in January and April 2010 (TEC, 2010a; TEC, 2010b).

In 2011, groundwater samples were collected from wells OWDFMW01 and HDMW2253-03. Samples were collected in January, April, July, and October 2011. None of the COPCs were detected at concentrations exceeding the current DOH EALs for gross contamination or drinking water toxicity. In Fall 2011, the DOH EALs were revised. The drinking water toxicity EAL for TPH-d decreased from 210 to 190 micrograms per liter (µg/L).

In 2012, groundwater samples were collected from wells OWDFMW01 and HDMW2253-03. Samples were collected in January, April, July, and November 2012. TPH-d was detected at a concentration above the DOH EALs in samples collected from wells HDMW2253-03 and OWDFMW01 (Environet, 2012; Environmental Science International, Inc. [ESI], 2013a). The COPCs with concentrations that exceeded current DOH EALs are summarized below.

- **HDMW2253-03** – TPH-d was detected at concentrations above the DOH EALs for gross contamination and drinking water toxicity in April and November 2012.
- **OWDFMW01** – TPH-d was detected at a concentration above the DOH EALs for gross contamination and drinking water toxicity in April 2012.

In 2013, groundwater samples were collected from wells OWDFMW01 and HDMW2253-03. Samples were collected in January, April, July, and October 2013. TPH-d was detected at a concentration above the DOH EALs in samples collected from wells OWDFMW01 and HDMW2253-03 (ESI, 2013b, 2013c, 2013d, and 2014a). The COPCs with concentrations that exceeded current DOH EALs are summarized below.

- **HDMW2253-03** – TPH-d was detected at a concentration above the DOH EALs for gross contamination and drinking water toxicity in January 2013.
- **OWDFMW01** – TPH-d was detected at concentrations above the DOH EALs for gross contamination and drinking water toxicity in all four quarters during 2013.

In 2014, groundwater samples were collected from wells OWDFMW01 and HDMW2253-03. Samples were collected in January, April, July, and October 2014. Well RHMW04 was also sampled in July and October 2014. TPH-d was detected at concentrations above the DOH EALs in samples collected from well OWDFMW01 in January and April 2014. TPH-d was also

detected at a concentration above the DOH EALs in a sample collected from well HDMW2253-03 in April 2014; however, this was likely an erroneous result due to a switched sample (ESI, 2014c, 2014d, 2014e, and 2015a). The COPCs with concentrations that exceeded current DOH EALs are summarized below.

- **HDMW2253-03** – TPH-d was detected at a concentration above the DOH EALs for both gross contamination and drinking water toxicity in April 2014. However, as discussed above, this was likely an erroneous result.
- **OWDFMW01** – TPH-d was detected at a concentration above the DOH EALs for gross contamination and drinking water toxicity in April 2014 and above only the EAL for gross contamination in January 2014.

In January 2014, an additional groundwater sampling was conducted at HDMW2253-03 in response to a suspected release from Tank 5. None of the COPC concentrations exceeded the current DOH EALs (ESI, 2014b).

Between August and October 2014, wells RHMW06 and RHMW07 were installed at the RHSF in order to develop a more robust groundwater monitoring network at the site (Battelle, 2015a). Both wells were sampled in October 2014. The polycyclic aromatic hydrocarbon (PAH) 2-methylnaphthalene was detected in the sample collected from well RHMW06. TPH-d, 2-methylnaphthalene, and acetone were detected in the sample collected from well RHMW07. None of the COPC concentrations exceeded the current DOH EALs for gross contamination or drinking water toxicity. In the well installation report, it was speculated that these detections may have been related to the drilling foam used during the installation of the wells.

In 2015, groundwater samples were collected from wells OWDFMW01, HDMW2253-03, RHMW04, RHMW06 and RHMW07. In January, none of the COPC concentrations exceeded the current DOH EALs for drinking water toxicity or gross contamination. The COPCs with concentrations that exceeded current DOH EALs are summarized below.

- **OWDFMW01** – TPH-d and TPH as oil (TPH-o) were detected at concentrations above their respective DOH EALs during the April, July and October 2015 events.

In January 2016, groundwater samples were collected from wells OWDFMW01, HDMW2253-03, RHMW04, RHMW06, and RHMW07 (E2, 2016). The COPCs with concentrations that exceeded current DOH EALs are summarized below.

- **OWDFMW01** – TPH-d was detected above its respective DOH Tier 1 EAL.

1.3.1 Previous Reports

The following groundwater monitoring reports for wells located outside the RHSF tunnel system were previously submitted to DOH:

1. Groundwater Monitoring Report, August 2009 (submitted September 2009).
2. Groundwater Monitoring Report, October 2009 (submitted December 2009).
3. Groundwater Monitoring Report, January 2010 (submitted April 2010).
4. Groundwater Monitoring Report, April 2010 (submitted May 2010).
5. Groundwater Monitoring Report, July 2010 (submitted August 2010).
6. Groundwater Monitoring Report, October 2010 (submitted December 2010).
7. Groundwater Monitoring Report, January 2011 (submitted March 2011).
8. Groundwater Monitoring Report, April 2011 (submitted June 2011).
9. Groundwater Monitoring Report, July 2011 (submitted September 2011).
10. Groundwater Monitoring Report, October 2011 (submitted December 2011).
11. Groundwater Monitoring Report, January 2012 (submitted March 2012).
12. Groundwater Monitoring Report, April 2012 (submitted July 2012).
13. Groundwater Monitoring Report, July 2012 (submitted August 2012).
14. Groundwater Monitoring Report, November 2012 (submitted January 2013).
15. Groundwater Monitoring Report, January 2013 (submitted April 2013).
16. Groundwater Monitoring Report, April 2013 (submitted July 2013).
17. Groundwater Monitoring Report, July 2013 (submitted September 2013).
18. Groundwater Monitoring Report, October 2013 (submitted January 2014).
19. Groundwater Monitoring Report for Additional Sampling of HDMW2253-03, January 2014 (submitted February 2014).
20. Groundwater Monitoring Report, January 2014 (submitted April 2014).
21. Groundwater Monitoring Report, April 2014 (submitted June 2014).
22. Groundwater Monitoring Report, July 2014 (submitted September 2014).
23. Groundwater Monitoring Report, October 2014 (submitted January 2015).
24. Groundwater Monitoring Report, January 2015 (submitted March 2015).
25. Draft Monitoring Well Installation Report for RHMW06 and RHMW07, March 2015 (submitted March 2015).
26. Draft Technical Memorandum, Groundwater Sampling Event for RHMW06 and RHMW07, April 2015 (submitted April 2015).
27. Groundwater Monitoring Report, April 2015 (submitted August 2015).
28. Groundwater Monitoring Report, July 2015 (submitted November 2015).
29. Groundwater Monitoring Report, October 2015 (submitted February 2016).

30. Groundwater Monitoring Report, January 2016 (submitted March 2016).

SECTION 2 – GROUNDWATER SAMPLING

On 19 April 2016, E2 personnel collected groundwater samples from five monitoring wells (OWDFMW01, HDMW2253-03, RHMW04, RHMW06, and RHMW07). In addition, a duplicate groundwater sample was collected from well OWDFMW01.

The samples were collected in accordance with the approved *WP/SAP*, with the following exceptions:

- The project Work Plan indicates that groundwater samples will be collected from wells OWDFMW01 and HDMW2252-03 with disposable bailers. During this, April 2016, sampling event, the sampling technique for wells OWDFMW01 and HDMW2253-03 was changed to the low-flow technique, as per the DOH HEER TGM (2009).
- Third party data validation was conducted on analytical data generated during this event.

The *WP/SAP* is consistent with DOH UST release response requirements (DOH, 2000); DON Procedure I-C-3, *Monitoring Well Sampling* (DON, 2007); and the *Interim Update, Final RHSP Groundwater Protection Plan* (HDR, 2014). Prior to purging and sampling, the depths to groundwater in the wells were measured by E2 using a Geotech oil/water interface probe as well as visual observations. The measurements are included in the groundwater sampling logs. No measurable product, sheen, or petroleum hydrocarbon odor was observed in any of the wells.

2.1 GROUNDWATER SAMPLING

Prior to collecting groundwater samples, the monitoring wells were purged using the low-flow sampling technique, as per the DOH HEER TGM. Wells OWDFMW01 and HDMW2253-03 were purged and sampled using a portable submersible bladder pump with dedicated bladders. Wells RHMW04, RHMW06, and RHMW07 contain dedicated bladder pumps, which were used to conduct the low-flow purge to collect samples. The monitoring wells were purged at rates of approximately 0.37 to 0.47 liters per minute.

Well HDMW2253-03 is not constructed as an environmental monitoring well and, as such, is not cased to its full depth (1,575 feet below ground surface [bgs]). The casing in well HDMW2253-03 extends to a depth of 250 feet bgs but does not include any screened section to allow the groundwater to flow into the casing. Subsequently, the portable bladder pump was lowered to a depth of 255 feet bgs in order to ensure that the sample was collected from the uncased portion of the well and representative formation water.

To operate the pump, a portable air compressor with an in-line filter was connected to a QED MP50 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 one liter of water per minute.

Water quality parameters were monitored periodically during well purging. Water quality parameters that were measured included potential of hydrogen (pH), temperature, conductivity, dissolved oxygen, turbidity, salinity, total dissolved solids and oxidation-reduction potential. The water quality parameters were evaluated to demonstrate that the natural characteristics of the aquifer formation water were present within the monitoring well before collecting the sample. Purging was considered complete when water quality measurements stabilized within approximately 10%. For each monitoring well, groundwater samples were collected immediately after (no more than two hours after) purging was completed to prevent groundwater interaction with the monitoring well casing and atmosphere. The readings were recorded on Groundwater Sampling Logs, which are included in Appendix A. The field notes for the event are included in Appendix B.

All samples were labeled and logged on the Sample Inventory Log, placed in resealable bags and sealed, custody sealed, sealed with tape, placed in a cooler with wet ice, and logged onto the Chain-of-Custody (COC) Form. The samples were labeled and logged in accordance with DON Procedure III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* (DON, 2007). All samples were shipped under COC to the analytical laboratory and analyzed for the COPCs as described below in Section 2.2.

2.2 ANALYTICAL RESULTS

Groundwater samples were analyzed for TPH as gasoline (TPH-g), TPH-d, and TPH-o using EPA Method 8015M; volatile organic compounds (VOCs) using EPA Methods 8260C, 8260C-selective ion monitoring (SIM), and 8011; and PAHs using EPA Method 8270C SIM. A copy of the laboratory report is included as Appendix C and the third party data validation report (DVR) is included in Appendix D.

Analytical results were compared to the EALs listed in the EPA/DOH letter, Enclosure A, dated February 4, 2016. A copy of Enclosure A (including the list of COPCs and their respective EALs) is included in Appendix E. The results of the second quarter groundwater sampling event are summarized in Table 2.1 and described below. A description of laboratory data qualifiers, definitions of the terms Method Detection Limit (MDL), Limit of Detection (LOD), and Limit of Quantitation (LOQ), and basic concepts of those terms are presented as Appendix F.

- **OWDFMW01** – No analytes were detected in groundwater above the laboratory LOQ or the applicable DOH Tier 1 EALs. TPH-g, TPH-d and TPH-o were positively identified by the laboratory at levels below the LOQ but are considered not detected (ND) at these concentrations due to the presence of these contaminants in the associated source blank and, subsequently equipment rinseate (TPH-g) and laboratory method blank (TPH-d and TPH-o). No other contaminants were detected above the laboratory detection limits.

Though elevated potential of hydrogen (pH) has historically been detected in well OWDFMW01 (approximately 11), the pH level measured during this round was not as elevated (approximately 8). The sampling method was revised to low-flow sampling using a bladder pump during this sampling event, while prior to this event, samples had been collected using hand bailers.

- **HDMW2253-03** – No analytes were detected in groundwater above the laboratory LOQs or the applicable DOH Tier 1 EALs. TPH-g, TPH-d and TPH-o were positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated source blank and, subsequently equipment rinseate (TPH-g) and laboratory method blank (TPH-d and TPH-o). No other contaminants were detected above the laboratory detection limits. The sampling method was revised to low-flow sampling using a bladder pump during this sampling event, while prior to this event, samples had been collected using hand bailers.
- **RHMW04** – No analytes were detected in groundwater above the laboratory LOQs or the applicable DOH Tier 1 EALs. TPH-d and TPH-o were both positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated laboratory method blank. No other contaminants were detected above the laboratory detection limits.
- **RHMW06** – No analytes were detected in groundwater above the laboratory LOQs or the applicable DOH Tier 1 EALs. TPH-d and TPH-o were positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated laboratory method blank. No other contaminants were detected above the laboratory detection limits.
- **RHMW07** – No analytes were detected in groundwater above the laboratory LOQs or the applicable DOH Tier 1 EALs. TPH-d, TPH-o and 2-methylnaphthalene were positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated laboratory method blank (TPH-d and TPH-o) and the source blank and, subsequently equipment rinseate (2-methylnaphthalene). No other contaminants were detected above the laboratory detection limits.

2.3 GROUNDWATER CONTAMINANT TRENDS

The historical groundwater contaminant concentration trends for COPCs that exceeded the DOH Tier 1 EALs are illustrated in Appendix G. A summary of groundwater contaminant trends is provided below.

- **OWDFMW01** – TPH-o concentrations have been trending downward since a high in July 2015, while TPH-d concentrations remained similar to the previous event. Overall, concentrations of both TPH-d and TPH-o were the lowest they have been since April 2015. Detections of TPH-o and TPH-d identified during this April 2016 event are most likely the result of lab contamination and were flagged as ND by the data validators. During several

previous events dating back to 2010, TPH-d has been detected in this well exceeding the DOH Tier 1 EAL. Concentrations of all other COPCs detected during this round of quarterly sampling were consistent with historical data.

- **HDMW2253-03** – TPH-g, TPH-d and TPH-o were detected in this well at concentrations below the laboratory LOQ and the respective DOH Tier 1 EALs. These detections, however, are most likely the result of source water contamination (TPH-g) and lab contamination (TPH-d and TPH-o) and were flagged as ND by the data validators. With the exception of one possibly erroneous result obtained during the event in April 2014, TPH-d concentrations have not exceeded the DOH Tier 1 EAL in this well since January 2013.
- **RHMW04** – Concentrations of TPH-d and TPH-o were detected in this well below the laboratory LOQs and the respective DOH Tier 1 EALs. These detections are most likely the result of lab contamination and were flagged as ND by the data validators. Concentrations of all other COPCs detected during this round of quarterly sampling were below the laboratory detection limits.
- **RHMW06** – This well was installed in September 2014 and first sampled in October 2014. Concentrations of TPH-d and TPH-o were detected in this well below the laboratory LOQs and the respective DOH Tier 1 EALs. These detections are most likely the result of lab contamination and were flagged as ND by the data validators. Concentrations of all other COPCs detected during this round of quarterly sampling were below the laboratory detection limits. To date, no COPCs have been detected at concentrations exceeding the DOH Tier 1 EALs.
- **RHMW07** – This well was installed and first sampled in October 2014. Concentrations of TPH-d, TPH-o and 2-methylnaphthalene were detected in this well below the laboratory LOQs and the respective DOH Tier 1 EALs. These detections, however, are most likely the result of source water contamination (TPH-g) and lab contamination (TPH-d and TPH-o) and were flagged as ND by the data validators. Concentrations of all other COPCs detected during this round of quarterly sampling were below the laboratory detection limits. To date, no COPCs have been detected at concentrations exceeding the DOH Tier 1 EALs.

2.4 WASTE DISPOSAL

The purged groundwater and decontamination water generated during sampling of the wells were placed in two 55-gallon drums along with the purged water and decontamination water generated during sampling of the inside tunnel wells. The drums will be properly profiled and manifested following the next quarterly sampling event, or when they reach 90% full.

Purge water generated during the October 2015 and January 2016 sampling events was transported and disposed on April 19, 2016. A copy of the disposal manifest is included in Appendix H.

TABLE 2.1
Analytical Results for Groundwater Sampling (19 April 2016)
Red Hill Bulk Storage Facility
April 2016 Quarterly Monitoring Report

Method	Chemical	DOH EAL	OWDFMW01 (ERH030)					OWDFMW01 (ERH031-Duplicate of ERH030)					HDMW2253-03 (ERH029)					RHMW04 (ERH034)					RHMW06 (ERH033)					RHMW07 (ERH032)				
			Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL
EPA 8015C	TPH-g	100	13	B,U	50	25	8.3	9.0	B,U	50	25	8.3	21	B,U	50	25	8.3	ND	U	50	25	8.3	ND	U	50	25	8.3	ND	U	50	25	8.3
	TPH-d	100	38	B,U	51	21	12	36	B,U	53	21	12	25	B,U	55	22	12	20	B,U	53	21	12	28	B,U	53	21	12	26	B,U	53	21	12
	TPH-o	100	56	B,U	110	51	20	67	B,U	110	52	20	48	B,U	110	55	21	33	B,U	110	53	20	48	B,U	110	51	20	52	B,U	110	53	20
PAHs by 8270C SIM	1-Methylnaphthalene	4.7	ND>LOD	U	0.020	0.0050	0.0035	ND>LOD	U	0.020	0.0050	0.0035	ND>LOD	U	0.020	0.0050	0.0035	ND>LOD	U	0.020	0.0050	0.0035	ND>LOD	U	0.020	0.0050	0.0035	ND>LOD	U	0.019	0.0050	0.0035
	2-Methylnaphthalene	10	ND>LOD	U	0.020	0.0050	0.0023	ND>LOD	U	0.020	0.0050	0.0023	ND>LOD	U	0.020	0.0050	0.0023	ND>LOD	U	0.020	0.0050	0.0023	ND>LOD	U	0.020	0.0050	0.0023	0.0036	B,U	0.019	0.0050	0.0023
	Naphthalene	17	ND>LOD	U	0.020	0.0050	0.0038	ND>LOD	U	0.020	0.0050	0.0038	ND>LOD	U	0.020	0.0050	0.0038	ND>LOD	U	0.020	0.0050	0.0038	ND>LOD	U	0.020	0.0050	0.0038	ND>LOD	U	0.019	0.0050	0.0038
EPA 8260C	Benzene	5	ND>LOD	U	0.50	0.10	0.062	ND>LOD	U	0.50	0.10	0.062	ND>LOD	U	0.50	0.10	0.062	ND>LOD	U	0.50	0.10	0.062	ND>LOD	U	0.50	0.10	0.062	ND>LOD	U	0.50	0.10	0.062
	Ethylbenzene	30	ND>LOD	U	0.50	0.10	0.050	ND>LOD	U	0.50	0.10	0.050	ND>LOD	U	0.50	0.10	0.050	ND>LOD	U	0.50	0.10	0.050	ND>LOD	U	0.50	0.10	0.050	ND>LOD	U	0.50	0.10	0.050
	Toluene	40	ND>LOD	U	0.50	0.10	0.054	ND>LOD	U	0.50	0.10	0.054	ND>LOD	U	0.50	0.10	0.054	ND>LOD	U	0.50	0.10	0.054	ND>LOD	U	0.50	0.10	0.054	ND>LOD	U	0.50	0.10	0.054
	Xylenes, Total	20	ND>LOD	U	0.50	0.20	0.074	ND>LOD	U	0.50	0.20	0.074	ND>LOD	U	0.50	0.20	0.074	ND>LOD	U	0.50	0.20	0.074	ND>LOD	U	0.50	0.20	0.074	ND>LOD	U	0.50	0.20	0.074

Data are reported in micrograms per liter (µg/L).

