Quarterly Groundwater Monitoring Report – Outside (Non-Tunnel) Wells

Red Hill Fuel Storage Facility

Pearl Harbor, Oahu, Hawaii
Latitude: 21°22'15" N
Longitude: 157°53'33" W

HDOH Facility ID No. 9-102271
HDOH Release ID No. 99051, 010011, 020028

December 2009

Prepared by:

TEC Inc.
1001 Bishop St. Suite 1400
American Savings Bank Tower
Honolulu, Hawaii 96813

Prepared for:

Commander
Navy Region Hawaii
Environmental Department, Code N45
850 Ticonderoga Street, Suite 110
Pearl Harbor, Hawaii 96860-5101

Table of Contents

List of Tables

List of Figures

List of Appendices

Executive Summary

This quarterly groundwater monitoring report presents the results of groundwater sampling conducted on October 13, 2009 at locations surrounding the United States (US) Navy Bulk Fuel Storage Facility at Red Hill, Oahu, Hawaii (the Facility). The sampling and reporting was conducted by TEC Inc. (TEC) for the Fleet and Industrial Supply Center (FISC) at Pearl Harbor, Hawaii. This report is part of a series of quarterly groundwater monitoring reports, supplemental to the groundwater reports for the groundwater monitoring wells within the Facility, provided by the US Navy to the State of Hawaii Department of Health (HDOH) in accordance with HDOH's release response requirements. Currently, there are 18 active and 2 inactive, 12.5 million gallon, field-constructed underground storage tanks (USTs) located at the Facility.

Background

In 2002, the US Navy installed a groundwater monitoring well (currently named RHMW01) into the basal aquifer, directly down-gradient from the Facility, within the lower access tunnel. Groundwater samples from this well indicated that petroleum from the Facility has migrated to the basal aquifer (AMEC, 2002). In 2005, the US Navy began quarterly monitoring of the aquifer to protect their down-gradient drinking water resource associated with the US Navy Well 2254-01. US Navy Well 2254-01 is located approximately 3,000 feet down-gradient from the Facility USTs and provides approximately 24% of the potable water to the Pearl Harbor Water System (PHWS).

By September 2005, the US Navy had installed two more groundwater monitoring wells (RHMW02 and RHMW03) within the Facility UST system and a groundwater monitoring well within the US Navy Well 2254-01 infiltration gallery (RHMW2254-01). Since 2005, these wells have been sampled quarterly for Total Petroleum Hydrocarbons (TPH) quantified as Diesel-Range Organics (DRO) and Gasoline Range Organics (GRO), Volatile Organic Compounds (VOCs), Polynuclear Aromatic Hydrocarbons (PAHs), and dissolved lead.

In response to increasing concentrations of contaminants of potential concern at the groundwater monitoring wells within the facility (specifically RHMW02) during 2008, plans were made to conduct quarterly sampling at the following monitoring well locations:

- RHMW04, up-gradient of the Facility;
- Oily Waste Disposal Facility monitoring well 01 (OWDFMW01), down-gradient of the Facility; and
- Halawa Deep Well 2253-03 (referred to as HDMW2253-03 in this report).

During the summer and fall of 2008, HDOH updated their Environmental Action Levels (EALs), which resulted in significant changes to the action levels associated with methylnaphthalenes. The HDOH Drinking Water toxicity EAL for these compounds was 240 μg/L. This concentration assumed that methylnaphthalenes were not human carcinogens. Once evidence emerged and was accepted by the US Environmental Protection Agency (USEPA) that methylnaphthalenes are carcinogenic to humans, HDOH adopted more rigorous EALs of 4.7 μg/L for 1-methylnaphthalene and 24 μg/L for 2-methylnaphthalene (HDOH, 2008).

The HDOH Drinking Water EAL for naphthalene was also updated during this process. Previously, HDOH based their naphthalene EAL on USEPA Region 9 Preliminary Remediation Goal (USEPA PRG) of 6.2 μg/L, which is associated with a non-cancer Hazard Index of 1. In deference to the California Department of Public Health's Drinking Water Notification Levels, (HDOH, 2008) HDOH updated their naphthalene drinking water EAL to 17 μg/L.

Finally, the HDOH Drinking Water EAL for TPH-DRO was increased from 100 μg/L to 210 μg/L, although the Groundwater Gross Contamination EAL for TPH-DRO remains 100 μg/L.

