Quarterly Groundwater Monitoring Report
Red Hill Fuel Storage Facility

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Introduction

There are 18 active and two inactive, 12.5 million gallon, field-constructed underground storage tanks (USTs) located at the Red Hill Fuel Storage Facility (the Facility). Previous environmental site investigations indicated a release has occurred and contaminated the groundwater underlying the Facility.

The United States (US) Navy implemented a groundwater monitoring program, which includes collecting groundwater samples quarterly from US Navy Well 2254-01 (RHMW2254-01) and four wells installed in the Facility lower access tunnel (RHMW01, RHMW02, RHMW03, and RHMW05). The US Navy Well 2254-01 is located approximately 3,000 feet downgradient from the Facility and provides approximately 24 percent of the potable water to the Pearl Harbor Water System (PHWS). The groundwater samples were analyzed for petroleum constituents and compared against State of Hawaii Department of Health (HDOH) Drinking Water Environmental Action Levels (EALs) (HDOH, 2008).

This groundwater monitoring report presents the analytical results and compares them to HDOH Drinking Water EALs for samples collected on July 13, 2010. Contaminant trends that have exceeded HDOH Drinking Water EALs are also provided in this report.

July 2010 Sampling Event Results

Laboratory analytical results from the July 2010 sampling event indicate Total Petroleum Hydrocarbons (TPH) as Diesel Range Organics (TPH-DRO), Polynuclear Aromatic Hydrocarbons (PAHs), and Volatile Organic Hydrocarbons (VOCs) are present in the groundwater beneath the Facility at concentrations that exceed HDOH Drinking Water EALs.

Specifically, TPH-DRO was detected in RHMW01 at 228F µg/L [F indicates that the compound was identified, with the concentration above the laboratory method detection limit (MDL), but below the reporting limit (RL), therefore it is considered an estimate]. At RHMW02, TPH-DRO was detected at 3,085 µg/L (i.e., the average of normal and duplicate samples). The HDOH Drinking Water EAL for TPH-DRO is 210 µg/L. Also during the July 2010 sampling event, 1-methylnaphthalene was detected at RHMW02 above the HDOH Drinking Water EAL at an average concentration of 7.24 µg/L (HDOH Drinking Water EAL is 4.7 µg/L). Naphthalene was also detected at RHMW02 above the HDOH Drinking Water EAL at an average concentration of 104.5 µg/L (HDOH Drinking Water EAL is 17 µg/L).

Conversely, during the July 2010 sampling event at RHMW2254-01 and RHMW03, no compounds were detected above the laboratory MDLs. In addition, at RHMW05, only a trace concentration of naphthalene was detected significantly below the respective HDOH Drinking Water EAL.

TPH-DRO Contaminant Trends

Regarding TPH-DRO contaminant trends, since January 2008 TPH-DRO at RHMW01 has fluctuated between the historical range established from September 2005 through September

2007. However, in July 2010 at RHMW01, TPH-DRO decreased to the lowest concentration observed to date (228 µg/L). At RHMW02, TPH-DRO concentrations were relatively stable prior to 2008, after which significant variations in the measured concentrations occurred. In July 2010 at RHMW02, TPH-DRO showed an increase in concentration; however the latest observed TPH-DRO concentration remains within the historical range for this well. Since February 2009, TPH-DRO at RHMW03 has not been detected above the MDL. At RHMW05, TPH-DRO had been increasing since it was first sampled in May 2009. However, in April 2010 and July 2010, TPH-DRO at RHMW05 was not detected above the laboratory MDL.

Other Contaminant Trends

Regarding other contaminant trends, the concentrations of three PAHs detected at RHMW02 are discussed. Since October 2008, the concentration of 2-methylnaphthalene has remained below the HDOH Drinking Water EAL. In addition, Naphthalene and 1-methylnaphthalene concentrations decreased to below the HDOH Drinking Water EALs in May 2009 and October 2009, respectively. However, the average concentrations for Naphthalene and 1-methylnaphthalene have since increased and in July 2010, remained greater than their respective HDOH Drinking Water EALs of 17 µg/L and 4.7 µg/L.

Summary

At RHMW01 and RHMW02, TPH-DRO concentrations have fluctuated, but remain lower than or within their historical ranges. At RHMW03 and RHMW2254-01 during July 2010, no compounds were detected above laboratory MDLs. At RHMW05 TPH-DRO was not detected above the laboratory MDL. Finally, no light-non aqueous phased liquid (LNAPL), otherwise known as “free product”, has been observed in any of the Facility groundwater monitoring wells since January 2008.