B 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).

DL Detection limit

DOH EAL DOH Tier 1 Environmental Action Levels for groundwater where groundwater is a current drinking water source. (DOH, Fall 2011).

LOD Limit of Detection

LOQ Limit of Quantitation

ND>LOD Not Detected above the LOD

Q Qualifiers

U The analyte was analyzed for, but was not detected ("Non-detect") at or above the LOD and/or LOQ.

This Page Intentionally Left Blank.

SECTION 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 decision quality objectives (DQOs) for the project and if the data is usable for the intended purpose. The data quality assessment was performed in accordance with the approved *WP/SAP* (E2, 2015). The field Quality Control (QC) program consisted of standardized sample collection and management procedures, and the collection of field duplicate samples, equipment rinseate samples, source blank samples and matrix spike (MS)/MS duplicate (MSD) samples. Trip blank samples were also collected by the laboratory and accompanied the sample container shipment from the laboratory, during sample collection and back to the laboratory. The laboratory quality assurance program consisted of the use of standard analytical methods and the preparation and analyses of MS/MSD samples, surrogate spikes, blanks, Laboratory Control Samples (LCSs)/Laboratory Control Sample Duplicates (LCSDs).

3.1 DATA VALIDATION AND ASSESSMENT

The objective of data validation is to ensure the data provided is of known quality for project decisions. For this project, data validation was performed by a professional, third party data validator following Level D Validation Guidelines. Analytical data was assessed using the following documents, as applicable to each method:

- *U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013*
- *Project Procedures Manual, U.S. Naval Facilities Engineering Command, Environmental Restoration Program, NAVFAC Pacific, DON 2015*
- *EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, Update 1, August 1993; Update IIA, January 1994; Update II, January 1995; Update IIB, April 1995; Update III, June 1997; Update IIIA, May 1999; IIIB, June 2005; Update IV, January 2008; Update V, August 2015*

A number of factors may affect the quality of data, including: sample collection methods, sample analysis methods, and adherence to established procedures for sample collection, preservation, management, shipment, and analysis.

Data validation for this project was performed in accordance with the U.S. DoD Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013) and the Project Procedures Manual, U.S. NAVFAC Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience. All sample results 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 DVR detailing the results of the data validation is included as Appendix D.

Data Validation Items of Concern

- The fairly large error inherent to the analysis of TPH-d and TPH-o by EPA Method 8015 should be considered when results are compared to each other, to action levels, and to results from previous sampling events. Any comparative analysis of the results should take into consideration the fairly wide method acceptance limits (36-132%) as per DoD Quality Systems Manual (QSM) Version 5.0 (DoD, 2013).
- TPH-d and TPH-o were detected in the method blank at concentrations below their respective LOQs. Presence of these compounds at comparable levels in project samples likely indicate positive interference from laboratory procedures (laboratory contamination). Subsequently, detections for compounds identified in the method blank were flagged "B,U" by the data validators and in project sample summaries provided in Tables 2.1 and 3.1. The data validation report indicates that samples associated with this method blank should be considered as ND. The U flag added to the data by the data validator indicates that "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)".
- The source blank water (ozonated, micro-filtered bottled drinking water) used for decontamination of the portable bladder pump was found to contain trace levels of PAHs and VOCs. Subsequently, similar levels of PAHs and VOCs were found in the rinseate sample as well as several primary samples. Details are included in the DVR report in Appendix D.
- The consistently high pH (11 to 13) observed over several sampling events in well OWDFMW01 was not observed during the April 2016 sampling event. The difference in pH may be attributed to the change in sampling technique from collection of samples with bailers to collection via the low-flow technique.
- The significantly improved reporting limits should be considered when results are compared to data from previous events. Additionally, during the April 2015 event, TPH-o was added to the analyte list. There are very few previous TPH-o results to compare this data to.

3.2 DATA ASSESSMENT AND USABILITY CONCLUSIONS

It should be noted that analytical MDLs, LODs, and LOQs decreased beginning with the April 2015 sampling event compared to monitoring data from previous events due to a change of laboratories and the utilization of alternative methods. Analytes that were detected during the current event and were ND at or above the higher MDLs during past events include 1-methylnaphthalene, 2-methylnaphthelene and toluene in OWDFMW01; and

2-methylnaphthelene, in RHMW07. Consequently, these analytes may have been present at the currently detected concentrations during previous events without being detected and do not necessarily indicate any trend. These compounds were also identified in the method blank and may indicate that at these very low levels, laboratory contamination may lead to false low level hits. Furthermore, it should be noted that, in general, detections below the LOQ in primary samples, laboratory method blanks and trip blanks should be subject to scrutiny as they could be false low level hits resulting from positive interference from laboratory analytical processes (i.e., laboratory contamination).

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

This Page Intentionally Left Blank.

TABLE 3.1
Quality Control Results for Groundwater Sampling (19 April 2016)
Red Hill Bulk Storage Facility
April 2016 Quarterly Monitoring Report

Method	Chemical	DOH EAL	OWDFMW01 (ERH030)					OWDFMW01 (ERH031)					RPD Duplicate %	Trip Blank				
			Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL		Result	Q	LOQ	LOD	DL
EPA 8015C	TPH-g	100	13	B,U	50	25	8.3	9.0	B,U	50	25	8.3	9.1%	-	-	-	-	-
	TPH-d	100	38	B,U	53	21	12	36	B,U	53	21	12	1.4%	-	-	-	-	-
	TPH-o	100	56	B,U	110	51	20	67	B,U	110	52	20	4.5%	-	-	-	-	-
EPA 8270D SIM	1-Methylnaphthalene	4.7	ND>LOD	U	0.020	0.0050	0.0035	ND>LOD	U	0.020	0.0050	0.0035	NA	-	-	-	-	-
	2-Methylnaphthalene	10	ND>LOD	U	0.020	0.0050	0.0023	ND>LOD	U	0.020	0.0050	0.0023	NA	-	-	-	-	-
	Naphthalene	17	ND>LOD	U	0.020	0.0050	0.0038	ND>LOD	U	0.020	0.0050	0.0038	NA	-	-	-	-	-
EPA 8260C	Benzene	5	ND>LOD	U	0.50	0.10	0.062	ND>LOD	U	0.50	0.10	0.062	NA	ND	U	0.50	0.10	0.062
	Ethylbenzene	30	ND>LOD	U	0.50	0.10	0.050	ND>LOD	U	0.50	0.10	0.050	NA	ND	U	0.50	0.10	0.05
	Toluene	40	ND>LOD	U	0.50	0.10	0.054	ND>LOD	U	0.50	0.10	0.054	NA	ND	U	0.50	0.10	0.054
	Xylenes, Total	20	ND>LOD	U	0.50	0.20	0.074	ND>LOD	U	0.50	0.20	0.074	NA	ND	U	1.0	0.20	0.18

Data are reported in micrograms per liter (µg/L).

B 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).

DL Detection Limit

DOH EAL DOH Tier 1 Environmental Action Levels for groundwater where groundwater is a current drinking water source (DOH, Fall 2011).

LOD Limit of Detection

LOQ Limit of Quantitation

ND>LOD Not Detected above the LOD

Q Qualifiers

RPD Relative Percent Difference

U The analyte was analyzed for, but was not detected ("Non-detect") at or above the LOD and/or LOQ

This Page Intentionally Left Blank.

SECTION 4 – SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The groundwater sampling was conducted as part of the long-term groundwater and soil vapor monitoring program at the RHSF for NAVSUP FLC Pearl Harbor, under NAVFAC Contract Number N62742-14-D-1884, CTO 0014.

This quarterly monitoring report presents the results of groundwater sampling conducted on 19 April 2016, from five monitoring wells (OWDFMW01, HDMW2253-03, RHMW04, RHMW06, and RHMW07) at the RHSF, JBPHH, Hawaii. The sampling was conducted in accordance with the approved *WP/SAP* and *Technical Addendum* (E2, 2015). A summary of the analytical results is provided below.

- **OWDFMW01** – No analytes were detected in groundwater above the laboratory LOQ or the applicable DOH Tier 1 EALs. TPH-g, TPH-d and TPH-o were positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated source blank and, subsequently equipment rinseate (TPH-g) and laboratory method blank (TPH-d and TPH-o). No other contaminants were detected above the laboratory detection limits. Though elevated pH has historically been detected in well OWDFMW01 (approximately 11), the pH level measured during this round was not as elevated (approximately 8). The sampling method was revised to low-flow sampling using a bladder pump during this sampling event, while prior to this event, samples had been collected using hand bailers.
- **HDMW2253-03** – No analytes were detected in groundwater above the laboratory LOQs or the applicable DOH Tier 1 EALs. TPH-g, TPH-d and TPH-o were positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated source blank and, subsequently equipment rinseate (TPH-g) and laboratory method blank (TPH-d and TPH-o). No other contaminants were detected above the laboratory detection limits. The sampling method was revised to low-flow sampling using a bladder pump during this sampling event, while prior to this event, samples had been collected using hand bailers.
- **RHMW04** – No analytes were detected in groundwater above the laboratory LOQs or the applicable DOH Tier 1 EALs. TPH-d and TPH-o were both positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated laboratory method blank. No other contaminants were detected above the laboratory detection limits.
- **RHMW06** – No analytes were detected in groundwater above the laboratory LOQs or the applicable DOH Tier 1 EALs. TPH-d and TPH-o were positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated laboratory method blank. No other contaminants were detected above the laboratory detection limits.

RHMW07 – No analytes were detected in groundwater above the laboratory LOQs or the applicable DOH Tier 1 EALs. TPH-d, TPH-o and 2-methylnaphthalene were positively identified by the laboratory at levels below the LOQ but are considered ND at these concentrations due to the presence of these contaminants in the associated laboratory method blank (TPH-d and TPH-o) and the source blank and, subsequently equipment rinseate (2-methylnaphthalene). No other contaminants were detected above the laboratory detection limits.

4.1 GROUNDWATER CONTAMINANT TRENDS

The historical groundwater contaminant concentration trends for COPCs that exceeded the DOH Tier 1 EALs are illustrated in Appendix G. A summary of groundwater contaminant trends is provided below.

- **OWDFMW01** – TPH-o concentrations have been trending downward since a high in July 2015, while TPH-d concentrations remained similar to the previous event. Overall, concentrations of both TPH-d and TPH-o were the lowest they have been since April 2015. Detections of TPH-o and TPH-d identified during this April 2016 event are most likely the result of lab contamination and were flagged as ND by the data validators. During several previous events dating back to 2010, TPH-d was detected at concentrations that exceeded the DOH Tier 1 EAL. Concentrations of all other COPCs detected during this round of quarterly sampling were consistent with historical data.
- **HDMW2253-03** – TPH-g, TPH-d and TPH-o were detected in this well at concentrations below the laboratory LOQ and the respective DOH Tier 1 EALs. These detections, however, are most likely the result of source water contamination (TPH-g) and lab contamination (TPH-d and TPH-o) and were flagged as ND by the data validators. With the exception of one possibly erroneous result obtained during the event in April 2014, TPH-d concentrations have not exceeded the DOH Tier 1 EAL in this well since January 2013.
- **RHMW04** – Concentrations of TPH-d and TPH-o were detected in this well below the laboratory LOQs and the respective DOH Tier 1 EALs. These detections are most likely the result of lab contamination and were flagged as ND by the data validators. Concentrations of all other COPCs detected during this round of quarterly sampling were below the laboratory detection limits.
- **RHMW06** – This well was installed in September 2014 and first sampled in October 2014. Concentrations of TPH-d and TPH-o were detected in this well below the laboratory LOQs and the respective DOH Tier 1 EALs. These detections are most likely the result of lab contamination and were flagged as ND by the data validators. Concentrations of all other COPCs detected during this round of quarterly sampling were below the laboratory detection limits. To date, no COPCs have been detected at concentrations exceeding the DOH Tier 1 EALs.

- **RHMW07** – This well was installed and first sampled in October 2014. Concentrations of TPH-d, TPH-o and 2-methylnaphthalene were detected in this well below the laboratory LOQs and the respective DOH Tier 1 EALs. These detections, however, are most likely the result of source water contamination (TPH-g) and lab contamination (TPH-d and TPH-o) and were flagged as ND by the data validators. Concentrations of all other COPCs detected during this round of quarterly sampling were below the laboratory detection limits. To date, no COPCs have been detected at concentrations exceeding the DOH Tier 1 EALs.

Conclusions and Recommendations

During the April 2016 sampling event, TPH-d was ND at a concentration above the DOH Tier 1 EAL in OWDFMW01. TPH-d was present in well OWDFMW01 at concentrations exceeding the DOH Tier 1 EAL during the previous four events. The varied result during this April 2016 event may be attributed to the change in sampling methods, from hand bailing to the low-flow sampling technique. In addition, the historically high pH observed in this well (11-13) was observed to be lower (8) during this April event.

The groundwater contaminant concentrations in wells HDMW2253-03, RHMW04, RHMW06, and RHMW07 remained low and did not change significantly since the previous sampling event (January 2015), or were ND. No COPCs were detected at concentrations above their respective laboratory LOQs or DOH Tier 1 EALs in any of the five wells.

Detections of TPH-d, TPH-o, and PAHs below the LOQ were likely a result of low level laboratory contamination as seen in the laboratory method blank.

Lead scavengers 1,2-dibromoethane and 1,2-dichloroethane have not been detected at concentrations above their respective DOH Tier 1 EALs for four consecutive quarters. Subsequently, and in accordance with the EPA/DOH letter, Enclosure A, Analytes and Action Levels dated February 4, 2016, analysis for lead scavengers and all but the ten COPCs listed in Enclosure A, has been discontinued.

Based on a suspected 2014 release at the RHSF and the results of the recent groundwater sampling and analysis, continued groundwater monitoring at the RHSF is recommended. If the TPH-d concentrations significantly increase, the monitoring frequency should be increased to monthly, even though wells OWDFMW01, HDMW2253-03, RHMW04, RHMW06, and RHMW07 are not included in the *RHSF Groundwater Protection Plan*.

This Page Intentionally Left Blank.

SECTION 5 – FUTURE WORK

Future work includes the Third Quarter 2016 groundwater monitoring, which is tentatively scheduled for July 2016. A quarterly groundwater monitoring report will be prepared to document the sampling.

This Page Intentionally Left Blank.

SECTION 6 – REFERENCES

Atlas of Hawaii, 1983, Department of Geography, University of Hawaii Press.

Battelle, 2015a, Draft Monitoring Well Installation Report, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, Hawaii, March 2015.

Battelle, 2015b, Draft Technical Memorandum, Groundwater Sampling Event for RHMW06 and RHMW07 – January 2015, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, Hawaii, April 2015.

DLNR, 1985, Pan Evaporation: State of Hawai'i 1894-1983: Report R74, Division of Water and Land Development, August 1995.

DLNR, 1986, Rainfall Atlas of Hawaii: Report R76, Division of Water and Land Development, June 1986.

DoD, 2013, Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0. July 2013

DOH, 2000, Hawaii Department of Health, Technical Guidance Manual for Underground Storage Tank Closure and Release Response, March 2000.

DOH, 2011, Screening for Environmental Hazards at Sites with Contaminated Soil and Groundwater, Hawai'i Department of Health, Hazard Evaluation and Emergency Response, December 2011.

DOH, 2013, Hawaii Administrative Rules Title 11, Department of Health, Chapter 281 Underground Storage Tanks (HAR 11-281), Subchapter 7, Release Response Action.

DON, 2007, Project Procedures Manual, U.S. Navy Installation Restoration Program, NAVFAC Pacific, Prepared for Pacific Division, Naval Facilities Engineering Command (NAVFAC Pacific), February 2007.

E2, 2015, Work Plan/Sampling and Analysis Plan, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, September 2015.

E2, 2016, Fourth Quarter 2015 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, January 2016.

E2, 2016, First Quarter 2016 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, March 2016.

Environet, 2010, Work Plan, Long-Term Monitoring, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, September 2010.

Environet, 2012, Quarterly Groundwater Monitoring Report-Outside (Non-Tunnel Wells), Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, July 2012.

ESI, 2012, Work Plan/Sampling and Analysis Plan, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, October 2012.

ESI, 2013a, Fourth Quarter 2012 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, January 2013.

ESI, 2013b, First Quarter 2013 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, April 2013.

ESI, 2013c, Second Quarter 2013 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, July 2013.

ESI, 2013d, Third Quarter 2013 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, September 2013.

ESI, 2014a, Fourth Quarter 2013 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, January 2014.

ESI, 2014b, Groundwater Sampling Report for Additional Sampling of HDMW2253-03, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, February 2014.

ESI, 2014c, First Quarter 2014 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, April 2014.

ESI, 2014d, Second Quarter 2014 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, June 2014.

ESI, 2014e, Third Quarter 2014 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, September 2014.

ESI, 2015a, Fourth Quarter 2014 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, January 2015.

ESI, 2015b, First Quarter 2015 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, March 2015.

ESI, 2015c, Work Plan/Sampling and Analysis Plan, Second Technical Addendum, Long-Term Groundwater and Soil Vapor Monitoring, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, April 2015.

ESI, 2015d, Second Quarter 2015 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, August 2015.

ESI, 2015e, Third Quarter 2015 - Quarterly Groundwater Monitoring Report Outside Tunnel Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oahu, Hawaii, November 2015.

Foote et al., 1972, Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.

HDR, Inc., 2014, Interim Update, Red Hill Bulk Fuel Storage Facility, Final Groundwater Protection Plan, Prepared for Naval Facilities Engineering Command, Pacific, Pearl Harbor, Hawaii, August 2014.

Mink, J.F. and Lau, L.S., 1990, Aquifer Identification and Classification for Oahu: Groundwater Protection Strategy for Hawaii: Water Resources Research Center Technical Report No. 179, February 1990.