Current Results

On October 13, 2009, three groundwater samples (i.e., RHMW04, OWDFMW01, and HDMW2253-03), along with the required quality control samples (duplicate, matrix spike, and matrix spike duplicate) were collected for analysis. Samples were analyzed for TPH-DRO, TPH-GRO, VOCs, PAHs, and dissolved lead.

No HDOH Drinking Water EALs were exceeded and no contaminants of concern were detected above the laboratory method detection limit (MDL).

Conclusions and Recommendations

Based on the October 2009 sampling event, there is no indication of contaminant migration from the Facility. Quarterly groundwater sampling for TPH-DRO, TPH-GRO, VOCs, PAHs, and dissolved lead will continue at the Facility until such time that data indicates that a different monitoring plan is warranted.

1.0 Introduction

This report presents the results of the second groundwater sampling event, conducted in October 2009 at three groundwater monitoring wells (i.e., RHMW04, OWDFMW01, and HDMW2253-03), surrounding the Red Hill Fuel Storage Facility, Oahu, Hawaii (hereafter referred to as "the Facility"). The Facility consists of 18 active and 2 inactive USTs operated by FISC, Pearl Harbor. This groundwater sampling and analysis event is supplemental to the quarterly groundwater sampling and analysis at groundwater monitoring wells within the Facility (i.e., part of the groundwater monitoring program for the UST site in response to past UST releases, previous environmental investigations, and recommendations from the HDOH).

1.1 Project Objective

This groundwater sampling project was performed to evaluate the presence of chemicals of potential concern in groundwater surrounding the Facility. The project was conducted to ensure the Navy remains in compliance with HDOH UST release response requirements. The groundwater sampling program followed the procedures described in *Red Hill Bulk Fuel Storage Facility Groundwater Protection Plan* [TEC Inc. (TEC), 2008], also referred to as "the Plan".

This groundwater sampling event was conducted by TEC under US Navy Contract Number N47408-04-D-8514, Task Order No. 54, Amendment/Modification No. 01.

1.2 Previous Reports

This is a quarterly sampling event that is being conducted to supplement the quarterly groundwater sampling and analysis at groundwater monitoring wells within the Facility, which began in 2005. The following groundwater monitoring reports were previously submitted to the HDOH, for groundwater monitoring wells within the Facility:

1. Groundwater Sampling Report, First Quarter 2005 (submitted April 2005);
2. Groundwater Sampling Report, Second Quarter 2005 (submitted August 2005);
3. Groundwater Sampling Report, Third Quarter 2005 (submitted November 2005);
4. Groundwater Sampling Report, Fourth Quarter 2005 (submitted February 2006);
5. Groundwater Monitoring Results, July 2006 (submitted September 2006);
6. Groundwater Monitoring Results, December 2006 (submitted January 2007);
7. Groundwater Monitoring Results, March 2007 (submitted May 2007);
8. Groundwater Monitoring Results, June 2007 (submitted August 2007);
9. Groundwater Monitoring Results, September 2007 (submitted October 2007);
10. Groundwater Monitoring Results, January 2008 (submitted March 2008);
11. Groundwater Monitoring Results, April 2008 (submitted May 2008);
12. Groundwater Monitoring Results, July 2008 (submitted October 2008);

13. Groundwater Monitoring Results, October and December 2008 (submitted February 2009);
14. Groundwater Monitoring Results, February 2009 (submitted May 2009);
15. Groundwater Monitoring Results, May 2009 (submitted July 2009); and
16. Groundwater Monitoring Results, July 2009 (submitted September 2009).

1.3 Background

The following sections provide a description of the site and information on the Facility and USTs.

1.3.1 Site Description

The Facility is located in Halawa Heights on Oahu, Hawaii. Land adjacent to the north of the Facility is occupied by Halawa Correctional Facility and private businesses. Land to the south and west of the Facility includes the Coast Guard Reservation. Moanalua Valley is located east of the Facility (Dawson, 2006).

The Navy Public Works Department operates a potable water infiltration tunnel approximately 1,550 feet hydraulically down-gradient from the Facility (Dawson, 2006). The US Navy Well 2254-01 is located approximately 3,000 feet down-gradient (west) of the Facility and provides approximately 24% of the potable water to the Pearl Harbor Water System, which serves approximately 52,200 military consumers (TEC, 2008).