Based on the results of the July 2010 sampling event, continued quarterly groundwater monitoring is warranted so that overall groundwater quality trends may be observed and proactive action taken if the groundwater quality shows evidence of deterioration. In addition, monthly oil/water interface measurements and soil vapor monitoring should continue within the Facility. Although the US Navy Well 2254-01 is not imminently threatened at this time, monitoring should continue to assess contaminant migration from up-gradient locations.

1.0 Introduction

This report presents the results of the 20th groundwater sampling event, conducted in July 2010 at the Red Hill Fuel Storage Facility, Oahu, Hawaii (hereafter referred to as "the Facility"). The Facility consists of 18 active and two inactive underground storage tanks (USTs) operated by the Fleet and Industrial Supply Center (FISC), Pearl Harbor. The groundwater sampling and analysis event is part of a groundwater monitoring program for the UST site in response to past UST releases, previous environmental investigations, and recommendations from the State of Hawaii Department of Health (HDOH).

1.1 Project Objective

This groundwater sampling project was performed to evaluate the presence of chemicals of potential concern in groundwater underlying the Facility. The project was conducted to ensure the Navy remains in compliance with HDOH UST release response requirements as described in Hawaii Administrative Rules (HAR) 11-281 Subchapter 7, Release Response Action. The groundwater sampling program followed the procedures described in *Red Hill Bulk Fuel Storage Facility Groundwater Protection Plan* [TEC Inc. (TEC), 2008 updated in 2009], also referred to as "the Plan".

This groundwater sampling event was conducted by TEC under United States (US) Navy Contract Number N47408-04-D-8514, Task Order No. 54.

1.2 Previous Reports

The following groundwater monitoring reports were previously submitted to the HDOH:

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);
16. Groundwater Monitoring Results, July 2009 (submitted September 2009);
17. Groundwater Monitoring Results, October 2009 (submitted December 2009);
18. Groundwater Monitoring Results, January, February, and March 2010 (submitted April 2010); and
19. Groundwater Monitoring Results, April 2010 (submitted May 2010).

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 Red Hill, 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 downgradient 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 percent of the potable water to the Pearl Harbor Water System (PHWS), which serves approximately 52,200 military consumers (TEC, 2008).

1.3.2 Facility Information

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

1.3.3 UST Information

The USTs were constructed in the early 1940s. The tanks were fabricated from steel and currently contain Jet Propulsion (JP)–5 fuel, JP-8, 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 Previous Environmental Investigations

1998 to 2001: From 1998 to 2001, the Navy conducted an investigation at the Facility to assess potential releases from the fuel storage USTs and piping systems. In February 2001, the Navy installed a one-inch diameter RHMW01 (previously known as MW-V1D) to monitor for contamination of the basal aquifer underlying the Facility. The well was installed and completed at approximately 100 feet below grade within the lower access tunnel. At the time of well completion, depth to water in RHMW01 was measured at 86 feet below grade (Dawson, 2006).

In February 2001, groundwater samples collected from RHMW01 contained total petroleum hydrocarbons (TPH) concentrations ranging from 883 micrograms per liter (μg/L) to 1,050 μg/L and total lead ranging from 10.4 μg/L to 15 μg/L. The maximum total lead concentration in the samples was equal to the primary drinking water standard of 15 μg/L for lead and exceeded the HDOH Tier 1 groundwater action level of 5.6 μg/L (Dawson, 2006).

2005 – Groundwater Sampling: The Navy began quarterly groundwater sampling at existing monitoring wells in 2005. Dawson Group, Inc. collected groundwater samples from RHMW01 and the Red Hill Navy Pump Station (US Navy Well 2254-01) in February, June, September, and December 2005.

Samples collected in February and June 2005 were not filtered in the field prior to analysis for lead. Analytical results for samples collected from RHMW01 indicated concentrations of total lead were above the HDOH Tier 1 action level of 5.6 μg/L. The results were not considered appropriate for risk assessment since the sample had not been filtered. In addition, lead was not a component of fuels from the tanks near RHMW01, but was a component is fuels stored in other tanks during the history of the Facility. Lead may have been part of the Facility construction material (TEC, 2007). Previous sampling efforts showed elevated lead when analyzed as unfiltered samples. Subsequent efforts where the lead samples were filtered has resolved this issue.

Samples were filtered in September and December 2005, and dissolved lead concentrations were below the HDOH Tier 1 action level. Concentrations of all other contaminants of potential concern were below HDOH Tier 1 action levels.