Stearns, H.T. and Vaksvik, K.N., 1935, Geology and Groundwater Resources of the Island of Oahu, Hawaii: Hawaii Div. Hydro. Bull.

Stearns, H.T. and Vaksvik, K.N., 1938, Records of the Drilled Wells on the Island of Oahu, Hawaii: Hawaii Div. Hydrogr. Bull. 4, 213 p.

TEC, 2008, Final Groundwater Protection Plan, Red Hill Fuel Storage Facility, Prepared for Navy Region Hawaii, Pearl Harbor, Hawaii, January 2008.

TEC, 2010a, Quarterly Groundwater Monitoring Report – Outside (Non-Tunnel) Wells, Prepared for Navy Region Hawaii, Pearl Harbor, Hawaii, April 2010.

TEC, 2010b, Quarterly Groundwater Monitoring Report – Outside (Non-Tunnel) Wells, Prepared for Navy Region Hawaii, Pearl Harbor, Hawaii, May 2010.

This Page Intentionally Left Blank.

APPENDIX A

Groundwater Sampling Logs

This Page Intentionally Left Blank.

GROUNDWATER SAMPLING LOG

WELL NO. RHMW04 LOCATION: RHFS PROJECT NO. 150037
DATE: 4/19/2016 TIME: 1415 CLIMATIC CONDITIONS: 82°, Sunny, clear skies, NE 15 MPH
TIDAL CONDITIONS: Rising ☐ HIGH TIDE: _____
Falling ☐ LOW TIDE: _____ CURRENT TIDE: _____

STATIC WATER LEVEL (FT.) and TIME: 293.21' @ 1422 TOTAL DEPTH (FT.): _____
WELL PURGING: LENGTH OF SATURATED ZONE: _____ LINEAR FT. _____
a VOLUME OF WATER TO BE EVACUATED: _____ GALS. (Gals/Linear ft. X linear feet of saturation X 3-casing volumes)
METHOD OF REMOVAL: BLADDER PUMP PUMPING RATE: 500 mL/min

WELL PURGE DATA:

DATE/ TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (µS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
<u>4/19/16 @ 1438</u>	<u>293.21</u>	<u>0.1</u>	<u>0.29</u>	<u>6.76</u>	<u>440.5</u>	<u>7.80</u>	<u>1.7</u>	<u>23.1</u>	<u>54.1</u>	<u>0.21</u>
<u>1440</u>	<u>293.21</u>	<u>0.25</u>	<u>0.29</u>	<u>6.92</u>	<u>438.7</u>	<u>8.32</u>	<u>1.7</u>	<u>22.9</u>	<u>43.3</u>	<u>0.21</u>
<u>1442</u>	<u>293.21</u>	<u>0.50</u>	<u>0.29</u>	<u>7.03</u>	<u>440.0</u>	<u>8.45</u>	<u>1.6</u>	<u>22.9</u>	<u>37.3</u>	<u>0.21</u>
<u>1444</u>	<u>293.21</u>	<u>0.75</u>	<u>0.29</u>	<u>7.08</u>	<u>440.0</u>	<u>8.55</u>	<u>1.6</u>	<u>22.9</u>	<u>37.2</u>	<u>0.21</u>
<u>1446</u>	<u>293.21</u>	<u>1.00</u>	<u>0.29</u>	<u>7.11</u>	<u>440.7</u>	<u>8.59</u>	<u>1.5</u>	<u>22.9</u>	<u>35.4</u>	<u>0.21</u>
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

SAMPLE WITHDRAWAL METHOD: BLADDER PUMP

APPEARANCE OF SAMPLE: COLOR: CLEAR

SEDIMENT: NONE

OTHER: NONE

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES TPH-D/G/O, BTEX, NAPH,
1/2-METHYLNAPH.

NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 1x1L AMBER (Ø), 1x500mL AMBER (HCl)
4x40mL vials CHCl TOTAL=6

SAMPLE IDENTIFICATION NUMBER(S) RH-RHMW04-GW116 / ERH034 @ 1457

DECONTAMINATION PROCEDURES: NAVY I-F

NOTES:

SAMPLED BY: MN/MH

SAMPLES DELIVERED TO: ALS, KELSO, WA

TRANSPORTER: _____

DATE: _____ TIME: _____

CAPACITY OF CASING (GALLONS/LINEAR FOOT)
2"-0.16•4"-0.65•6"-1.47•8"-2.61•10"-4.08•12"-5.87

Figure I-C-3-1: Groundwater Sampling Log

GROUNDWATER SAMPLING LOG

WELL NO. RHMW06 LOCATION: RHFS PROJECT NO. 150037
DATE: 4/19/2016 TIME: 1334 CLIMATIC CONDITIONS: 82°F, Sunny, clear skies, NE 17MPH
TIDAL CONDITIONS: Rising ☐ HIGH TIDE: _____ CURRENT TIDE: _____
Falling ☐ LOW TIDE: _____

STATIC WATER LEVEL (FT.) and TIME: 240.35 @ 1338 TOTAL DEPTH (FT.): _____
WELL LENGTH OF SATURATED ZONE: _____ LINEAR FT. _____
PURGING: _____
a VOLUME OF WATER TO BE EVACUATED: _____ GALS. (Gals/Linear ft. X linear feet of saturation X 3-casing volumes)
METHOD OF REMOVAL: BLADDER PUMP PUMPING RATE: 250 mL/min
~ 500

WELL PURGE DATA:

DATE/ TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
<u>4/19/16 @ 1340</u>	<u>240.35</u>	<u>0.25</u>	<u>1.02</u>	<u>8.06</u>	<u>1577</u>	<u>98.7</u>	<u>13.2</u>	<u>25.9</u>	<u>-78.3</u>	<u>0.79</u>
<u>1342</u>	<u>240.35</u>	<u>0.25</u>	<u>1.02</u>	<u>8.27</u>	<u>1575</u>	<u>99.7</u>	<u>2.4</u>	<u>24.4</u>	<u>-88.2</u>	<u>0.79</u>
<u>1344</u>	<u>240.35</u>	<u>0.50</u>	<u>1.03</u>	<u>8.67</u>	<u>1581</u>	<u>86.6</u>	<u>16.5</u>	<u>23.9</u>	<u>-36.2</u>	<u>0.81</u>
<u>1346</u>	<u>240.35</u>	<u>0.75</u>	<u>1.06</u>	<u>7.30</u>	<u>1630</u>	<u>6.65</u>	<u>10.8</u>	<u>23.6</u>	<u>-38.7</u>	<u>0.82</u>
<u>1348</u>	<u>240.35</u>	<u>1.00</u>	<u>1.06</u>	<u>7.29</u>	<u>1635</u>	<u>6.55</u>	<u>6.7</u>	<u>23.4</u>	<u>-44.6</u>	<u>0.82</u>
<u>1350</u>	<u>240.3</u>	<u>1.25</u>	<u>1.00</u>	<u>7.29</u>	<u>1637</u>	<u>6.56</u>	<u>4.5</u>	<u>23.5</u>	<u>-8.2</u>	<u>0.83</u>

SAMPLE WITHDRAWAL METHOD: BLADDER PUMP

APPEARANCE OF SAMPLE: COLOR: CLEAR

SEDIMENT: NONE

OTHER: NONE

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES TPH-D/G/O, BTEX, NAPH,
1/2-METHYL NAPH.

NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 1x1L AMBER (Ø), 1x500mL AMBER (CHCI),
4x40mL VOAs (CHCI) TOTAL = 6

SAMPLE IDENTIFICATION NUMBER(S) RH-RHMW06-GW416 / ERH Ø33 @ 1405

DECONTAMINATION PROCEDURES: NAVY ppm I-F

NOTES:

SAMPLED

BY: MN / MH

SAMPLES DELIVERED TO: ALS, KELSO, WA

TRANSPORTER: _____

DATE: _____ TIME: _____

CAPACITY OF CASING (GALLONS/LINEAR FOOT)

2"-0.16•4"-0.65•6"-1.47•8"-2.61•10"-4.08•12"-5.87

Figure I-C-3-1: Groundwater Sampling Log

GROUNDWATER SAMPLING LOG

WELL NO. RHMMW07 LOCATION: RHFS PROJECT NO. 150037
DATE: 4/19/2016 TIME: 1302 CLIMATIC CONDITIONS: Sunny, clear skies
TIDAL CONDITIONS: Rising ☐ HIGH TIDE: _____
Falling ☐ LOW TIDE: _____
STATIC WATER LEVEL (FT.) and TIME: 197.76' @ 1307 TOTAL DEPTH (FT.): _____
WELL PURGING: LENGTH OF SATURATED ZONE: _____ LINEAR FT. _____
a VOLUME OF WATER TO BE EVACUATED: _____ GALS. (Gals/Linear ft. X linear feet of saturation X 3-casing volumes)
METHOD OF REMOVAL: BLADDER PUMP PUMPING RATE: ~400 mL/min

WELL PURGE DATA:

DATE/ TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (µS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
4/19/16 1312	197.76	0.1	1.17	7.95	1794	7.87	1.6	23.7	-84.6	0.91
1316	197.76	0.1 0.75	1.20	7.04	1848	3.41	1.6	23.2	-51.4	0.94
1318	197.76	1.0	1.20	7.19	1853	2.49	1.9	23.2	-70.4	0.94
1320	197.76	1.25	1.20	7.44	1851	2.30	2.0	23.6	-75.9	0.94
1322	197.76	1.50	1.20	7.54	1846	2.24	2.3	22.8	-78.4	0.94
1324	197.76	1.75	1.20	7.55	1843	2.20	2.3	22.9	-79.6	0.93

SAMPLE WITHDRAWAL METHOD: BLADDER PUMP
APPEARANCE OF SAMPLE: COLOR: CLEAR
SEDIMENT: NONE
OTHER: NONE

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES TPH-D/G/O, BTEX, NAPH, 1/2-METHYLNAPH.

NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 1x1L AMBER (Φ), 1x500mL AMBER (HCl), 4x40mL vials (HCl) (TOTAL=6)

SAMPLE IDENTIFICATION NUMBER(S) RH-RHMMW07-GW416 / ERH032 @ 1332

DECONTAMINATION PROCEDURES: NAVY PPM I-F

NOTES: _____

SAMPLED BY: _____

SAMPLES DELIVERED TO: ALS, KELSO, WA TRANSPORTER: _____

DATE: _____ TIME: _____

CAPACITY OF CASING (GALLONS/LINEAR FOOT)
2"-0.16•4"-0.65•6"-1.47•8"-2.61•10"-4.08•12"-5.87

Figure I-C-3-1: Groundwater Sampling Log

GROUNDWATER SAMPLING LOG

WELL NO. ND MW 2253-03 LOCATION: HALAWA PROJECT NO. 150031
DATE: 4/19/2016 TIME: 0840 CLIMATIC CONDITIONS: Sunny, clear skies, no wind
TIDAL CONDITIONS: Rising ☐ HIGH TIDE: _____
Falling ☐ LOW TIDE: _____
STATIC WATER LEVEL (FT.) and TIME: 106.91' @ 0855 TOTAL DEPTH (FT.): 1575'
WELL PURGING: LENGTH OF SATURATED ZONE: _____ LINEAR FT. _____
a VOLUME OF WATER TO BE EVACUATED: _____ GALS. (Gals/Linear ft. X linear feet of saturation X 3-casing volumes)
METHOD OF REMOVAL: BLADDER PUMP PUMPING RATE: ~400 mL/min

WELL PURGE DATA:

DATE/TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (µS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
4/19/16 @ 0936	206.97	0.1	0.32	6.12	484.8	5.25	60.4	23.4	-2.2	0.23
0940	206.97	0.25	0.32	6.17	485.5	2.62	55.9	23.0	-17.4	0.23
0944	206.97	0.50 @ 0.75	0.32	6.12	486.5	1.63	53.6	22.9	-8.0	0.23
0948	206.97	1.25	0.32	6.11	485.6	1.25	49.2	22.8	-5.6	0.23
0952	206.97							22.8		0.23

SAMPLE WITHDRAWAL METHOD: BLADDER PUMP

APPEARANCE OF SAMPLE: COLOR: CLEAR

SEDIMENT: NONE

OTHER: ONE PIECE OF ALGAE

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES: 8270 PAHs, SIM (NAPH, 1-METHYLNAPH, 2-METHYLNAPH), 8015C DRG KRO, GRO, AND VOCs (BTEX)

NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 1x 1L AMBER (φ), 1x 500 mL AMBER (HCl), 3x 40 mL vials (HCl) (TOTAL=5)

SAMPLE IDENTIFICATION NUMBER(S): RH-MW2253-BW416 / ERHφ29 @ 0952

DECONTAMINATION PROCEDURES: NAYY PPM I-P

NOTES:

SAMPLED BY: MN/MH

SAMPLES DELIVERED TO: ALS, KELSO, WA

TRANSPORTER: TRACIE SOBER, ALS

DATE: _____ TIME: _____

CAPACITY OF CASING (GALLONS/LINEAR FOOT)
2"-0.16•4"-0.65•6"-1.47•8"-2.61•10"-4.08•12"-5.87

Figure I-C-3-1: Groundwater Sampling Log

GROUNDWATER SAMPLING LOG

WELL NO. OWDFMW01 LOCATION: RHFS PROJECT NO. 150037
DATE: 4/19/2016 TIME: 1025 CLIMATIC CONDITIONS: 79°, SUNNY, CLEAR SKIES, NNE 10 MPH
TIDAL CONDITIONS: Rising ☐ HIGH TIDE: _____
Falling ☐ LOW TIDE: _____

STATIC WATER LEVEL (FT.) and TIME: 119.28' @ 1030 TOTAL DEPTH (FT.): _____
WELL PURGING: LENGTH OF SATURATED ZONE: _____ LINEAR FT. _____
a VOLUME OF WATER TO BE EVACUATED: _____ GALs. (Gals/Linear ft. X linear feet of saturation X 3-casing volumes)
METHOD OF REMOVAL: BLADDER PUMP PUMPING RATE: ~ 600 mL/min

WELL PURGE DATA:

DATE/TIME	DTW	GALLONS REMOVED	TDS (g/L)	pH	SP. COND. (mS/cm)	D.O. (mg/L)	TURB. (NTU)	TEMP. (°C)	ORP (mV)	SAL (ppt)
4/19/16 @ 1040	119.28'	0.1	2.56	7.28	3846	6.80	30.0	28.2	-104.7	2.02
1214	119.28'	0.25	2.56	8.06	3940	6.80 4.526	49.9	20.4	-134.3	2.08
1216	119.28'	0.5	2.55	8.14	3929	4.62	49.6	25.5	-137.7	2.07
1218	119.28'	0.75	2.55	7.97	3924	4.13	46.4	25.1	-124.1	2.07
1220	119.28'	1.00	2.55	7.93	3919	4.12	46.9	25.1	-122.8	2.07
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

SAMPLE WITHDRAWAL METHOD: BLADDER PUMP
APPEARANCE OF SAMPLE: COLOR: CLEAR
SEDIMENT: SLIGHT
OTHER: NONE

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES 8220 SIM CNAPH, 1-METHILNAPH.
8015C (TPH-D/G/O) + (BTEX)

NUMBER AND TYPES OF SAMPLE CONTAINERS USED: 1x1L AMBER (φ), 1x500mL AMBER CHCl
4x40mL VOAS (CHCl) (TOTAL = 6)

SAMPLE IDENTIFICATION NUMBER(S) RH-OWDFMW01-GW416/ERH030 @ 1228 +MS/MSD
DECONTAMINATION PROCEDURES: NAVY PPM I-F 04P ERH031 @ 1308

NOTES:

SAMPLED BY: MN/MH

SAMPLES DELIVERED TO: ALS, KELSO, WA TRANSPORTER: TRACHE SPOBER, ALS

DATE: _____ TIME: _____

CAPACITY OF CASING (GALLONS/LINEAR FOOT)
2"-0.16•4"-0.65•6"-1.47•8"-2.61•10"-4.08•12"-5.87

Figure I-C-3-1: Groundwater Sampling Log

APPENDIX B

Field Notes

This Page Intentionally Left Blank.