1.3.2 Facility Information

The Facility consists of 18 active and 2 inactive USTs operated by Navy FISC Pearl Harbor. Each UST has a capacity of 12.5 million gallons. The Facility is located approximately 100 feet above the basal aquifer (Dawson, 2006).

In 2002, the US Navy installed a groundwater monitoring well (currently named RHMW01) into the basal aquifer, directly down-gradient from the Facility, within the lower access tunnel. Groundwater samples from this well indicated that petroleum from the Facility has migrated to the basal aquifer (AMEC, 2002). In 2005, the US Navy began quarterly monitoring of the aquifer to protect their down-gradient drinking water resource associated with the US Navy Well 2254-01. US Navy Well 2254-01 is located approximately 3,000 feet down-gradient from the Facility USTs and provides approximately 24 % of the potable water to the PHWS.

By September 2005, the US Navy had installed two more groundwater monitoring wells (RHMW02 and RHMW03) within the Facility UST system, a background groundwater monitoring well (RHMW04) up-gradient from the Facility adjacent to the US Navy Firing Range, and a groundwater monitoring well within the US Navy Well 2254-01 infiltration gallery (RHMW2254-01). Since 2005, RHMW01, RHMW02, RHMW03, and RHMW2254-01 have been sampled quarterly for TPH-DRO, TPH-GRO, VOCs, PAHs, and dissolved lead.

Due to increasing concentrations of contaminants of potential concern at the groundwater monitoring wells within the Facility (specifically RHMW02) during 2008, response measures were warranted. In April 2009, another groundwater monitoring well (RHMW05) was installed

down-gradient from the USTs, within the lower access tunnel between RHMW01 and RHMW2254-01. It was installed to identify the extent of contaminant migration down-gradient before it reaches the infiltration gallery at RHMW2254-01.

Additionally, plans were made to sample three monitoring wells surrounding the Facility, RHMW04, OWDFMW01, and HDMW2253-03. RHMW04 is adjacent to the US Navy Firing Range, geographically up-gradient of the USTs. It was installed to provide geochemistry for water moving through the basal aquifer beneath the Facility. OWDFMW01 (originally known as MW08) was installed into the basal aquifer in 1998 for a Phase II Remedial Investigation/ Feasibility Study for the Red Hill Oily Waste Disposal Facility (Earth Tech Inc., 2000). It is located geographically down-gradient of the USTs and US Navy Well 2254-01. HDMW2253-03 is controlled by the State of Hawaii Commission on Water Resource Management. It is located cross-gradient of the Facility, between the Facility and the municipal drinking water supply well run by the City and County of Honolulu Board of Water Supply (Halawa Shaft pumping station 2354-01).

Table 1 summarizes basic groundwater monitoring well information, Figure 1 shows groundwater monitoring well locations, and Appendix B includes the well construction logs for RHMW04 and OWDFMW01.

Table 1. Monitoring Well Information

Groundwater Well	TOC Elevation (ft msl)	DTW (ft)	TD (ft)
RHMW04	313.03	293	320
OWDFMW01	138.94	120	142.8
HDMW2253-03	225	210	1,575

Notes:
DTW - Distance to water
TD - Total depth of well
TOC - Top of casing
ft – Feet
ft msl - Feet from mean sea level

1.3.3 UST Information

The USTs were constructed in the early 1940s. The tanks were constructed of steel and currently contain Jet Propulsion (JP)–5 fuel and F-76 (diesel marine fuel). Previously, several tanks stored Navy Special Fuel Oil, Navy Distillate, aviation gasoline, and motor gasoline. Each tank measures approximately 245 feet in height and 100 feet in diameter. The upper domes of the tanks lie at depths varying between approximately 100 feet and 200 feet below the existing ground surface (TEC, 2006).

1.4 Regulatory Updates

During the summer and fall of 2008, HDOH updated their EALs, which resulted in significant changes to the action levels associated with methylnaphthalenes. The drinking water toxicity EAL for these compounds was 240 μg/L. This concentration presumed that methylnaphthalenes were non-carcinogenic. Evidence that they are human carcinogens has now been accepted by the US Environmental Protection Agency (USEPA). As a result, HDOH adopted more rigorous

EALs of 4.7 μg/L for 1-methylnaphthalene and 24 μg/L for 2-methylnaphthalene, corresponding to a residential tap water scenario, and a 1 in a million cancer risk (HDOH, 2008).