TUESDAY 4-19-2016

ACTIVITY: GW MONITORING (OUTSIDE WELLS)

TEAM: MATHEW NEAL (MN), MARVIN HOCKETT (MH), BERNICE BALUTE (BB) w/E2
ROBERT "BOB" CHENET, HAWAII DLNR CWRM

PDE LEVEL: D

WEATHER: 73°F, 71% HUMIDITY, WINDS NNW 5 MPH, CLEAR SKIES

REFERENCES: WWSAP, HSP, NAVY PPM

0828 MN/MH MEET BB @ HALAWA PRISON PARKING LOT
 0830 E2 MEETS RC (DLNR) AND CHECK IN w/ PRISON GUARD
 0835 ARRIVE @ WELL ^{HP} MW2253-03 IN LOCKED GATED FENCE ENCLOSURE
 CONDUCT H&S BRIEFING
 0840 SETUP EQUIPMENT & CALIBRATE YSI WATER QUALITY METER
 0855 WL = 206.97' (NO PRODUCT OBSERVED)
 0857 START TO LOWER PUMP
 0918 START PURGING
 0930 FIRST WATER OBSERVED

PUMP - PRESSURE	140 PSI
- DISCHARGE TIME	20 SEC
- FILL TIME	20 SEC
CO ₂ TANK - PRESSURE	200 PSI

0952 COLLECT SAMPLE ERH029
 BREAKDOWN EQUIPMENT (LEFT TUBING IN BLACK GARBAGE BAG IN SHED.)
 1015 LEAVE WELL
 RC CHECKS OUT w/ PRISON GUARD

1025 ARRIVE @ IDW STORAGE w/ PCS, WHO TAKE DRUMS (DRUM-ØØ1 AND -ØØ2)
 SETUP EQUIPMENT @ WELL OWDFMWØ1

1030 WL = 119.28'

1032 START TO LOWER PUMP

1038 ~~START PURGING~~ ^{BB} START PUMPING / NOTHING

1100 RELOWER PUMP

~~FIRST WATER OBSERVED~~ ^{BB}

PUMP - PRESSURE	80 PSI
- DISCHARGE TIME	20 SEC
- FILL TIME	20 SEC
CO ₂ TANK - PRESSURE	250 PSI

1110 PCS LEAVES, WILL RETURN w/ 2 EMPTY DRUMS

1130 CHANGE OUT BLADDER, SINCE FIRST WAS FLATTENED / RELOWER PUMP

1150 PULL UP PUMP AND CHANGE OUT EVERYTHING (HOSE / BLADDER)

TUESDAY 4-19-2016

SAMPLE LOG:

<u>EPA ID:</u>	<u>SAMPLE ID:</u>	<u>DATE:</u>	<u>TIME:</u>	<u># CONT.</u>
ERH ϕ 29	^{AD} RH-MW2253- ^{ϕ3} GW*1G ²	04-19-16	0952	5
ERH ϕ 30 MS/MSD	RH-OWDFMW ϕ 1-GW*1G	04-19-16	1228	^{BD} 5 18
ERH ϕ 31 DUP	RH-OWDFMW ϕ 1-GW*1G -DUP	04-19-16	1308	6
ERH ϕ 32	RH-RH MW ϕ 7-GW*1G	04-19-16	1332	6
ERH ϕ 33	RH-RH MW ϕ 6-GW*1G	04-19-16	1405	6
ERH ϕ 34	RH-RH MW ϕ 4-GW*1G	04-19-16	1457	6
ERH ϕ 35	+* RH-ERB-GW*1G	04-19-16	1500	6
ERH ϕ 36	* RH-SB-GW*1G ^{BB}	04-19-16	1515	6

* Refresh ozonated, ^{micro-}filtered drinking water
 + BLADDER PUMP LAST USED @ OWDFMW ϕ 1

TUESDAY 4/19/2016

1200	RELOWER PUMP ^{15'} 20' BELOW WATER TABLE	
1204	FIRST WATER OBSERVED	
1228	COLLECT SAMPLE <u>ERHϕ3ϕ</u> AND <u>MS/MSD</u>	
(1308)	TIME GIVEN TO <u>DUPLICATE SAMPLE ERHϕ31</u>	
1245	CLEANUP (STORE TUBING IN BLACK TRASH BAG)	
1300	LEAVE WELL	
1302	ARRIVE @ WELL AND SETUP EQUIPMENT (<u>RHMWϕ7</u>)	
1307	WL = 197.76'	- PRESSURE 110 PSI
1309	START PUMP (USE LAST QUARTER'S PUMP SETTINGS)	- DISCHARGE 90 SEC
(1332)	COLLECT SAMPLE <u>ERHϕ32</u>	- FILL 30 SEC
1330	CLEANUP	
1333	LEAVE WELL	
1334	ARRIVE @ WELL AND SETUP EQUIPMENT (<u>RHMWϕ6</u>)	
1338	WL = 240.35'	- PRESSURE 130 PSI
1339	START PUMP (USE LAST QUARTER'S PUMP SETTINGS)	- DISCHARGE 30 SEC
(1405)	COLLECT SAMPLE <u>ERHϕ33</u>	- FILL 20 SEC
	CLEANUP	(³⁵ ³⁰ ³⁰ ³⁰ DURING SAMPLING) 30 30 30 30
1404	LEAVE WELL	
1407	REQUEST ACCESS THROUGH GATE (FOR NEXT WELL) FROM GUARD	
1415	ARRIVE @ WELL AND SETUP EQUIPMENT (<u>RHMWϕ4</u>), ^{REMOVED} SOME WATER IN ANNULUS	
1422	WL = 293.21'	- PRESSURE 170 PSI
1425	START PUMP (USE LAST QUARTER'S PUMP SETTINGS)	- DISCHARGE 30 SEC
(1457)	COLLECT SAMPLE <u>ERHϕ34</u>	- FILL 40 SEC
	CLEANUP (BOTH TANKS ARE EMPTY)	
1457	REDECONTAMINATE BLADDER PUMP USED @ MW-OWDFMW ϕ 1	
1500	COLLECT EQUIPMENT RINSATE SAMPLE <u>ERHϕ35</u>	
1515	COLLECT SOURCE BLANK SAMPLE <u>ERHϕ36</u>	
	LEAVE WELL	
1517	ENTER TUNNEL @ ADIT 5 TO PLUG IN GOLF CART FOR TOMORROW	
1530	LEAVE TUNNEL	
1533	TELL GUARD WE ARE DONE @ RHMW ϕ 4	
	LEAVE SITE	

Benjamin [Signature]
4/19/2016

APPENDIX C

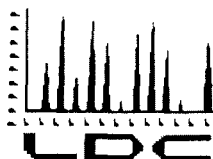
**Laboratory Report
(included on attached CD)**

This Page Intentionally Left Blank.

APPENDIX D

Laboratory Data Third Party Validation Report

This Page Intentionally Left Blank.



LABORATORY DATA CONSULTANTS, INC.

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

Element Environmental LLC
98-030 Hekaha Street, Unit 9
Aiea, Hawaii 96701
ATTN: Mr. Marvin Heskett

May 26, 2016

SUBJECT: Red Hill Bulk Fuel Storage Facility, Data Validation

Dear Mr. Heskett,

Enclosed is the final validation report for the fractions listed below. This SDG was received on May 6, 2016. Attachment 1 is a summary of the sample that was reviewed for the analysis.

LDC Project #36302:

SDG #

Fraction

K1604068

Volatiles, PAHs, Gasoline Range Organics, Diesel Range Organics & Residual Range Organics

The data validation was performed under Level D Validation guidelines. The analyses were validated using the following documents, as applicable to each method:

- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013
- Project Procedures Manual, U.S. Naval Facilities Engineering Command, Environmental Restoration Program, NAVFAC Pacific, DON 2015
- 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,

Christina Rink
Project Manager/Chemist

[illegible]

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Fuel Storage Facility

LDC Report Date: May 21, 2016

Parameters: Volatiles

Validation Level: Level D

Laboratory: ALS Environmental

Sample Delivery Group (SDG): K1604068

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH029	K1604068-001	Water	04/19/16
ERH030	K1604068-002	Water	04/19/16
ERH031	K1604068-003	Water	04/19/16
ERH032	K1604068-004	Water	04/19/16
ERH033	K1604068-005	Water	04/19/16
ERH034	K1604068-006	Water	04/19/16
ERH035	K1604068-007	Water	04/19/16
ERH036	K1604068-008	Water	04/19/16
ERH030MS	K1604068-002MS	Water	04/19/16
ERH030MSD	K1604068-002MSD	Water	04/19/16

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 U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013) and the Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015). 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 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. 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 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 ERH035 was identified as an equipment rinsate. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH035	04/19/16	Toluene Ethylbenzene m,p-Xylenes o-Xylene	0.060 ug/L 0.85 ug/L 2.3 ug/L 1.6 ug/L	ERH029 ERH030 ERH031 ERH032 ERH033 ERH034

Sample ERH036 was identified as a source blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH036	04/19/16	Toluene Ethylbenzene m,p-Xylenes o-Xylene	0.060 ug/L 1.1 ug/L 2.9 ug/L 2.1 ug/L	ERH035

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
ERH035	Toluene Ethylbenzene m,p-Xylenes o-Xylene	0.060 ug/L 0.85 ug/L 2.3 ug/L 1.6 ug/L	0.060U ug/L 0.85U ug/L 2.3U ug/L 1.6U ug/L

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 ERH030 and ERH031 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.

XIII. Target Compound Identifications

All target compound identifications met validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

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

Due to source 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 Fuel Storage Facility
Volatiles - Data Qualification Summary - SDG K1604068

No Sample Data Qualified in this SDG

Red Hill Bulk Fuel Storage Facility
Volatiles - Laboratory Blank Data Qualification Summary - SDG K1604068

No Sample Data Qualified in this SDG

Red Hill Bulk Fuel Storage Facility
Volatiles - Field Blank Data Qualification Summary - SDG K1604068

Sample	Compound	Modified Final Concentration	A or P	Code
ERH035	Toluene Ethylbenzene m,p-Xylenes o-Xylene	0.060U ug/L 0.85U ug/L 2.3U ug/L 1.6U ug/L	A	F

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Volatile Organic Compounds

Sample Name: ERH029
Lab Code: K1604068-001
Extraction Method: EPA 5030B
Analysis Method: 8260C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.10	0.062	1	05/02/16	05/02/16	KWG1603424	
Toluene	ND	U	0.50	0.10	0.054	1	05/02/16	05/02/16	KWG1603424	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	05/02/16	05/02/16	KWG1603424	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	05/02/16	05/02/16	KWG1603424	
o-Xylene	ND	U	0.50	0.20	0.074	1	05/02/16	05/02/16	KWG1603424	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,2-Dichloroethane-d4	96	81-118	05/02/16	Acceptable
Dibromofluoromethane	91	80-119	05/02/16	Acceptable
Toluene-d8	104	89-112	05/02/16	Acceptable
4-Bromofluorobenzene	95	85-114	05/02/16	Acceptable

NAVFAC PACIFIC
VALIDATED LEVEL D

MAY 23 2016

Initials: *CR*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Volatile Organic Compounds

Sample Name: ERH030
Lab Code: K1604068-002
Extraction Method: EPA 5030B
Analysis Method: 8260C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.10	0.062	1	05/02/16	05/02/16	KWG1603424	
Toluene	ND	U	0.50	0.10	0.054	1	05/02/16	05/02/16	KWG1603424	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	05/02/16	05/02/16	KWG1603424	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	05/02/16	05/02/16	KWG1603424	
o-Xylene	ND	U	0.50	0.20	0.074	1	05/02/16	05/02/16	KWG1603424	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,2-Dichloroethane-d4	99	81-118	05/02/16	Acceptable
Dibromofluoromethane	92	80-119	05/02/16	Acceptable
Toluene-d8	103	89-112	05/02/16	Acceptable
4-Bromofluorobenzene	94	85-114	05/02/16	Acceptable

**NAVFAC PACIFIC
VALIDATED LEVEL D**

MAY 23 2016

Initials: *CR*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Volatile Organic Compounds

Sample Name: ERH031
Lab Code: K1604068-003
Extraction Method: EPA 5030B
Analysis Method: 8260C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.10	0.062	1	05/02/16	05/02/16	KWG1603424	
Toluene	ND	U	0.50	0.10	0.054	1	05/02/16	05/02/16	KWG1603424	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	05/02/16	05/02/16	KWG1603424	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	05/02/16	05/02/16	KWG1603424	
o-Xylene	ND	U	0.50	0.20	0.074	1	05/02/16	05/02/16	KWG1603424	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,2-Dichloroethane-d4	98	81-118	05/02/16	Acceptable
Dibromofluoromethane	90	80-119	05/02/16	Acceptable
Toluene-d8	103	89-112	05/02/16	Acceptable
4-Bromofluorobenzene	94	85-114	05/02/16	Acceptable

**NAVFAC PACIFIC
VALIDATED LEVEL D**

MAY 23 2016

Initials: *CR*

Comments: _____

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Volatile Organic Compounds

Sample Name: ERH032
Lab Code: K1604068-004
Extraction Method: EPA 5030B
Analysis Method: 8260C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.10	0.062	1	05/02/16	05/02/16	KWG1603424	
Toluene	ND	U	0.50	0.10	0.054	1	05/02/16	05/02/16	KWG1603424	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	05/02/16	05/02/16	KWG1603424	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	05/02/16	05/02/16	KWG1603424	
o-Xylene	ND	U	0.50	0.20	0.074	1	05/02/16	05/02/16	KWG1603424	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,2-Dichloroethane-d4	98	81-118	05/02/16	Acceptable
Dibromofluoromethane	90	80-119	05/02/16	Acceptable
Toluene-d8	104	89-112	05/02/16	Acceptable
4-Bromofluorobenzene	93	85-114	05/02/16	Acceptable

NAVFAC PACIFIC
VALIDATED LEVEL D

MAY 23 2016

Initials: *ER*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Volatile Organic Compounds

Sample Name: ERH033
Lab Code: K1604068-005
Extraction Method: EPA 5030B
Analysis Method: 8260C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.10	0.062	1	05/02/16	05/02/16	KWG1603424	
Toluene	ND	U	0.50	0.10	0.054	1	05/02/16	05/02/16	KWG1603424	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	05/02/16	05/02/16	KWG1603424	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	05/02/16	05/02/16	KWG1603424	
o-Xylene	ND	U	0.50	0.20	0.074	1	05/02/16	05/02/16	KWG1603424	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,2-Dichloroethane-d4	98	81-118	05/02/16	Acceptable
Dibromofluoromethane	90	80-119	05/02/16	Acceptable
Toluene-d8	103	89-112	05/02/16	Acceptable
4-Bromofluorobenzene	92	85-114	05/02/16	Acceptable

**NAVFAC PACIFIC
VALIDATED LEVEL D**

MAY 23 2016

Initials: *ER*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Volatile Organic Compounds

Sample Name: ERH034
Lab Code: K1604068-006
Extraction Method: EPA 5030B
Analysis Method: 8260C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.10	0.062	1	05/02/16	05/02/16	KWG1603424	
Toluene	ND	U	0.50	0.10	0.054	1	05/02/16	05/02/16	KWG1603424	
Ethylbenzene	ND	U	0.50	0.10	0.050	1	05/02/16	05/02/16	KWG1603424	
m,p-Xylenes	ND	U	0.50	0.20	0.11	1	05/02/16	05/02/16	KWG1603424	
o-Xylene	ND	U	0.50	0.20	0.074	1	05/02/16	05/02/16	KWG1603424	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,2-Dichloroethane-d4	97	81-118	05/02/16	Acceptable
Dibromofluoromethane	91	80-119	05/02/16	Acceptable
Toluene-d8	103	89-112	05/02/16	Acceptable
4-Bromofluorobenzene	92	85-114	05/02/16	Acceptable

**NAVFAC PACIFIC
VALIDATED LEVEL D**

MAY 23 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Volatile Organic Compounds

Sample Name: ERH035
Lab Code: K1604068-007
Extraction Method: EPA 5030B
Analysis Method: 8260C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.10	0.062	1	05/03/16	05/03/16	KWG1603424	
Toluene	0.060	J	0.50	0.10	0.054	1	05/03/16	05/03/16	KWG1603424	
Ethylbenzene	0.85		0.50	0.10	0.050	1	05/03/16	05/03/16	KWG1603424	
m,p-Xylenes	2.3		0.50	0.20	0.11	1	05/03/16	05/03/16	KWG1603424	
o-Xylene	1.6		0.50	0.20	0.074	1	05/03/16	05/03/16	KWG1603424	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,2-Dichloroethane-d4	99	81-118	05/03/16	Acceptable
Dibromofluoromethane	91	80-119	05/03/16	Acceptable
Toluene-d8	103	89-112	05/03/16	Acceptable
4-Bromofluorobenzene	95	85-114	05/03/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 25 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Volatile Organic Compounds

Sample Name: ERH036
Lab Code: K1604068-008
Extraction Method: EPA 5030B
Analysis Method: 8260C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Benzene	ND	U	0.50	0.10	0.062	1	05/03/16	05/03/16	KWG1603424	
Toluene	0.060	J	0.50	0.10	0.054	1	05/03/16	05/03/16	KWG1603424	
Ethylbenzene	1.1		0.50	0.10	0.050	1	05/03/16	05/03/16	KWG1603424	
m,p-Xylenes	2.9		0.50	0.20	0.11	1	05/03/16	05/03/16	KWG1603424	
o-Xylene	2.1		0.50	0.20	0.074	1	05/03/16	05/03/16	KWG1603424	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,2-Dichloroethane-d4	97	81-118	05/03/16	Acceptable
Dibromofluoromethane	90	80-119	05/03/16	Acceptable
Toluene-d8	103	89-112	05/03/16	Acceptable
4-Bromofluorobenzene	95	85-114	05/03/16	Acceptable

**NAVFAC PACIFIC
VALIDATED LEVEL D**

MAY 23 2016

Initials: *CR*

Comments:

LDC #: 36302A1

VALIDATION COMPLETENESS WORKSHEET

SDG #: K1604068

Level IV

Laboratory: ALS Environmental

Date: 05/20/16

Page: 1 of 2

Reviewer: TM2nd Reviewer: OR**METHOD:** GC/MS Volatiles (EPA SW 846 Method 8260B)

(BTEX)

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	≤ 15 ICV ≤ 20
IV.	Continuing calibration / ending	A	≤ 20 / ≤ 50
V.	Laboratory Blanks	A	
VI.	Field blanks	SW	ER = 2FB 7, SB = 8
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	ND	D = 2+3
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
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	ERH029	K1604068-001	Water	04/19/16
2	ERH030	K1604068-002	Water	04/19/16
3	ERH031	K1604068-003	Water	04/19/16
4	ERH032	K1604068-004	Water	04/19/16
5	ERH033	K1604068-005	Water	04/19/16
6	ERH034	K1604068-006	Water	04/19/16
7	ERH035	K1604068-007	Water	04/19/16
8	ERH036	K1604068-008	Water	04/19/16
9	ERH030MS	K1604068-002MS	Water	04/19/16
10	ERH030MSD	K1604068-002MSD	Water	04/19/16
11				
13	KWG1603424-4			

Notes:

LDC #: 36302A1

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: gm
2nd Reviewer: an

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) $\leq 20\%$ 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?	(S)	/		
Were target compounds detected in the field blanks?	(S)		X	
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 #: 36302A1

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	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
Field Blankscode: F

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

☒ N N/A Were field blanks identified in this SDG?☒ N N/A Were target compounds detected in the field blanks?Blank units: µg/L Associated sample units: µg/LField blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: ERAssociated Samples: 1-6 (ND)

Compound	Blank ID <u>7</u>	Blank ID	Sample Identification							
Sampling Date	<u>04/19/16</u>									
CC	<u>0.060</u>									
EE	<u>0.85</u>									
RRR	<u>2.3</u>									
SSS	<u>1.6</u>									

Blank units: µg/L Associated sample units: µg/LField blank type: (circle one) Field Blank / Rinsate / Trip Blank / Other: SBAssociated Samples: 7Qual U

Compound	Blank ID <u>8</u>	Blank ID	Sample Identification							
Sampling Date	<u>04/19/16</u>		<u>7</u>							
CC	<u>0.060</u>		<u>0.060</u>							
EE	<u>1.1</u>		<u>0.85</u>							
RRR	<u>2.9</u>		<u>2.3</u>							
SSS	<u>2.1</u>		<u>1.6</u>							

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 #: 36302A1

VALIDATION FINDINGS WORKSHEET **Initial Calibration Calculation Verification**

Page: 1 of 1
 Reviewer: am
 2nd Reviewer: cz

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

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

$$RRF = (A_x)(C_{is}) / (A_{is})(C_x)$$

average RRF = sum of the RRFs/number of standards

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

A_x = Area of compound,

C_x = Concentration of compound,

S = Standard deviation of the RRFs

X = Mean of the RRFs

A_{is} = Area of associated internal standard

C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
				RRF (10 std)	RRF (10 std)	Average RRF (initial)	Average RRF (initial)	%RSD	%RSD
1	CAL14682 (GC-MS18)	04/13/16	Toluene (1st internal standard)	0.679	0.679	0.700	0.700	4.1	4.1
			Ethylbenzene (2nd internal standard)	1.00	1.00	0.998	0.997	6.7	6.6
			(3rd internal standard)						
2			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						
3			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						
4			(1st internal standard)						
			(2nd internal standard)						
			(3rd internal standard)						