The drinking water EAL for naphthalene has also been updated during this process. Previously, HDOH based their naphthalene EAL on USEPA Region 9 Preliminary Remediation Goal (USEPA PRG) of 6.2 μg/L, which is associated with a non-cancer Hazard Index of 1. HDOH has updated their naphthalene drinking water EAL to 17 μg/L, in deference to the California Department of Public Health's Drinking Water Notification Levels, a Hazard Index of 2.7 (HDOH, 2008).

Finally, the HDOH Drinking Water EAL for TPH-DRO was increased from 100 μg/L to 210 μg/L, although the HDOH Groundwater Gross Contamination EAL for TPH-DRO remains 100 μg/L.

2.0 Sample Collection and Analyses

Field activities relating to groundwater sample collection were conducted on October 13, 2009. Groundwater samples were collected from three monitoring wells, RHMW04, OWDFMW01, and HDMW2253-03. Sampling and analysis were conducted according to *Red Hill Bulk Fuel Storage Facility Groundwater Protection Plan* (TEC, 2008). A total of six samples were collected as follows:

- one environmental sample from RHMW04, OWDFMW01, and HDMW2253-03;
- one duplicate sample from RHMW04 (sampled as RHMWA01 and reported as RHMW04D); and
- one matrix spike and matrix spike duplicate from OWDFMW01.

2.1 Monitoring Well Purging

RHMW04 and OWDFMW01 were purged and sampled using a dedicated pump system. Well purging was considered complete when no less than three successive water quality parameter measurements had stabilized within approximately 10 percent. Field parameters were measured at regular intervals during well purging and included pH, temperature, specific conductivity, dissolved oxygen, and turbidity. Due to the well construction characteristics of HDMW2253-03, the well was not purged prior to sampling, but field parameters were recorded. Rather than purging, a grab sample was collected at a depth below the solid casing (which extends about 50 feet below the water table) and within the open-holed portion of the well.

2.2 Groundwater Sample Collection

Immediately following purging, RHMW04 and OWDFMW01 were sampled directly from their dedicated bladder pump system. HDMW2253-03 was sampled using a disposable bailer designed to collect samples at desired depths. Samples were placed into sampling containers with appropriate preservatives [i.e., hydrochloric acid (HCl) for volatile organic analysis, nitric acid (HNO_3) for dissolved lead]. Dissolved lead samples were filtered in the field and placed in preserved bottles. Sample containers were labeled with the date, sample identification number, type of analysis, and sampler's name. The containers were placed on ice in sample coolers and transported under chain-of-custody procedures to the certified laboratory for analysis.

2.3 Groundwater Sample Analyses

Groundwater samples were analyzed by SGS Environmental Service, Inc. in Anchorage, Alaska for TPH-DRO and TPH-GRO by EPA Method 8015B, VOCs by EPA Method 8260B, PAHs by EPA Method 8270C SIM, and dissolved lead by EPA Method 6020.

3.0 Groundwater Sample Analytical Results

This section provides a summary of analytical results for groundwater samples collected from three monitoring wells, RHMW04, OWDFMW01, and HDMW2253-03. Duplicate sample results from monitoring well RHMW04 are reported in this document as RHMW04D. A summary of groundwater analytical results for TPH-DRO and TPH-GRO, VOCs, PAHs, and dissolved lead is included in Table 2. Complete analytical laboratory reports are provided in Appendix A.

3.1 October 2009 Sample Analytical Results

All groundwater samples were analyzed for TPH-DRO, TPH-GRO, VOCs, PAHs, and dissolved lead. The results for each groundwater monitoring well are discussed below.

RHMW04
No potential chemical of concern was detected above the laboratory MDLs at RHMW04 (Table 2).

OWDFMW01
No potential chemical of concern was detected above the laboratory MDLs at OWDFMW01 (Table 2).

HDMW2253-03
No potential chemical of concern was detected above the laboratory MDLs at HDMW2253-03 (Table 2).