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

LDC #: 36302A1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Page: 1 of 1
Reviewer: Sm
2nd Reviewer: 92

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 = $100 * (\text{ave. RRF} - \text{RRF}) / \text{ave. RRF}$ 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 (Reference internal Standard)	Average RRF (initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	0502F008	05/02/16	Toluene (1st internal standard)	0.700	0.635	0.635	9	9
			Ethylbenzene (2nd internal standard)	0.998	0.957	0.957	4	4
			(3rd internal standard)					
2			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
3			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
4			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					
5			(1st internal standard)					
			(2nd internal standard)					
			(3rd internal standard)					

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

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification**METHOD:** GC/MS VOA (EPA SW 846 Method 8260B)

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

% Recovery: $SF/SS \times 100$ Where: SF = Surrogate Found
SS = Surrogate Spiked**Sample ID:** 7

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane	10.000	9.08	91	91	0
1,2-Dichloroethane-d4		9.90	99	99	0
Toluene-d8		10.33	103	103	0
Bromofluorobenzene		9.53	95	95	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 #: 36302A

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

METHOD: GC/MS VOA (EPA SW 846 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: 9/10

Compound	Spike Added (<u>mg/L</u>)		Sample Concentration (<u>mg/L</u>)	Spiked Sample Concentration (<u>mg/L</u>)		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	100	ND	9.52	9.19	95	95	92	92	4	4
Toluene	↓	↓	ND	9.60	9.41	96	96	94	94	2	2
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 #: 36302A1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Page: 1 of 1
Reviewer: jm
2nd Reviewer: g

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: KWG1603424-3

Compound	Spike Added (mg/L)		Spiked Sample Concentration (mg/L)		LCS		LCSD		LCS/LCSD	
					Percent Recovery		Percent Recovery		RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene										
Trichloroethene										
Benzene	10.0	NA	8.42	NA	84	84				
Toluene	↓		8.55		86	85				
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 Fuel Storage Facility
LDC Report Date: May 21, 2016
Parameters: Polynuclear Aromatic Hydrocarbons
Validation Level: Level D
Laboratory: ALS Environmental
Sample Delivery Group (SDG): K1604068

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH029	K1604068-001	Water	04/19/16
ERH030	K1604068-002	Water	04/19/16
ERH031	K1604068-003	Water	04/19/16
ERH032	K1604068-004	Water	04/19/16
ERH033	K1604068-005	Water	04/19/16
ERH034	K1604068-006	Water	04/19/16
ERH035	K1604068-007	Water	04/19/16
ERH036	K1604068-008	Water	04/19/16
ERH030MS	K1604068-002MS	Water	04/19/16
ERH030MSD	K1604068-002MSD	Water	04/19/16

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 U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013) and the Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015). 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) by Environmental Protection Agency (EPA) SW 846 Method 8270C in Selected Ion Monitoring (SIM) mode

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. 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 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 ERH035 was identified as an equipment rinsate. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH035	04/19/16	Naphthalene 2-Methylnaphthalene 1-Methylnaphthalene	0.15 ug/L 0.016 ug/L 0.0085 ug/L	ERH029 ERH030 ERH031 ERH032 ERH033 ERH034

Sample ERH036 was identified as a source blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH036	04/19/16	Naphthalene 2-Methylnaphthalene 1-Methylnaphthalene	0.14 ug/L 0.015 ug/L 0.0085 ug/L	ERH035

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
ERH032	2-Methylnaphthalene	0.0036 ug/L	0.0036U ug/L
ERH035	Naphthalene 2-Methylnaphthalene 1-Methylnaphthalene	0.15 ug/L 0.016 ug/L 0.0085 ug/L	0.15U ug/L 0.016U ug/L 0.0085U ug/L

VII. Surrogates

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

VIII. Matrix Spike/Matrix Spike Duplicates

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

IX. Laboratory Control Samples

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

X. Field Duplicates

Samples ERH030 and ERH031 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 were within validation criteria.

XIII. Target Compound Identifications

All target compound identifications were within validation criteria.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment of Data

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

Due to equipment rinsate contamination, data were qualified as not detected in one sample.

Due to source 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 Fuel Storage Facility
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG
K1604068**

No Sample Data Qualified in this SDG

**Red Hill Bulk Fuel Storage Facility
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification
Summary - SDG K1604068**

No Sample Data Qualified in this SDG

**Red Hill Bulk Fuel Storage Facility
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary -
SDG K1604068**

Sample	Compound	Modified Final Concentration	A or P	Code
ERH032	2-Methylnaphthalene	0.0036U ug/L	A	F
ERH035	Naphthalene 2-Methylnaphthalene 1-Methylnaphthalene	0.15U ug/L 0.016U ug/L 0.0085U ug/L	A	F

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Polynuclear Aromatic Hydrocarbons

Sample Name: ERH029
Lab Code: K1604068-001
Extraction Method: EPA 3520C
Analysis Method: 8270D SIM

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	0.020	0.0050	0.0038	1	04/26/16	05/02/16	KWG1603185	
2-Methylnaphthalene	ND	U	0.020	0.0050	0.0023	1	04/26/16	05/02/16	KWG1603185	
1-Methylnaphthalene	ND	U	0.020	0.0050	0.0035	1	04/26/16	05/02/16	KWG1603185	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	104	46-114	05/02/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 23 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Polynuclear Aromatic Hydrocarbons

Sample Name: ERH030
Lab Code: K1604068-002
Extraction Method: EPA 3520C
Analysis Method: 8270D SIM

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	0.020	0.0050	0.0038	1	04/26/16	05/02/16	KWG1603185	
2-Methylnaphthalene	ND	U	0.020	0.0050	0.0023	1	04/26/16	05/02/16	KWG1603185	
1-Methylnaphthalene	ND	U	0.020	0.0050	0.0035	1	04/26/16	05/02/16	KWG1603185	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	98	46-114	05/02/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 23 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Polynuclear Aromatic Hydrocarbons

Sample Name: ERH031 **Units:** ug/L
Lab Code: K1604068-003 **Basis:** NA
Extraction Method: EPA 3520C **Level:** Low
Analysis Method: 8270D SIM

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	0.020	0.0050	0.0038	1	04/26/16	05/02/16	KWG1603185	
2-Methylnaphthalene	ND	U	0.020	0.0050	0.0023	1	04/26/16	05/02/16	KWG1603185	
1-Methylnaphthalene	ND	U	0.020	0.0050	0.0035	1	04/26/16	05/02/16	KWG1603185	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	103	46-114	05/02/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 23 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Polynuclear Aromatic Hydrocarbons

Sample Name: ERH032 **Units:** ug/L
Lab Code: K1604068-004 **Basis:** NA
Extraction Method: EPA 3520C **Level:** Low
Analysis Method: 8270D SIM

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	0.019	0.0050	0.0038	1	04/26/16	05/02/16	KWG1603185	
2-Methylnaphthalene	0.0036	J	0.019	0.0050	0.0023	1	04/26/16	05/02/16	KWG1603185	
1-Methylnaphthalene	ND	U	0.019	0.0050	0.0035	1	04/26/16	05/02/16	KWG1603185	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	99	46-114	05/02/16	Acceptable

NAVFAC PACIFIC
VALIDATED LEVEL D

MAY 25 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Polynuclear Aromatic Hydrocarbons

Sample Name: ERH033
Lab Code: K1604068-005
Extraction Method: EPA 3520C
Analysis Method: 8270D SIM

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	0.020	0.0050	0.0038	1	04/26/16	05/02/16	KWG1603185	
2-Methylnaphthalene	ND	U	0.020	0.0050	0.0023	1	04/26/16	05/02/16	KWG1603185	
1-Methylnaphthalene	ND	U	0.020	0.0050	0.0035	1	04/26/16	05/02/16	KWG1603185	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	100	46-114	05/02/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 23 2016

Initials: *CR*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Polynuclear Aromatic Hydrocarbons

Sample Name: ERH034
Lab Code: K1604068-006
Extraction Method: EPA 3520C
Analysis Method: 8270D SIM

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	ND	U	0.020	0.0050	0.0038	1	04/26/16	05/02/16	KWG1603185	
2-Methylnaphthalene	ND	U	0.020	0.0050	0.0023	1	04/26/16	05/02/16	KWG1603185	
1-Methylnaphthalene	ND	U	0.020	0.0050	0.0035	1	04/26/16	05/02/16	KWG1603185	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	94	46-114	05/02/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 23 2016

Initials: *CR*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Polynuclear Aromatic Hydrocarbons

Sample Name: ERH035
Lab Code: K1604068-007
Extraction Method: EPA 3520C
Analysis Method: 8270D SIM

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	0.15	UCP)	0.020	0.0050	0.0038	1	04/26/16	05/02/16	KWG1603185	
2-Methylnaphthalene	0.016	J	0.020	0.0050	0.0023	1	04/26/16	05/02/16	KWG1603185	
1-Methylnaphthalene	0.0085	J	0.020	0.0050	0.0035	1	04/26/16	05/02/16	KWG1603185	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	100	46-114	05/02/16	Acceptable

**NAVFAC PACIFIC
VALIDATED LEVEL D**

MAY 25 2016

Initials: *CR*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Polynuclear Aromatic Hydrocarbons

Sample Name: ERH036
Lab Code: K1604068-008
Extraction Method: EPA 3520C
Analysis Method: 8270D SIM

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Naphthalene	0.14		0.019	0.0050	0.0038	1	04/26/16	05/02/16	KWG1603185	
2-Methylnaphthalene	0.015	J	0.019	0.0050	0.0023	1	04/26/16	05/02/16	KWG1603185	
1-Methylnaphthalene	0.0085	J	0.019	0.0050	0.0035	1	04/26/16	05/02/16	KWG1603185	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Fluorene-d10	101	46-114	05/02/16	Acceptable

NAVFAC PACIFIC
VALIDATED LEVEL D

MAY 23 2016

Initials: *OR*

Comments:

LDC #: 36302A2b

VALIDATION COMPLETENESS WORKSHEET

SDG #: K1604068

Level IV

Laboratory: ALS Environmental

Date: 05/20/16

Page: 1 of 2

Reviewer: TM2nd Reviewer: AL**METHOD:** GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270C-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	≤ 15 ICV ≤ 20
IV.	Continuing calibration /ending	A	$\leq 20 / \leq 50$
V.	Laboratory Blanks	A	
VI.	Field blanks	N	ER = 7, SB = 8
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS/D
X.	Field duplicates	ND	D = 2 + 3
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	
XIII.	Target compound identification	A	
XIV.	System performance	A	
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	ERH029	K1604068-001	Water	04/19/16
2	ERH030	K1604068-002	Water	04/19/16
3	ERH031	K1604068-003	Water	04/19/16
4	ERH032	K1604068-004	Water	04/19/16
5	ERH033	K1604068-005	Water	04/19/16
6	ERH034	K1604068-006	Water	04/19/16
7	ERH035	K1604068-007	Water	04/19/16
8	ERH036	K1604068-008	Water	04/19/16
9	ERH030MS	K1604068-002MS	Water	04/19/16
10	ERH030MSD	K1604068-002MSD	Water	04/19/16
11				
12				
13				

LDC #: 36302A2b

VALIDATION COMPLETENESS WORKSHEET

SDG #: K1604068

Level IV

Laboratory: ALS Environmental

Date: 05/20/16

Page: 2 of 2

Reviewer: *SM*2nd Reviewer: *aw***METHOD:** GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270C-SIM)

	Client ID	Lab ID	Matrix	Date
14				
15				

Notes:

	KNG1603185-7					

LDC #: 36302A2b

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: gm
2nd Reviewer: gm

Method: Semivolatiles (EPA SW 846 Method 8270C-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 > 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) $\leq 20\%$ 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) $\leq 20\%$ 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 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?	/	X		
Were target compounds detected in the field blanks?	/		X	
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. 1,2-Diphenylhydrazine	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.	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV. Benzonaphthothiophene	VVVV.	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 #: 36302A**VALIDATION FINDINGS WORKSHEET**
Field BlanksPage: 1 of 1Reviewer: sm2nd Reviewer: ca**METHOD:** GC/MS BNA (EPA SW 846 Method 8270C)☒ **N** N/A Were field blanks identified in this SDG?☒ **N** N/A Were target compounds detected in the field blanks?**Blank units:** µg/L **Associated sample units:** µg/L**Sampling date:** 04/19/16**Field blank type:** (circle one) Field Blank / Rinsate / Other: ER Associated Samples: 1-6 Qual UCode: F

Compound	Blank ID	Sample Identification							
	<u>7</u>	<u>4</u>							
<u>S</u>	<u>0.15</u>								
<u>W</u>	<u>0.016</u>	<u>0.0036</u>							
<u>TTT</u>	<u>0.0085</u>								

Blank units: µg/L **Associated sample units:** µg/L**Sampling date:** 04/19/16**Field blank type:** (circle one) Field Blank / Rinsate / Other: SB Associated Samples: 7 Qual U

Compound	Blank ID	Sample Identification							
	<u>8</u>	<u>7</u>							
<u>S</u>	<u>0.14</u>	<u>0.15</u>							
<u>W</u>	<u>0.015</u>	<u>0.016</u>							
<u>TTT</u>	<u>0.0085</u>	<u>0.0085</u>							

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".

VALIDATION FINDINGS WORKSHEET **Initial Calibration Calculation Verification**

METHOD: GC/MS BNA (EPA SW 846 Method 8270C) – SIM

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

$$RRF = (A_x)(C_{is}) / (A_{is})(C_x)$$

average RRF = sum of the RRFs/number of standards

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

A_x = Area of compound,

C_x = Concentration of compound,

S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard

C_{is} = Concentration of internal standard

X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported	Recalculated	Reported	Recalculated	Reported	Recalculated
				RRF (100 std)	RRF (100 std)	Average RRF (initial)	Average RRF (initial)	%RSD	%RSD
1	CAL14530	01/11/16	(1st internal standard) Naphthalene (2nd internal standard) ^{IST}	1.06	1.06	1.01	1.01	7.3	7.2
	(MS14)								
2			(1st internal standard) Naphthalene (2nd internal standard) ^{IST}						
3			(1st internal standard) Naphthalene (2nd internal standard) ^{IST}						

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

LDC #: 36302A2b

VALIDATION FINDINGS WORKSHEET

Continuing Calibration Results Verification

Page: 1 of 1

Reviewer: 92

2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270C) - SIM

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

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

Where: ave. RRF = initial calibration average RRF

RRF = continuing calibration RRF

A_x = Area of compound,

C_x = Concentration of compound,

A_{is} = Area of associated internal standard

C_{IS} = Concentration of internal standard

[illegible]

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 #: 36302A2b

VALIDATION FINDINGS WORKSHEET **Surrogate Results Verification**

Page: 1 of 1Reviewer: gn2nd reviewer: ca**METHOD:** GC/MS Semivolatiles (EPA SW 846 Method 8270C) - Sim

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 Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5 <u>Fluorene-d10</u>	<u>400</u>	<u>414.80</u>	<u>104</u>	<u>104</u>	<u>0</u>
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					

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

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

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

$$\text{RPD} = | \text{MSC} - \text{MSD} | * 2 / (\text{MSC} + \text{MSDC})$$

MSC = Matrix spike concentration

MSDC = Matrix spike duplicate concentration

MS/MSD samples: 9/10

Compound	Spike Added (<u>ng/L</u>)		Sample Concentration (<u>ng/L</u>)	Spiked Sample Concentration (<u>ng/L</u>)		Matrix Spike		Matrix Spike Duplicate		MS/MSD	
						Percent Recovery		Percent Recovery		RPD	
	MS	MSD		MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Naphthalene	2.36	2.45	ND	1.88	2.01	80	80	82	82	7	7

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 #: 36302A2b

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

Page: 1 of 1
Reviewer: On
2nd Reviewer: ay

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270C) - SIM

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: KW 61603185-5/-6

Compound	Spike Added (<u>ng/L</u>)		Spike Concentration (<u>ng/L</u>)		LCS		LCSD		LCS/LCSD	
					Percent Recovery		Percent Recovery		RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Naphthalene	2.50	2.50	2.06	2.01	82	82	81	81	2	2

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

VALIDATION FINDINGS WORKSHEET

Sample Calculation Verification

METHOD: GC/MS SVOA (EPA SW 846 Method 8270C) — SIM

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_{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_1 = 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. 7, Naphthalene:

$$\text{Conc.} = \frac{(10392)(200.00)(5)(1)}{(66619)(1.01)(1020)(1)}$$

$$= 0.151418699 \approx 0.15 \text{ mg/L}$$

[illegible]

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Fuel Storage Facility

LDC Report Date: May 24, 2016

Parameters: Gasoline Range Organics

Validation Level: Level D

Laboratory: ALS Environmental

Sample Delivery Group (SDG): K1604068

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH029	K1604068-001	Water	04/19/16
ERH030	K1604068-002	Water	04/19/16
ERH031	K1604068-003	Water	04/19/16
ERH032	K1604068-004	Water	04/19/16
ERH033	K1604068-005	Water	04/19/16
ERH034	K1604068-006	Water	04/19/16
ERH035	K1604068-007	Water	04/19/16
ERH036	K1604068-008	Water	04/19/16
ERH030MS	K1604068-002MS	Water	04/19/16
ERH030MSD	K1604068-002MSD	Water	04/19/16

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 U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013) and the Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Gasoline Range Organics by Environmental Protection Agency (EPA) SW 846 Method 8015C

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 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 ERH035 was identified as an equipment rinsate. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH035	04/19/16	Gasoline range organics	13 ug/L	ERH029 ERH030 ERH031 ERH032 ERH033 ERH034

Sample ERH036 was identified as a source blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH036	04/19/16	Gasoline range organics	14 ug/L	ERH035

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
ERH029	Gasoline range organics	21 ug/L	21U ug/L
ERH030	Gasoline range organics	13 ug/L	13U ug/L
ERH031	Gasoline range organics	9.0 ug/L	9.0U ug/L
ERH035	Gasoline range organics	13 ug/L	13U 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

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

VIII. Laboratory Control Samples

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

IX. Field Duplicates

Samples ERH030 and ERH031 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	ERH030	ERH031	
Gasoline range organics	13	9.0	36

X. Compound Quantitation

All compound quantitations met validation criteria.

XI. Target Compound Identifications

All target compound identifications were within 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 equipment rinsate contamination, data were qualified as not detected in three samples.

Due to source 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. 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 Fuel Storage Facility
Gasoline Range Organics - Data Qualification Summary - SDG K1604068**

No Sample Data Qualified in this SDG

**Red Hill Bulk Fuel Storage Facility
Gasoline Range Organics - Laboratory Blank Data Qualification Summary - SDG
K1604068**

No Sample Data Qualified in this SDG

**Red Hill Bulk Fuel Storage Facility
Gasoline Range Organics - Field Blank Data Qualification Summary - SDG
K1604068**

Sample	Compound	Modified Final Concentration	A or P	Code
ERH029	Gasoline range organics	21U ug/L	A	F
ERH030	Gasoline range organics	13U ug/L	A	F
ERH031	Gasoline range organics	9.0U ug/L	A	F
ERH035	Gasoline range organics	13U ug/L	A	F

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Gasoline Range Organics

Sample Name: ERH029 **Units:** ug/L
Lab Code: K1604068-001 **Basis:** NA
Extraction Method: EPA 5030B **Level:** Low
Analysis Method: 8015C

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Gasoline Range Organics (GRO)	21	J UCF)	50	8.3	1	04/27/16	04/27/16	KWG1603412	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Difluorobenzene	101	80-107	04/27/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 25 2016

Initials: CR

Comments: _____

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Gasoline Range Organics

Sample Name: ERH030 **Units:** ug/L
Lab Code: K1604068-002 **Basis:** NA
Extraction Method: EPA 5030B **Level:** Low
Analysis Method: 8015C

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Gasoline Range Organics (GRO)	13	J	50	8.3	1	04/27/16	04/27/16	KWG1603412	UCP

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Difluorobenzene	103	80-107	04/27/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 25 2016

Initials: *ER*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Gasoline Range Organics

Sample Name: ERH031
Lab Code: K1604068-003
Extraction Method: EPA 5030B
Analysis Method: 8015C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Gasoline Range Organics (GRO)	9.0	J	50	8.3	1	04/27/16	04/27/16	KWG1603412	UCP)

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Difluorobenzene	103	80-107	04/27/16	Acceptable

**NAVFAC PACIFIC
VALIDATED LEVEL D**

MAY 25 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Gasoline Range Organics

Sample Name: ERH032
Lab Code: K1604068-004
Extraction Method: EPA 5030B
Analysis Method: 8015C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Gasoline Range Organics (GRO)	ND	U	50	8.3	1	04/27/16	04/27/16	KWG1603412	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Difluorobenzene	102	80-107	04/27/16	Acceptable

**NAVFAC PACIFIC
VALIDATED LEVEL D**

MAY 23 2016

Initials: *OR*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Gasoline Range Organics

Sample Name: ERH033
Lab Code: K1604068-005
Extraction Method: EPA 5030B
Analysis Method: 8015C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Gasoline Range Organics (GRO)	ND	U	50	8.3	1	04/27/16	04/27/16	KWG1603412	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Difluorobenzene	102	80-107	04/27/16	Acceptable

**NAVFAC PACIFIC
VALIDATED LEVEL D**

MAY 23 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Gasoline Range Organics

Sample Name: ERH034
Lab Code: K1604068-006
Extraction Method: EPA 5030B
Analysis Method: 8015C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Gasoline Range Organics (GRO)	ND	U	50	8.3	1	04/27/16	04/27/16	KWG1603412	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Difluorobenzene	101	80-107	04/27/16	Acceptable

**NAVFAC PACIFIC
VALIDATED LEVEL D**

MAY 23 2016

Initials: *ER*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Gasoline Range Organics

Sample Name: ERH035
Lab Code: K1604068-007
Extraction Method: EPA 5030B
Analysis Method: 8015C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Gasoline Range Organics (GRO)	13	J	UCF	50	8.3	1	04/27/16	04/27/16	KWG1603412

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Difluorobenzene	102	80-107	04/27/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 25 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Gasoline Range Organics

Sample Name: ERH036 **Units:** ug/L
Lab Code: K1604068-008 **Basis:** NA
Extraction Method: EPA 5030B **Level:** Low
Analysis Method: 8015C

Analyte Name	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Gasoline Range Organics (GRO)	14	J	50	8.3	1	04/27/16	04/27/16	KWG1603412	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
1,4-Difluorobenzene	101	80-107	04/27/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 23 2016

Initials: CR

Comments: _____

LDC #: 36302A7

VALIDATION COMPLETENESS WORKSHEET

SDG #: K1604068

Level IV

Laboratory: ALS Environmental

Date: 05/20/16

Page: 1 of 1

Reviewer: TH2nd Reviewer: AKMETHOD: ^{GRD}GC-TPH as Gasoline (EPA SW 846 Method 8015B) ^C

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	≤ 20 ICV ≤ 20
III.	Continuing calibration	A	≤ 20
IV.	Laboratory Blanks	A	
V.	Field blanks	5W	ER = 7, SB = 8
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS/D
IX.	Field duplicates	SW	D = 2 + 3
X.	Compound quantitation RL/LOQ/LODs	A	
XI.	Target compound identification	A	
XII.	System performance	A	
XIII.	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	ERH029	K1604068-001	Water	04/19/16
2	ERH030	K1604068-002	Water	04/19/16
3	ERH031	K1604068-003	Water	04/19/16
4	ERH032	K1604068-004	Water	04/19/16
5	ERH033	K1604068-005	Water	04/19/16
6	ERH034	K1604068-006	Water	04/19/16
7	ERH035	K1604068-007	Water	04/19/16
8	ERH036	K1604068-008	Water	04/19/16
9	ERH030MS	K1604068-002MS	Water	04/19/16
10	ERH030MSD	K1604068-002MSD	Water	04/19/16
11				
12				
13				

Notes:

KW61603412-5							

Method: X GC _____ HPLC _____

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	/			
Cooler temperature criteria was met.	/			
II. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Was a linear fit used for evaluation? If yes, were all percent relative standard deviations (%RSD) $\leq 20\%$?	/			
Was a curve fit used for evaluation? If Yes, what was the acceptance criteria used?		/		
Did the initial calibration meet the curve fit acceptance criteria?			/	
Were the RT windows properly established?	/			
IV. Initial calibration verification				
What type of initial calibration verification calculation was performed? <u>X</u> %D or %R	/			
Was an initial calibration verification standard analyzed after each ICAL for each instrument?	/			
Were all percent differences (%D) $\leq 20\%$ or percent recoveries 80-120%?	/			
V. Continuing calibration				
What type of continuing calibration calculation was performed? <u>X</u> %D or %R	/			
Was a continuing calibration analyzed daily?	/			
Were all percent differences (%D) $\leq 20\%$ or percent recoveries 80-120%?	/			
Were all the retention times within the acceptance windows?	/			
VI. Blanks				
Was a method blank associated with every sample in this SDG?	/			
Was a method blank analyzed for each matrix and concentration?	/			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		/		
VII. Surrogate spikes				
Were all surrogate %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?	/			

Validation Area	Yes	No	NA	Findings/Comments
IX. 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?	/			
X. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		/		
Were the performance evaluation (PE) samples within the acceptance limits?			/	
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	/			
XII. Compound quantitation/CRQLs				
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XIII. System performance				
System performance was found to be acceptable.	/			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			
XVI. Field duplicates				
Field duplicate pairs were identified in this SDG.	/			
Target compounds were detected in the field duplicates.	/			
XVII. Field blanks				
Field blanks were identified in this SDG.	(S)	x		
Target compounds were detected in the field blanks.	(S)		x	

LDC #: 30302A7VALIDATION FINDINGS WORKSHEET
Field BlanksPage: 1 of 1
Reviewer: [Signature]
2nd Reviewer: [Signature]METHOD: ☒ GC ☐ HPLC☒ N/A Were field blanks identified in this SDG?☒ N/A Were target compounds detected in the field blanks?Blank units: µg/L Associated sample units: µg/LSampling date: 04/19/16

Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank

Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: _____Associated Samples: 1-6Coda! F
Qual U

Compound	Blank ID	Sample Identification						
	<u>7</u>	<u>1</u>	<u>2</u>	<u>3</u>				
<u>GRO</u>	<u>13</u>	<u>21</u>	<u>13</u>	<u>9.0</u>				
CRQL								

Blank units: µg/L Associated sample units: µg/LSampling date: 04/19/16

Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank

Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: _____Associated Samples: 7Qual U

Compound	Blank ID	Sample Identification						
	<u>8</u>	<u>7</u>						
<u>GRO</u>	<u>14</u>	<u>13</u>						
CRQL								

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:

Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC #: 36302A7

VALIDATION FINDINGS WORKSHEET

Field DuplicatesPage: 1 of 1Reviewer: On2nd reviewer: orMETHOD: ☒ GC ☐ HPLC☒ N N/A

Were field duplicate pairs identified in this SDG?

☒ N N/A

Were target compounds detected in the field duplicate pairs?

Compound	Concentration (<u>µg/L</u>)		%RPD Limit (≤ <u> </u> %)	Qualification (Parent only)
	<u>2</u>	<u>3</u>		
<u>GRD</u>	<u>13</u>	<u>9.0</u>	<u>36</u>	

Compound	Concentration ()		%RPD Limit (≤ <u> </u> %)	Qualification (Parent only)

Compound	Concentration ()		%RPD Limit (≤ <u> </u> %)	Qualification (Parent only)

LDC #: 36302A7**VALIDATION FINDINGS WORKSHEET**
Initial Calibration Calculation VerificationPage: 1 of 1Reviewer: an2nd Reviewer: QMETHOD: GC X HPLC _____

The calibration factors (CF) and relative standard deviation (%RSD) were recalculated 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	Recalculated	Reported	Recalculated	Reported	Recalculated
				CF (500 std)	CF (500 std)	CF (initial)	CF (initial)	%RSD	%RSD
1	CAL4201 (GC39)	08/06/15	ERO	1.09e5	1.09e5	113000	113000	4.5	4.5
2									
3									
4									

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

LDC #: 36302A7

VALIDATION FINDINGS WORKSHEET **Continuing Calibration Results Verification**

Page: 1 of 1Reviewer: SA2nd Reviewer: SAMETHOD: GC X 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 $\left(\frac{\text{CF}}{\text{ICAL}}\right) / \text{CCV}$ Conc.	Reported	Recalculated	Reported	Recalculated
					$\frac{\text{CF}}{\text{Conc.}} / \text{CCV}$	$\frac{\text{CF}}{\text{Conc.}} / \text{CCV}$	%D	%D
1	0426F029	04/26/16	GRO	113000	112000	111845	1	1
2	0426F050	04/27/16	GRO	113000	111000	110946	2	2
3								
4								

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

LDC #: 36302A7**VALIDATION FINDINGS WORKSHEET**
Surrogate Results VerificationPage: 1 of 1Reviewer: [Signature]2nd reviewer: [Signature]METHOD: X 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	
F			101.161	101	102	0.3

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 #: 36302A7

VALIDATION FINDINGS WORKSHEET **Matrix Spike/Matrix Spike Duplicates Results Verification**

Page: 1 of 1Reviewer: QA2nd Reviewer: QAMETHOD: X 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: 9/10

Compound	Spike Added (<u>µg/L</u>)		Sample Conc. (<u>µg/L</u>)	Spike Sample Concentration (<u>µg/L</u>)		Matrix spike		Matrix Spike Duplicate		MS/MSD	
						Percent Recovery		Percent Recovery		RPD	
	MS	MSD		---	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported
Gasoline (8015)	500	500	13	453	414	88	88	80	80	9	9
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)											
Aroclor 1260 (8082)											

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 #: 36302A7

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1Laboratory Control Sample/Laboratory Control Sample Duplicates Results VerificationReviewer: OK2nd Reviewer: OKMETHOD: X 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

SA = Spike added

LCS = Laboratory Control Sample

LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: KWG1603412-3/-4

Compound	Spike Added (<u>mg/L</u>)		Spike Sample Concentration (<u>mg/L</u>)		LCS		LCSD		LCS/LCSD	
					Percent Recovery		Percent Recovery		RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)	500	500	471	492	94	94	98	98	4	4
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)										
Aroclor 1260 (8082)										

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 #: 36302A7**VALIDATION FINDINGS WORKSHEET**
Sample Calculation VerificationPage: 1 of 1
Reviewer: an
2nd Reviewer: gMETHOD: ☒ GC ☐ HPLC

☒ N N/A Were all reported results recalculated and verified for all level IV samples?
☒ 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. 1 Compound Name GRO

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 = $\frac{(2352972)(10)(1)}{(113000)(10)}$ =20.82276106 \approx 21 mg/L

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

Laboratory Data Consultants, Inc. Data Validation Report

Project/Site Name: Red Hill Bulk Fuel Storage Facility

LDC Report Date: May 24, 2016

Parameters: Diesel Range Organics & Residual Range Organics

Validation Level: Level D

Laboratory: ALS Environmental

Sample Delivery Group (SDG): K1604068

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
ERH029	K1604068-001	Water	04/19/16
ERH030	K1604068-002	Water	04/19/16
ERH031	K1604068-003	Water	04/19/16
ERH032	K1604068-004	Water	04/19/16
ERH033	K1604068-005	Water	04/19/16
ERH034	K1604068-006	Water	04/19/16
ERH035	K1604068-007	Water	04/19/16
ERH036	K1604068-008	Water	04/19/16
ERH030MS	K1604068-002MS	Water	04/19/16
ERH030MSD	K1604068-002MSD	Water	04/19/16

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 U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013) and the Project Procedures Manual, U.S. Naval Facilities Engineering Command (NAVFAC) Environmental Restoration (ER) Program, NAVFAC Pacific (DON 2015). 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:

Diesel Range Organics and Residual Range Organics by Environmental Protection Agency (EPA) SW 846 Method 8015C

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 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 with the following exceptions:

Blank ID	Extraction Date	Compound	Concentration	Associated Samples
KWG1603188-4	04/26/16	Diesel range organics Residual range organics	20 ug/L 75 ug/L	All samples in SDG K1604068

Sample concentrations were compared to concentrations detected in the laboratory blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
ERH029	Diesel range organics Residual range organics	25 ug/L 48 ug/L	25U ug/L 48U ug/L
ERH030	Diesel range organics Residual range organics	38 ug/L 56 ug/L	38U ug/L 56U ug/L

Sample	Compound	Reported Concentration	Modified Final Concentration
ERH031	Diesel range organics Residual range organics	36 ug/L 67 ug/L	36U ug/L 67U ug/L
ERH032	Diesel range organics Residual range organics	26 ug/L 52 ug/L	26U ug/L 52U ug/L
ERH033	Diesel range organics Residual range organics	28 ug/L 48 ug/L	28U ug/L 48U ug/L
ERH034	Diesel range organics Residual range organics	20 ug/L 33 ug/L	20U ug/L 33U ug/L
ERH035	Diesel range organics Residual range organics	27 ug/L 35 ug/L	27U ug/L 35U ug/L
ERH036	Diesel range organics Residual range organics	28 ug/L 26 ug/L	28U ug/L 26U ug/L

V. Field Blanks

Sample ERH035 was identified as an equipment rinsate. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH035	04/19/16	Diesel range organics Residual range organics	27 ug/L 35 ug/L	ERH029 ERH030 ERH031 ERH032 ERH033 ERH034

Sample ERH036 was identified as a source blank. No contaminants were found with the following exceptions:

Blank ID	Collection Date	Compound	Concentration	Associated Samples
ERH036	04/19/16	Diesel range organics Residual range organics	28 ug/L 26 ug/L	ERH035

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater than the concentrations found in the associated field blanks with the following exceptions:

Sample	Compound	Reported Concentration	Modified Final Concentration
ERH029	Diesel range organics Residual range organics	25 ug/L 48 ug/L	25U ug/L 48U ug/L
ERH030	Diesel range organics Residual range organics	38 ug/L 56 ug/L	38U ug/L 56U ug/L
ERH031	Diesel range organics Residual range organics	36 ug/L 67 ug/L	36U ug/L 67U ug/L
ERH032	Diesel range organics Residual range organics	26 ug/L 52 ug/L	26U ug/L 52U ug/L
ERH033	Diesel range organics Residual range organics	28 ug/L 48 ug/L	28U ug/L 48U ug/L
ERH034	Diesel range organics Residual range organics	20 ug/L 33 ug/L	20U ug/L 33U ug/L
ERH035	Diesel range organics Residual range organics	27 ug/L 35 ug/L	27U ug/L 35U 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

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 ERH030 and ERH031 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD
	ERH030	ERH031	
Diesel range organics	38	36	5

Compound	Concentration (ug/L)		RPD
	ERH030	ERH031	
Residual range organics	56	67	18

X. Compound Quantitation

All compound quantitations were within validation criteria.

XI. Target Compound Identifications

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 laboratory blank contamination, data were qualified as not detected in eight samples.

Due to equipment rinsate contamination, data were qualified as not detected in six samples.