4.0 Summary and Conclusions

Summary
No potential chemicals of concern were detected above the laboratory MDLs, HDOH Drinking Water EALs, or Gross Contamination EALs at RHMW04, OWDFMW01, and HDMW2253-03.

Conclusions/Recommendations
Based on the October 2009 sampling event, there is no indication of contaminant migration from the Facility.

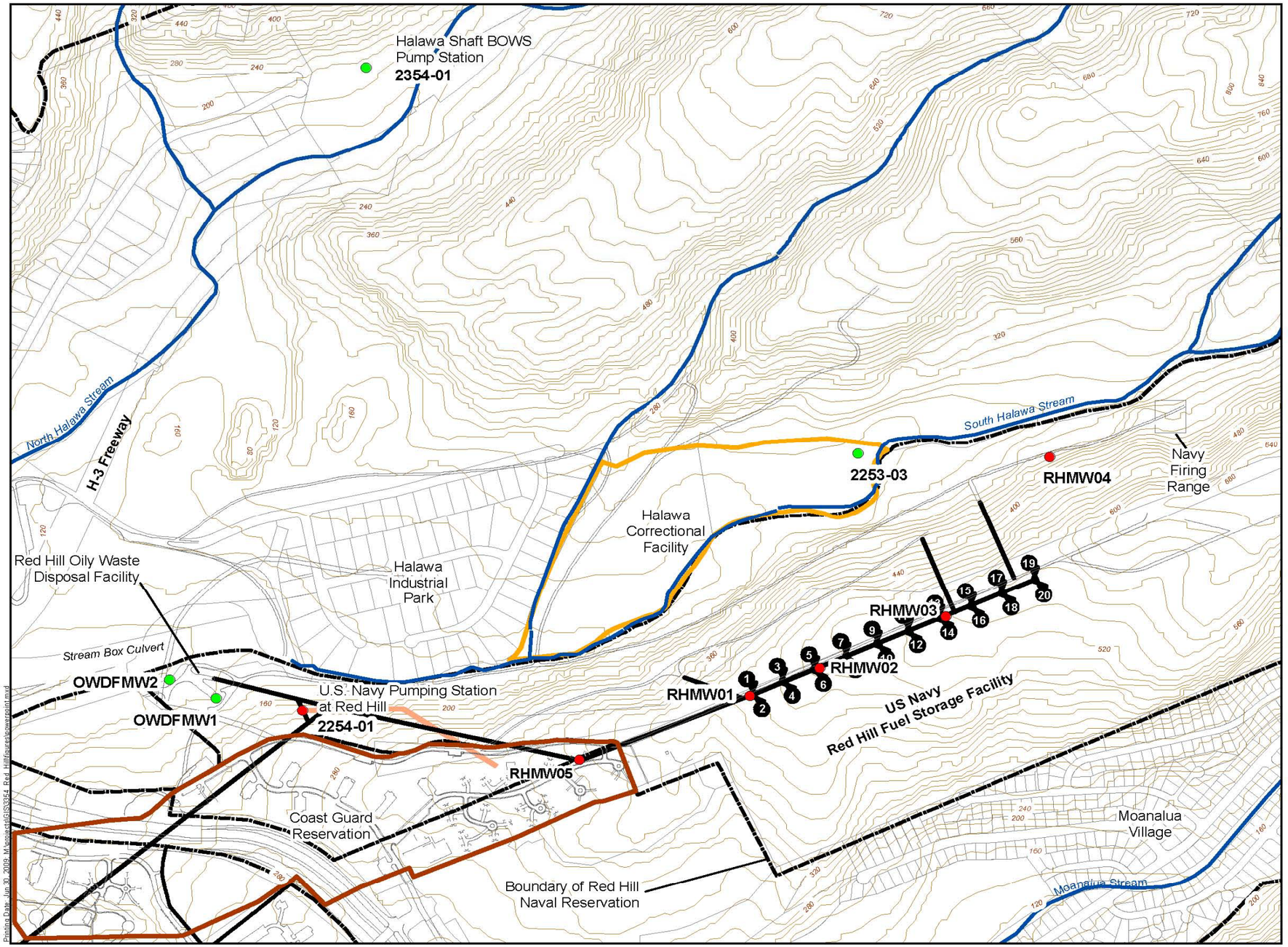
Table 2. Analytical Results for Quarterly Groundwater Monitoring Release Response Report (October 13, 2009)
Red Hill Fuel Storage Facility, Pearl Harbor, Hawaii