Due to source 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 Fuel Storage Facility
Diesel Range Organics & Residual Range Organics - Data Qualification Summary
- SDG K1604068**

No Sample Data Qualified in this SDG

**Red Hill Bulk Fuel Storage Facility
Diesel Range Organics & Residual Range Organics - Laboratory Blank Data
Qualification Summary - SDG K1604068**

Sample	Compound	Modified Final Concentration	A or P	Code
ERH029	Diesel range organics Residual range organics	25U ug/L 48U ug/L	A	B
ERH030	Diesel range organics Residual range organics	38U ug/L 56U ug/L	A	B
ERH031	Diesel range organics Residual range organics	36U ug/L 67U ug/L	A	B
ERH032	Diesel range organics Residual range organics	26U ug/L 52U ug/L	A	B
ERH033	Diesel range organics Residual range organics	28U ug/L 48U ug/L	A	B
ERH034	Diesel range organics Residual range organics	20U ug/L 33U ug/L	A	B
ERH035	Diesel range organics Residual range organics	27U ug/L 35U ug/L	A	B
ERH036	Diesel range organics Residual range organics	28U ug/L 26U ug/L	A	B

**Red Hill Bulk Fuel Storage Facility
Diesel Range Organics & Residual Range Organics - Field Blank Data
Qualification Summary - SDG K1604068**

Sample	Compound	Modified Final Concentration	A or P	Code
ERH029	Diesel range organics Residual range organics	25U ug/L 48U ug/L	A	F
ERH030	Diesel range organics Residual range organics	38U ug/L 56U ug/L	A	F

Sample	Compound	Modified Final Concentration	A or P	Code
ERH031	Diesel range organics Residual range organics	36U ug/L 67U ug/L	A	F
ERH032	Diesel range organics Residual range organics	26U ug/L 52U ug/L	A	F
ERH033	Diesel range organics Residual range organics	28U ug/L 48U ug/L	A	F
ERH034	Diesel range organics Residual range organics	20U ug/L 33U ug/L	A	F
ERH035	Diesel range organics Residual range organics	27U ug/L 35U ug/L	A	F

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Diesel and Residual Range Organics

Sample Name: ERH029 **Units:** ug/L
Lab Code: K1604068-001 **Basis:** NA
Extraction Method: EPA 3510C **Level:** Low
Analysis Method: 8015C

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Diesel Range Organics (DRO)	25	J	55	22	12	1	04/26/16	04/29/16	KWG1603188	
Residual Range Organics (RRO)	48	J	110	55	21	1	04/26/16	04/29/16	KWG1603188	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
o-Terphenyl	74	56-125	04/29/16	Acceptable
n-Triacontane	76	54-136	04/29/16	Acceptable

NAVFAC PACIFIC
VALIDATED LEVEL D

MAY 25 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Diesel and Residual Range Organics

Sample Name: ERH030 **Units:** ug/L
Lab Code: K1604068-002 **Basis:** NA
Extraction Method: EPA 3510C **Level:** Low
Analysis Method: 8015C

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Diesel Range Organics (DRO)	38	J	U(8,F) 51	21	12	1	04/26/16	04/29/16	KWG1603188	
Residual Range Organics (RRO)	56	J	↓ 110	51	20	1	04/26/16	04/29/16	KWG1603188	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
o-Terphenyl	85	56-125	04/29/16	Acceptable
n-Triacontane	86	54-136	04/29/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 25 2016

Initials: *CR*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Diesel and Residual Range Organics

Sample Name: ERH031 **Units:** ug/L
Lab Code: K1604068-003 **Basis:** NA
Extraction Method: EPA 3510C **Level:** Low
Analysis Method: 8015C

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Diesel Range Organics (DRO)	36	J	52	21	12	1	04/26/16	04/29/16	KWG1603188	
Residual Range Organics (RRO)	67	J	110	52	20	1	04/26/16	04/29/16	KWG1603188	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
o-Terphenyl	84	56-125	04/29/16	Acceptable
n-Triacontane	88	54-136	04/29/16	Acceptable

NAVFAC PACIFIC
VALIDATED LEVEL D

MAY 25 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Diesel and Residual Range Organics

Sample Name: ERH032 **Units:** ug/L
Lab Code: K1604068-004 **Basis:** NA
Extraction Method: EPA 3510C **Level:** Low
Analysis Method: 8015C

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Diesel Range Organics (DRO)	26	J	U(B,P) 53	21	12	1	04/26/16	04/29/16	KWG1603188	
Residual Range Organics (RRO)	52	J	↓ 110	53	20	1	04/26/16	04/29/16	KWG1603188	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
o-Terphenyl	83	56-125	04/29/16	Acceptable
n-Triacontane	84	54-136	04/29/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 25 2016

Initials: *CR*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Diesel and Residual Range Organics

Sample Name: ERH033 **Units:** ug/L
Lab Code: K1604068-005 **Basis:** NA
Extraction Method: EPA 3510C **Level:** Low
Analysis Method: 8015C

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Diesel Range Organics (DRO)	28	J	UCB, F) 51	21	12	1	04/26/16	04/29/16	KWG1603188	
Residual Range Organics (RRO)	48	J	↓ 110	51	20	1	04/26/16	04/29/16	KWG1603188	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
o-Terphenyl	93	56-125	04/29/16	Acceptable
n-Triacontane	93	54-136	04/29/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL I

MAY 25 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Diesel and Residual Range Organics

Sample Name: ERH034 **Units:** ug/L
Lab Code: K1604068-006 **Basis:** NA
Extraction Method: EPA 3510C **Level:** Low
Analysis Method: 8015C

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Diesel Range Organics (DRO)	20	J	53	21	12	1	04/26/16	04/29/16	KWG1603188	
Residual Range Organics (RRO)	33	J	110	53	20	1	04/26/16	04/29/16	KWG1603188	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
o-Terphenyl	90	56-125	04/29/16	Acceptable
n-Triacontane	91	54-136	04/29/16	Acceptable

NAVFAC PACIFIC
VALIDATED LEVEL D

MAY 25 2016

Initials: CR

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Diesel and Residual Range Organics

Sample Name: ERH035
Lab Code: K1604068-007
Extraction Method: EPA 3510C
Analysis Method: 8015C

Units: ug/L
Basis: NA
Level: Low

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Diesel Range Organics (DRO)	27	J	UC(B,P) 54	22	12	1	04/26/16	04/29/16	KWG1603188	
Residual Range Organics (RRO)	35	J	↓ 110	54	21	1	04/26/16	04/29/16	KWG1603188	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
o-Terphenyl	87	56-125	04/29/16	Acceptable
n-Triacontane	89	54-136	04/29/16	Acceptable

NAVFAC PACIFIC
VALIDATED LEVEL D

MAY 25 2016

Initials: *CR*

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client: Element Environmental, LLC
Project: Red Hill Bulk Fuel Storage Facility/150027
Sample Matrix: Water

Service Request: K1604068
Date Collected: 04/19/2016
Date Received: 04/21/2016

Diesel and Residual Range Organics

Sample Name: ERH036 **Units:** ug/L
Lab Code: K1604068-008 **Basis:** NA
Extraction Method: EPA 3510C **Level:** Low
Analysis Method: 8015C

Analyte Name	Result	Q	LOQ	LOD	MDL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Diesel Range Organics (DRO)	28	J (3)	52	21	12	1	04/26/16	04/29/16	KWG1603188	
Residual Range Organics (RRO)	26	J (3)	110	52	20	1	04/26/16	04/29/16	KWG1603188	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
o-Terphenyl	89	56-125	04/29/16	Acceptable
n-Triacontane	92	54-136	04/29/16	Acceptable

NAVFAC PACIFIC
 VALIDATED LEVEL D

MAY 23 2016

Initials: CR

Comments:

LDC #: 36302A8

VALIDATION COMPLETENESS WORKSHEET

SDG #: K1604068

Level IV

Laboratory: ALS Environmental

Date: 05/20/16

Page: 1 of 1

Reviewer: gm2nd Reviewer: aw

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	SW 1CV SW
III.	Continuing calibration	A	SW
IV.	Laboratory Blanks	SW	
V.	Field blanks	SW	ER=7 SB=8
VI.	Surrogate spikes	A	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	D=2+3
X.	Compound quantitation RL/LOQ/LODs	A	
XI.	Target compound identification	A	
XII.	System performance	A	
XIII.	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	ERH029	K1604068-001	Water	04/19/16
2	ERH030	K1604068-002	Water	04/19/16
3	ERH031	K1604068-003	Water	04/19/16
4	ERH032	K1604068-004	Water	04/19/16
5	ERH033	K1604068-005	Water	04/19/16
6	ERH034	K1604068-006	Water	04/19/16
7	ERH035	K1604068-007	Water	04/19/16
8	ERH036	K1604068-008	Water	04/19/16
9	ERH030MS	K1604068-002MS	Water	04/19/16
10	ERH030MSD	K1604068-002MSD	Water	04/19/16
11				
12				

Notes:

KWG1603188-4				

LDC #: 36302A8

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: gmv
2nd Reviewer: gmvMethod: X GC _____ HPLC _____

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	/			
Cooler temperature criteria was met.	/			
II. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	/			
Was a linear fit used for evaluation? If yes, were all percent relative standard deviations (%RSD) \leq 20%?	/			
Was a curve fit used for evaluation? If Yes, what was the acceptance criteria used?		/		
Did the initial calibration meet the curve fit acceptance criteria?			/	
Were the RT windows properly established?	/			
IV. Initial calibration verification				
What type of initial calibration verification calculation was performed? <u>X</u> %D or %R				
Was an initial calibration verification standard analyzed after each ICAL for each instrument?	/			
Were all percent differences (%D) \leq 20%.0 or percent recoveries 80-120%?	/			
V. Continuing calibration				
What type of continuing calibration calculation was performed? <u>X</u> %D or %R				
Was a continuing calibration analyzed daily?	/			
Were all percent differences (%D) \leq 20%.0 or percent recoveries 80-120%?	/			
Were all the retention times within the acceptance windows?	/			
VI. Blanks				
Was a method blank associated with every sample in this SDG?	/			
Was a method blank analyzed for each matrix and concentration?	/			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	/			
VII. Surrogate spikes				
Were all surrogate %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?	/			

Validation Area	Yes	No	NA	Findings/Comments
IX. 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?	/			
X. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		/		
Were the performance evaluation (PE) samples within the acceptance limits?			/	
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	/			
XII. Compound quantitation/CRQLs				
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	/			
XIII. System performance				
System performance was found to be acceptable.	/			
XIV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	/			
XVI. Field duplicates				
Field duplicate pairs were identified in this SDG.	/			
Target compounds were detected in the field duplicates.	/			
XVII. Field blanks				
Field blanks were identified in this SDG.	0	X		
Target compounds were detected in the field blanks.	0		X	

LDC #: 36302A8

VALIDATION FINDINGS WORKSHEET

BlanksPage: 1 of 1Reviewer: an2nd Reviewer: clMETHOD: X GC HPLC

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

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

Level IV/D Only

☒ N N/A (Gasoline and aromatics only) Was a method blank analyzed with each 24 hour batch?☒ N N/A Was a method blank analyzed for each analytical / extraction batch of ≤ 20 samples?Blank extraction date: 04/26/16 Blank analysis date: 04/28/16Associated samples: all

Qual U (code: B)

Conc. units: ng/L

Compound	Blank ID	Sample Identification						
	KW61603188-4	1	2	3	4	5	6	7
DRO	20	25	38	36	26	28	20	27
P20	75	48	56	67	52	48	33	35

Blank extraction date: Blank analysis date: Associated samples: Conc. units:

Compound	Blank ID	Sample Identification						
	(continued)	8						
		28						
		26						

ALL CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:

All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC #: 36302A8VALIDATION FINDINGS WORKSHEET
Field BlanksPage: 1 of 1
Reviewer: gn
2nd Reviewer: anMETHOD: X GC HPLCX N N/A Were field blanks identified in this SDG?Y N N/A Were target compounds detected in the field blanks?Blank units: µg/L Associated sample units: µg/LSampling date: 04/19/16

Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank

Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: Associated Samples: 1-6 QualityCode: BF

Compound	Blank ID	Sample Identification							
	<u>7</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>		
<u>DRO</u>	<u>27</u>	<u>25</u>	<u>38</u>	<u>36</u>	<u>26</u>	<u>28</u>	<u>20</u>		
<u>PPO</u>	<u>35</u>	<u>48</u>	<u>56</u>	<u>67</u>	<u>52</u>	<u>48</u>	<u>33</u>		
CRQL									

Blank units: µg/L Associated sample units: µg/LSampling date: 04/19/16

Field blank type: (circle one) Field Blank / Trip Blank / Atmospheric Blank / Ambient Blank

Rinsate / Equipment Rinsate / Equipment Blank / Source Blank / Other: Associated Samples: 7 Quality

Compound	Blank ID	Sample Identification							
	<u>8</u>	<u>7</u>							
<u>DRO</u>	<u>28</u>	<u>27</u>							
<u>PPO</u>	<u>26</u>	<u>35</u>							
CRQL									

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:

Samples with compound concentrations within five times the associated field blank concentration are listed above, these sample results were qualified as not detected, "U".

LDC #: 36302A8VALIDATION FINDINGS WORKSHEET
Field DuplicatesPage: 1 of 1
Reviewer: Sm
2nd reviewer: clMETHOD: ☒ GC ☐ HPLC☒ N N/A Were field duplicate pairs identified in this SDG?☒ N N/A Were target compounds detected in the field duplicate pairs?

Compound	Concentration (<u>ng/L</u>)		%RPD Limit (≤ <u> </u> %)	Qualification (Parent only)
	<u>2</u>	<u>3</u>		
<u>DRO</u>	<u>38</u>	<u>36</u>	<u>5</u>	
<u>PPO</u>	<u>56</u>	<u>67</u>	<u>18</u>	

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

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

LDC #: 36302A8**VALIDATION FINDINGS WORKSHEET**
Initial Calibration Calculation VerificationPage: 1 of 1Reviewer: gn2nd Reviewer: gMETHOD: GC X HPLC _____

The calibration factors (CF) and relative standard deviation (%RSD) were recalculated 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	Recalculated	Reported	Recalculated	Reported	Recalculated
				CF (<u>500</u> std)	CF (<u>500</u> std)	CF (initial)	CF (initial)	%RSD	%RSD
1	CAL14518 GC21	01/20/16	DRO	1070	1073	1170	1170	6.9	6.9
2									
3									
4									

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

LDC #: 36302AR

VALIDATION FINDINGS WORKSHEET **Continuing Calibration Results Verification**

Page: 1 of 1Reviewer: Sm2nd Reviewer: OLMETHOD: GC X 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 $\frac{\text{CF} \cdot \text{ICAL}}{\text{Conc.}}$ / CCV	Reported	Recalculated	Reported	Recalculated
					$\frac{\text{CF}}{\text{Conc.}}$ / CCV	$\frac{\text{CF}}{\text{Conc.}}$ / CCV	%D	%D
1	0428F008/14	04/28/16	DPO	1170	1080	1081	8	8
2	0429F044/16	04/29/16	DPO	1170	1210	1210	3	3
3								
4								

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

LDC #: 36302A8

VALIDATION FINDINGS WORKSHEET **Surrogate Results Verification**

Page: 1 of 1Reviewer: SN2nd reviewer: QZMETHOD: X 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	
H	/	50.000	37.03	74	74	0
S		↓	37.79	76	75.5	0.7

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 #: 36302A8

VALIDATION FINDINGS WORKSHEET **Matrix Spike/Matrix Spike Duplicates Results Verification**

Page: 1 of 1Reviewer: Sm2nd Reviewer: clMETHOD: X 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: 9/10

Compound	Spike Added (<u>µg/L</u>)		Sample Conc. (<u>µg/L</u>)	Spike Sample Concentration (<u>µg/L</u>)		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)	3330	3230	38	2510	2460	74	74	75	75	2	2	
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)												
Aroclor 1260 (8082)												

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 #: 36302A8

VALIDATION FINDINGS WORKSHEET

Page: 1 of 1Laboratory Control Sample/Laboratory Control Sample Duplicates Results VerificationReviewer: Q2nd Reviewer: QMETHOD: X 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: KWG/603188-3

Compound	Spike Added (<u>µg/L</u>)		Spike Sample Concentration (<u>µg/L</u>)		LCS		LCSD		LCS/LCSD	
					Percent Recovery		Percent Recovery		RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)	<u>1600</u>	<u>NA</u>	<u>1190</u>	<u>NA</u>	<u>74</u>	<u>74</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)										
Aroclor 1260 (8082)										

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 #: 36302A8**VALIDATION FINDINGS WORKSHEET**
Sample Calculation VerificationPage: 1 of 1
Reviewer: gn
2nd Reviewer: alMETHOD: X GC HPLCX 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 DRO

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 = $\frac{(13274)(1)(1)}{(1170)(0.460)} = 24.66369379 \approx 25 \mu\text{g/L}$

#	Sample ID	Compound	Reported Concentrations ()	Recalculated Results Concentrations ()	Qualifications

Comments: _____

APPENDIX E

**EPA/DOH Letter, Enclosure A, Analytes and
Action Levels, February 4, 2016**

This Page Intentionally Left Blank.

ENCLOSURE A
ANALYTES AND ACTION LEVELS

TABLE 1
ANALYTES AND ACTION LEVELS FOR RED HILL MONITORING WELLS
RHMW01, RHMW02, AND RHMW03

ANALYTE	Environmental Action Level µg/L	SSRBL µg/L
TPH-g	100	NA
TPH-d	100	4500
TPH-o	100	NA
Benzene	5	750
Ethylbenzene	30	NA
Toluene	40	NA
Total Xylenes	20	NA
Naphthalene	17	NA
1-Methylnaphthalene	4.7	NA
2-Methylnaphthalene	10	NA

NA - Not Applicable

TABLE 2
ANALYTES AND ACTION LEVELS FOR RED HILL MONITORING WELLS
RHMW04, RHMW05, RHMW06, RHMW07, RHMW2254-01,
HDMW2253, AND OWDFMW01

ANALYTE	Environmental Action Level µg/L
TPH-g	100
TPH-d	100
TPH-o	100
Benzene	5.0
Ethylbenzene	30
Toulene	40
Total Xylenes	20
Naphthalene	17
1-Methylnaphthalene	4.7
2-Methylnaphthalene	10

ENCLOSURE A
ANALYTES AND ACTION LEVELS

TABLE 3
ANALYTES AND ACTION LEVELS FOR FUTURE RED HILL MONITORING
WELLS RHMW08, RHMW09, RHMW10, AND RHMW11

ANALYTE	Environmental Action Level µg/L
TPH-g	100.0
TPH-d	100.0
TPH-o	100.0
Benzene	5.0
Ethylbenzene	30.0
Toulene	40.0
Total Xylenes	20.0
Naphthalene	17.0
1-Methylnaphthalene	4.7
2-Methylnaphthalene	10.0
1,2 Dichloroethane*	5.0
1,2 Dibromoethane*	0.04

*Lead Scavengers can be discontinued after one year of sampling if all samples result in non-detection.

APPENDIX F

Fact Sheet, Quantitation & Detection

This Page Intentionally Left Blank.

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.

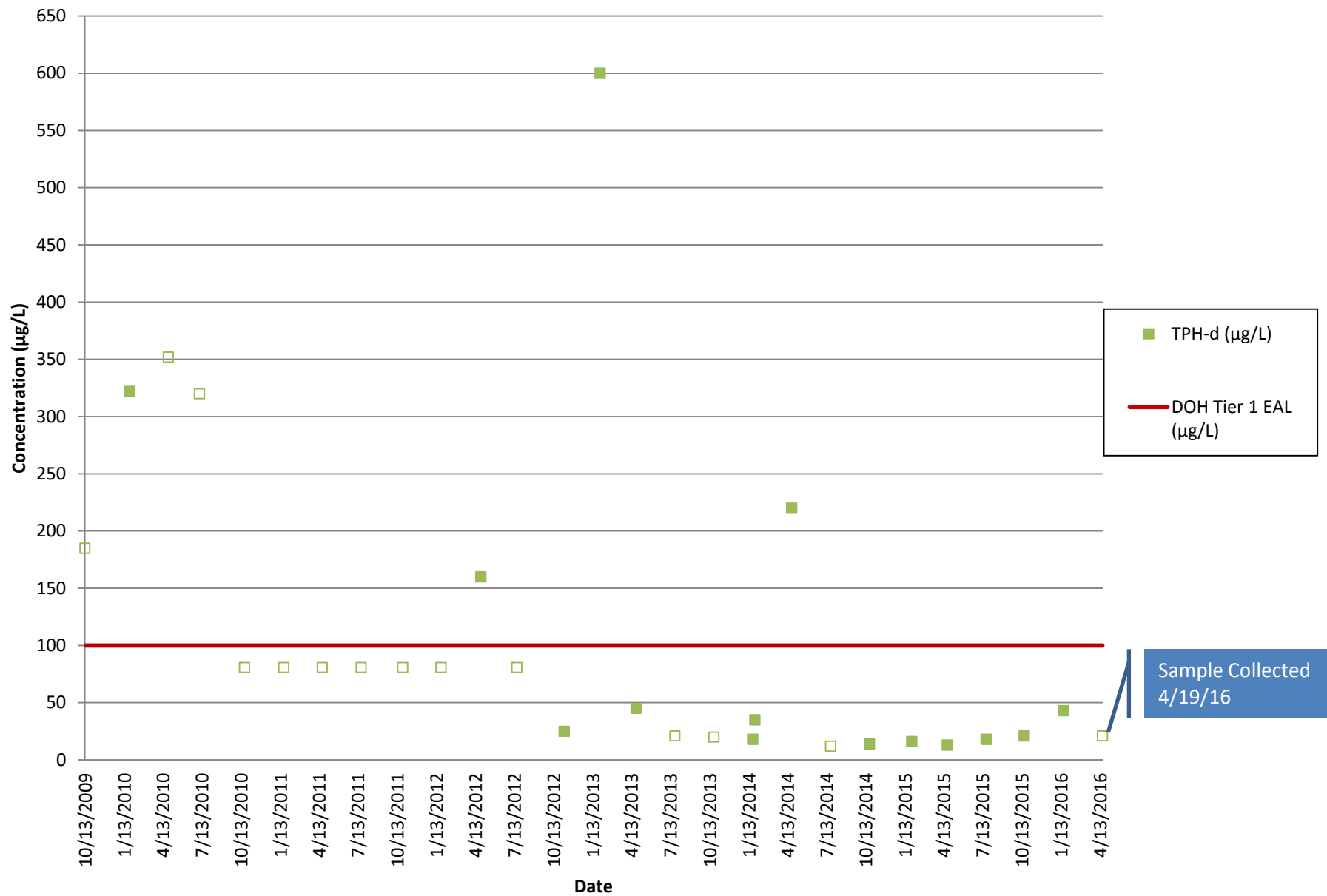
- As part of the laboratory selection process, provide the laboratory with project-specific RLs, including precision and bias, for each analyte and matrix. Ask the laboratory to provide its DL, LOD, and LOQ with associated precision and bias for each target analyte, in each matrix of concern (e.g., reagent 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.

APPENDIX G

Historical Groundwater Exceedance Trends

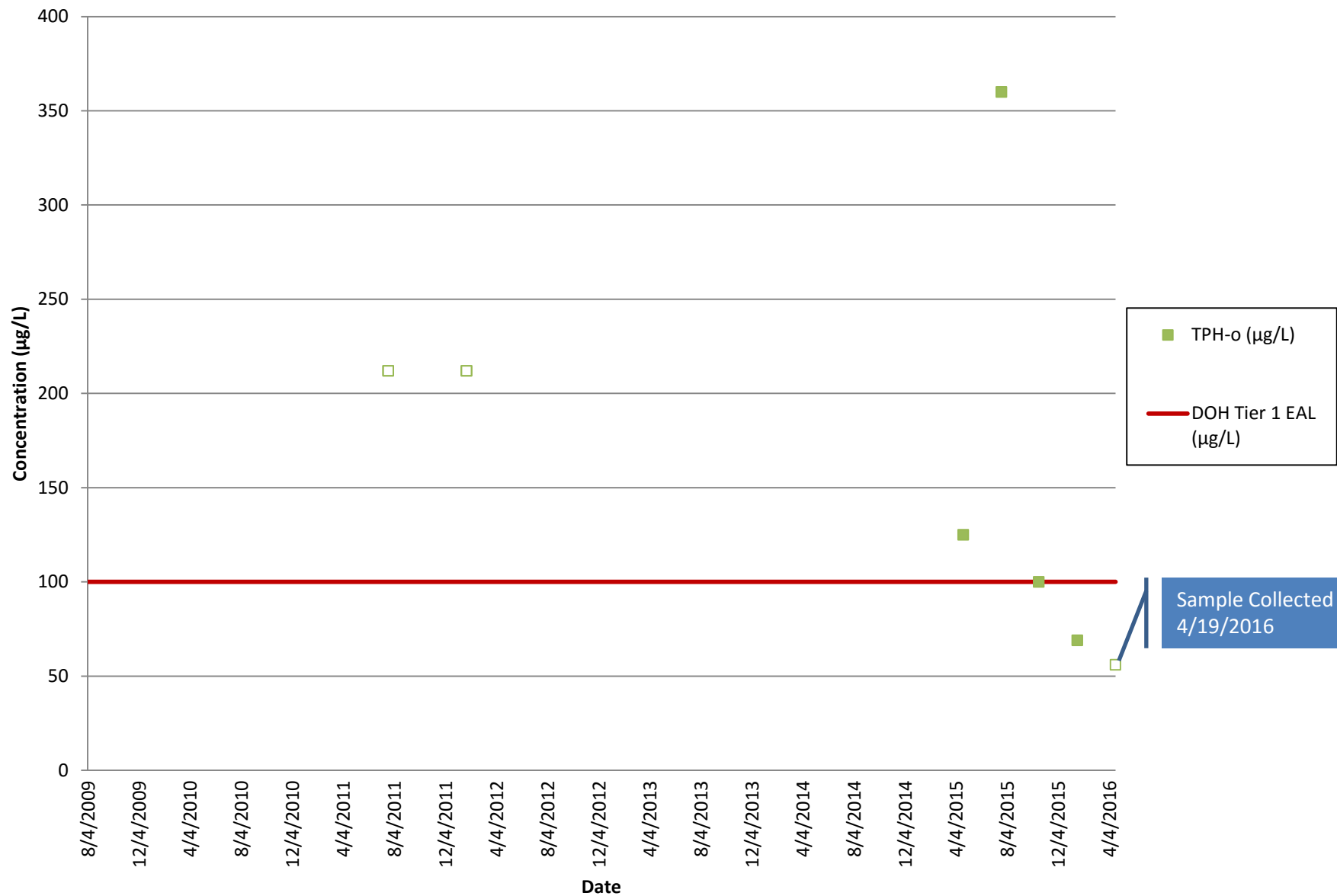
This page intentionally left blank.

TPH-d Concentrations for HDMW2253-03



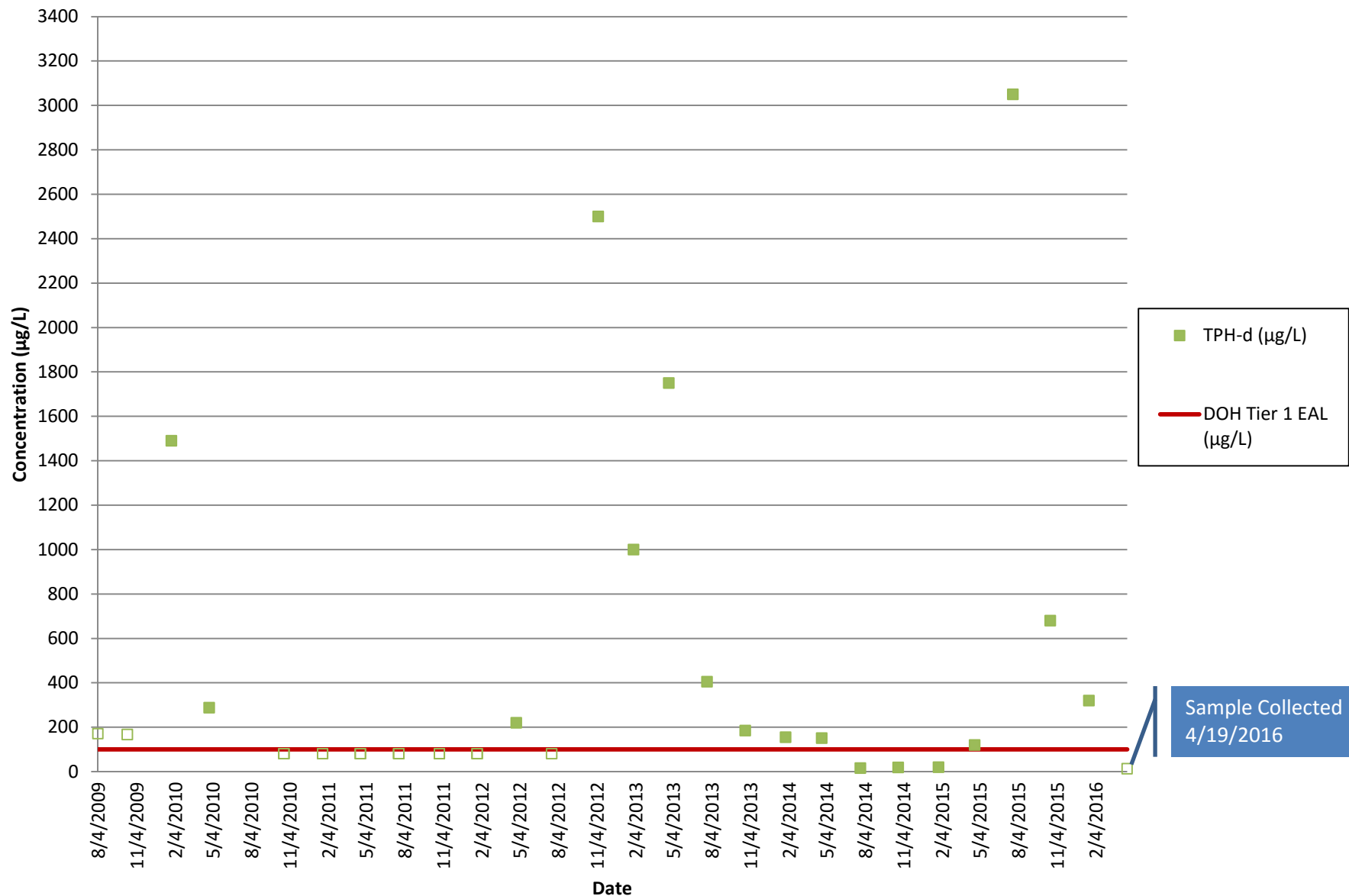
Unfilled boxes indicate non-detections. Numerous sample results had a chromatographic pattern that did not match the calibration standard.

TPH-o Concentrations for OWDFMW01



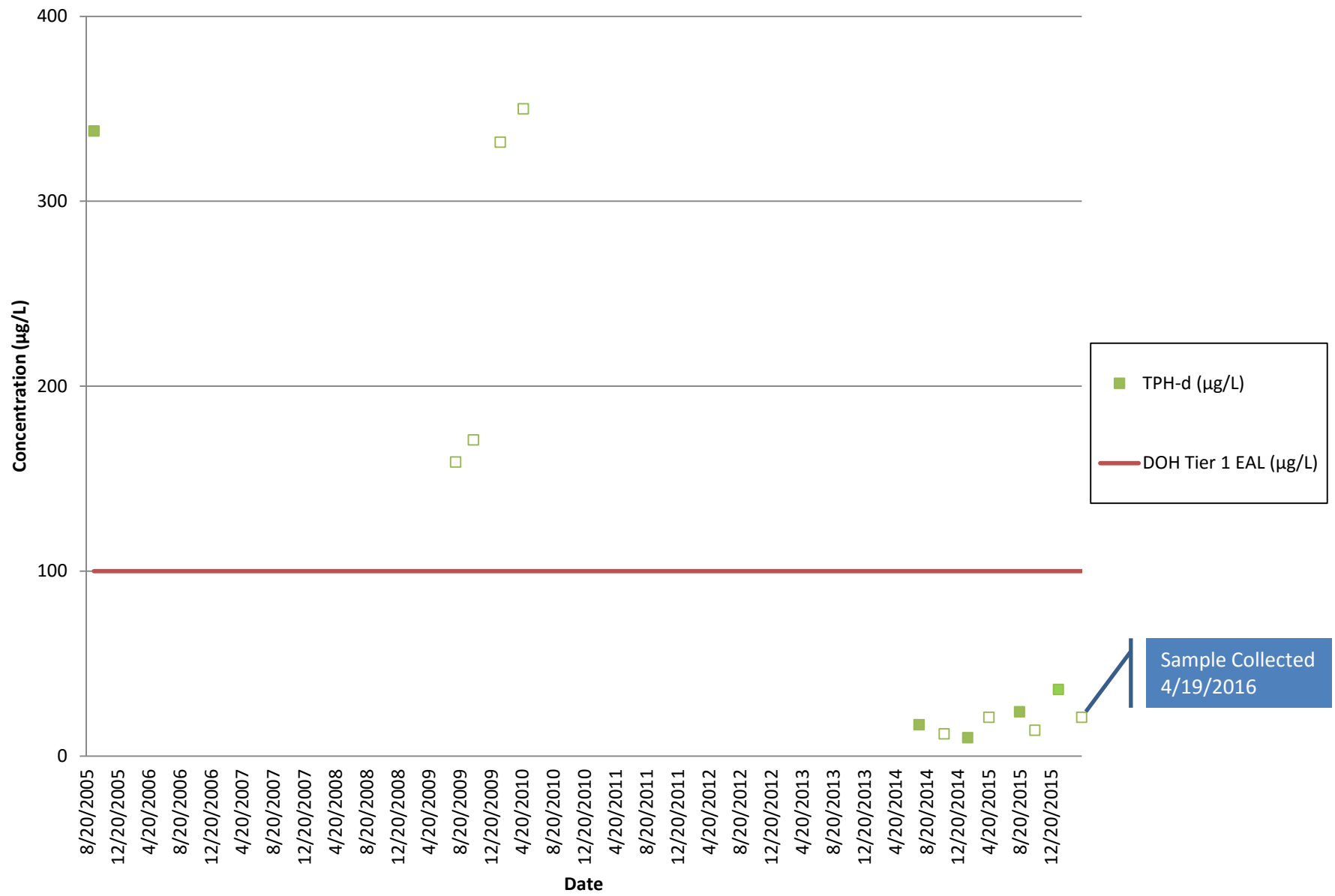
Unfilled boxes indicate non-detections. Several sample results had a chromatographic pattern that did not match the calibration standard.

TPH-d Concentrations for OWDFMW01



Unfilled boxes indicate non-detections. Numerous sample results had a chromatographic pattern that did not match the calibration standard.

TPH-d Concentrations for RHMW04



Unfilled boxes indicate non-detections. Several sample results had a chromatographic pattern that did not match the calibration standard.

APPENDIX H

IDW Disposal Manifest

This page intentionally left blank.

NON-HAZARDOUS WASTE MANIFEST		1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
NOT APPLICABLE		1	808-206-9989	000027497	
5. Generator's Name and Mailing Address COMNAVREG HAWAII, C/O NAVFAC HAWAII, CODE PRJ42 400 MARSHALL ROAD, ATTN: TROY KANESHIRO JBPHH, HI 96860-3139			Generator's Site Address (if different than mailing address) RED HILL BULK FUEL STORAGE FACILITY AIEA, HI 96701		
Generator's Phone: 808-471-1227			301344-01		
6. Transporter 1 Company Name PACIFIC COMMERCIAL SERVICES, LLC.			808-545-4599	U.S. EPA ID Number HID 982 040 578	
7. Transporter 2 Company Name UNITEK SOLVENT SERVICES, INC.-OAHU			808-682-8284	U.S. EPA ID Number HID 982 443 715	
8. Designated Facility Name and Site Address UNITEK SOLVENT SERVICES, INC. 91-125 KAOMI LOOP KAPOLEI, HI 96707			U.S. EPA ID Number HID 982 443 715		
Facility's Phone: 808-682-8284					
9. Waste Shipping Name and Description		10. Containers		11. Total Quantity	12. Unit Wt./Vol.
		No.	Type		
1. MATERIAL NOT REGULATED BY DOT (WELL MONITORING AND DECONTAMINATION WATER)		2	DM	00055	G
2.					
3.					
4.					
13. Special Handling Instructions and Additional Information Hydrochloric acid 100 ppm 2012 9b1pc provides kit TOTAL HALOGEN:					
GENERATOR'S CERTIFICATION: I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY PROPER SHIPPING NAME (WHERE APPLICABLE) AND ARE CLASSIFIED, PACKED, MARKED, AND LABELED AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT BY HIGHWAY ACCORDING TO APPLICABLE GOVERNMENT REGULATIONS. I FURTHER CERTIFY THAT IF THIS IS USED OIL IT IS SUBJECT TO REGULATION UNDER 40 CFR PART 279; THAT IT DOES NOT CONTAIN PCBs GREATER THAN OR EQUAL TO 2 PPM; AND THAT IT HAS NOT BEEN CONTAMINATED WITH CARBURATOR CLEANERS, BRAKE SPRAY, FREON, HALOGENATED SOLVENTS, OR OTHER HAZARDOUS MATERIALS AND/OR HAZARDOUS WASTES.					
14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.					
Generator's/Offor's Printed/Typed Name Matthew Neal		Signature Matthew Neal		Month 4	Day 19
15. International Shipment's <input type="checkbox"/> Import to U.S. <input type="checkbox"/> Export from U.S.		Port of entry/exit: Date leaving U.S.:		Year 16	
16. Transporter Acknowledgment of Receipt of Materials					
Transporter 1 Printed/Typed Name Kanye S. Sivas		Signature Kanye S. Sivas		Month 4	Day 19
Transporter 2 Printed/Typed Name Randy Solomon		Signature Randy Solomon		Year 16	
17. Discrepancy					
17a. Discrepancy Indication Space <input type="checkbox"/> Quantity <input type="checkbox"/> Type <input type="checkbox"/> Residue <input type="checkbox"/> Partial Rejection <input type="checkbox"/> Full Rejection					
Manifest Reference Number:					
17b. Alternate Facility (or Generator)			U.S. EPA ID Number		
Facility's Phone:					
17c. Signature of Alternate Facility (or Generator)			Month Day Year		
SEE CONSOLIDATED MANIFEST NW 16 43					
18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a					
Printed/Typed Name R. A. HARRIS		Signature R. A. HARRIS		Month 10	Day 25
				Year 2016	