Method	Chemical	HDOH Drinking Water EALs[1] for Human Toxicity UG/L	HDOH Groundwater Gross Contamination EALs[2] UG/L	HDMW2253-03 UG/L October 13, 2009				OWDFMW01 UG/L October 13, 2009				RHMW04 UG/L October 13, 2009				RHMW04D UG/L October 13, 2009			
				Result	Q	MDL	RL	Result	Q	MDL	RL	Result	Q	MDL	RL	Result	Q	MDL	RL
8015B (Petroleum)	TPH as DIESEL RANGE ORGANICS	210	100	ND	U	185	494	ND	U	167	444	ND	U	169	452	ND	U	174	465
	TPH as GASOLINE RANGE ORGANICS	100	100	ND	U	30	100	ND	U	30	100	ND	U	30	100	ND	U	30	100
8270C SIM (PAHs)	1-METHYLNAPHTHALENE	4.7	10	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	2-METHYLNAPHTHALENE	24	10	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	ACENAPHTHENE	370	20	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	ACENAPHTHYLENE	240	2000	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	ANTHRACENE	1800	22	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	BENZO(a)ANTHRACENE	0.092	4.7	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	BENZO(a)PYRENE	0.2	0.81	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	BENZO(b)FLUORANTHENE	0.092	0.75	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	BENZO(g,h,i)PERYLENE	1500	0.13	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	BENZO(k)FLUORANTHENE	0.92	0.4	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	CHRYSENE	9.2	1	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	DIBENZ(a,h)ANTHRACENE	0.0092	0.52	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	FLUORANTHENE	1500	130	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	FLUORENE	240	950	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	INDENO(1,2,3-c,d)PYRENE	0.092	0.095	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	NAPHTHALENE	17	21	ND	U	0.035	0.113	ND	U	0.0346	0.112	ND	U	0.0356	0.115	ND	U	0.0348	0.112
	PHENANTHRENE	240	410	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
	PYRENE	180	68	ND	U	0.0169	0.0565	ND	U	0.0168	0.0559	ND	U	0.0172	0.0575	ND	U	0.0169	0.0562
8260B (VOCs)	1,1,1,2-TETRACHLOROETHANE	0.52	50000	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5
	1,1,1-TRICHLOROETHANE	200	970	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	1,1,2,2-TETRACHLOROETHANE	0.067	500	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5
	1,1,2-TRICHLOROETHANE	5	50000	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	1,1-DICHLOROETHANE	2.4	50000	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	1,2,3-TRICHLOROPROPANE (TCP)	0.6	50000	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	1,2,4-TRICHLOROBENZENE	70	3000	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	0.04	10	ND	U	0.62	2	ND	U	0.62	2	ND	U	0.62	2	ND	U	0.62	2
	1,2-DIBROMOETHANE (EDB)	0.0065	50000	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	1,2-DICHLOROBENZENE	600	10	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	1,2-DICHLOROETHANE	0.15	7000	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5
	1,2-DICHLOROPROPANE	5	10	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	1,3-DICHLOROBENZENE	180	50000	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	1,4-DICHLOROBENZENE	75	5	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5
	ACETONE	22000	20000	ND	U	3.1	10	ND	U	3.1	10	ND	U	3.1	10	ND	U	3.1	10
	BENZENE	5	170	ND	U	0.12	0.4	ND	U	0.12	0.4	ND	U	0.12	0.4	ND	U	0.12	0.4
	BROMODICHLOROMETHANE	0.22	50000	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5
	BROMOFORM	100	510	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	BROMOMETHANE	8.7	50000	ND	U	0.94	3	ND	U	0.94	3	ND	U	0.94	3	ND	U	0.94	3
	CARBON TETRACHLORIDE	5	520	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	CHLOROBENZENE	100	50	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5
	CHLOROETHANE	8600	16	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	CHLOROFORM	70	2400	ND	U	0.3	1	ND	U	0.3	1	ND	U	0.3	1	ND	U	0.3	1
	CHLOROMETHANE	1.8	50000	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	cis-1,2-DICHLOROETHYLENE	70	50000	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	cis-1,3-DICHLOROPROPENE	0.43	50000	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5
	DIBROMOCHLOROMETHANE	0.16	50000	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5	ND	U	0.15	0.5
	ETHYLBENZENE	700	30	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	HEXACHLOROBUTADIENE	0.86	6	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	M,P-XYLENE (SUM OF ISOMERS)	10000	20	ND	U	0.62	2	ND	U	0.62	2	ND	U	0.62	2	ND	U	0.62	2
	METHYL ETHYL KETONE (2-BUTANONE)	7100	8400	ND	U	3.1	10	ND	U	3.1	10	ND	U	3.1	10	ND	U	3.1	10
	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	2000	1300	ND	U	3.1	10	ND	U	3.1	10	ND	U	3.1	10	ND	U	3.1	10
	METHYLENE CHLORIDE	4.8	9100	ND	U	1	5	ND	U	1	5	ND	U	1	5	ND	U	1	5
	NAPHTHALENE	17	21	ND	U	0.62	2	ND	U	0.62	2	ND	U	0.62	2	ND	U	0.62	2
	STYRENE	100	10	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	TETRACHLOROETHYLENE(PCE)	5	170	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	TOLUENE	1000	40	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	trans-1,2-DICHLOROETHENE	100	260	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	TRICHLOROETHYLENE (TCE)	5	310	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
	VINYL CHLORIDE	2	3400	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1
6020	LEAD	15	50000	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1	ND	U	0.31	1

PAHs - Polynuclear aromatic hydrocarbons
VOCs - Volatile organic compounds
UG/L - Micrograms per Liter
Q - Data qualifier
200 - Result exceeds one or both HDOH EALs
MDL - Method detection limit
RL - Reporting limit
TPH - Total petroleum hydrocarbons
ND - Indicates that the compound was not detected above the stated method detection limit
U- Indicates that the compound was analyzed for, but not detected at or above the stated limit

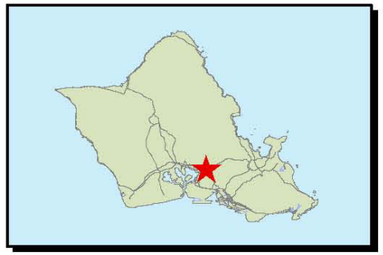
[1] Final Drinking Water Action Levels for Human Toxicity, Table D-3a, *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater* , HDOH, 2009

[2] Groundwater Gross Contamination Action Levels, Table G-1, *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater* , HDOH, 2009



Legend

- Red Hill UST ID Number
- Parcel
- 40-foot Interval Contour Line
- Road
- Stream
- Red Hill Navy Installation Boundary
- Red Hill Tunnels
- 2254-01 Infiltration Gallery
- Halawa Correctional Facility Boundary
- Coast Guard Reservation



N

Meters
0 185 370
0 340 680 1,360
Feet

Figure 1
Groundwater Monitoring Well Locations
Red Hill Fuel Storage Facility
Oahu, Hawaii

5.0 References

AMEC. *Red Hill Bulk Fuel Storage Facility Investigation Report*, Prepared for NAVFAC Pacific, August 2002.

Dawson Group, Inc. *Fourth Quarter 2005 Groundwater Sampling Report, Red Hill Fuel Storage Facility, Hawaii.* February 2006.

Earth Tech, Inc. *Remedial Investigation Phase II, Volume I, Technical Report, Red Hill Oily Waste Disposal Facility, Halawa, Oahu, Hawaii*. September 2000.

Hawaii Administrative Rules, Title 11, Chapter 281, Subchapter 7.

HDOH. *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Summary Lookup Tables.* March 2009.

HDOH. *Use of May 2005 Environmental Action Levels ("EALs") at Leaking Underground Storage Tank Sites*. Memo. July 2005.

HDOH. *Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater*. Summer 2008 (updated October 2008).

TEC, Inc. *Red Hill Bulk Fuel Storage Facility, Final – Addendum Planning Documents, Pearl Harbor, Hawaii.* May 2006.

TEC, Inc. *Red Hill Bulk Fuel Storage Facility, Final Groundwater Protection Plan, Pearl Harbor, Hawaii.* January 2008.

Appendix A
Laboratory Analytical Reports

Appendix B
Monitoring Well Construction Logs