2005 – Site Investigation: As part of a site investigation, TEC installed three groundwater monitoring wells at the Facility between June and September 2005. Well RHMW02 was installed in the lower access tunnel near Tanks 5 and 6. Well RHMW03 was installed in the lower access tunnel near Tanks 13 and 14. Well RHMW04 was installed north of UST tank 20 to provide contaminant chemistry data for water moving through the basal aquifer beneath the Facility. Wells RHMW02 and RHMW03 were completed to depths of approximately 125 feet below the tunnel floor, and well RHMW04 was completed to a depth of approximately 300 feet below ground surface outside the tunnel. Groundwater samples were collected from the three newly installed wells and two existing wells (RHMW01 and RHMW2254-01) in September 2005.

Naphthalene and trichloroethylene were detected in samples collected from RHMW02 at concentrations greater than the HDOH Tier 1 action levels. Lead was detected in the sample collected from RHMW01 at a concentration greater than the HDOH Tier 1 action level; however, the sample was not filtered in the field prior to analysis. Analytical results for filtered samples obtained by Dawson during the same period indicated concentrations of dissolved lead were below the HDOH Tier 1 action level.

2006 – Site Investigation: Dedicated sampling pumps were installed in five wells (RHMW01, RHMW02, RHMW03, RHMW04, and US Navy Well 2254-01). TEC collected groundwater samples from the wells in July 2006. The groundwater samples were analyzed for petroleum constituents. Naphthalene was detected in samples collected from RHMW02 at concentrations above the HDOH Tier 1 action level.

In September 2005, with concurrence from the HDOH, the Navy decided to use the newer HDOH Environmental Action Levels (EALs) for the Red Hill Site Investigation and Risk Assessment project. The EALs provide action levels for more chemicals, and are more useful for conducting screening risk assessments. Since the HDOH (HDOH May 2005) Policy Letter stated that the two sets of action levels should not be mixed, the Tier 1 screening levels presented in HAR Section 11-281-78 would no longer be used to evaluate environmental impact at the Facility.

An overall summary of Facility groundwater sampling data by year follows:

2006 – Groundwater Sampling: Groundwater samples were collected in December 2006. Analytical results indicated the following:

- No chemicals were detected in groundwater from US Navy Well 2254-01 or RHMW03;
- TPH as diesel range organics (TPH-DRO) was detected in groundwater above the HDOH Drinking Water EALs in RHMW01; and
- TPH as gasoline range organics (TPH-GRO), TPH-DRO, and naphthalene were detected in groundwater above the HDOH Drinking Water EALs in RHMW02.

2007 – Groundwater Sampling: Groundwater samples were collected in March, June, and September 2007. Analytical results indicated the following:

- No chemicals were detected above HDOH Drinking Water EALs at US Navy Well 2254-01;
- TPH-DRO exceeded HDOH Drinking Water EALs at RHMW01 during all three sampling events;
- TPH-GRO exceeded HDOH Drinking Water EALs at RHMW02 in March;
- TPH-DRO and naphthalene exceeded HDOH Drinking Water EALs at RHMW02 during all three sampling events;
- 1-methylnaphthalene and 2-methylnaphthalene exceeded the HDOH Groundwater Gross Contamination EAL at RHMW02 during all three sampling events; and
- TPH-DRO exceeded HDOH Drinking Water EALs at RHMW03 in June.

2008 – Groundwater Sampling: Groundwater samples were collected in January, April, July, and October 2008. Analytical results indicated the following:

- No chemicals were detected above HDOH Drinking Water EALs at US Navy Well 2254-01;
- Trace detections of 1-methylnaphthalene and naphthalene prompted a resample event in December at US Navy Well 2254-01, no chemicals were detected above the laboratory method detection limit (MDL);

- TPH-DRO exceeded HDOH Drinking Water EALs at RHMW01 during all four sampling events;
- TPH-GRO did not exceed HDOH Drinking Water EALs at RHMW02;
- TPH-DRO, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene exceeded HDOH Drinking Water EALs at RHMW02. Additionally, the SSRBL of 4,500 µg/L for TPH-DRO was exceed in the October sampling event; and
- TPH-DRO exceeded HDOH Drinking Water EALs at RHMW03 during all four sampling events.

2009 – Groundwater Sampling: Groundwater samples were collected in February, May, July, and October 2009. Analytical results indicated the following:

- No chemicals have been detected above HDOH Drinking Water EALs at US Navy Well 2254-01;
- Trace TPH-GRO at US Navy Well 2254-01 was detected above the laboratory MDL and significantly below the laboratory reporting limit and HDOH Drinking Water EAL, in February and May 2009;
- TPH-DRO exceeded HDOH Drinking Water EALs at RHMW01 during all four sampling events;
- TPH-GRO has not exceed HDOH Drinking Water EALs at RHMW02;
- TPH-DRO exceeded HDOH Drinking Water EALs at RHMW02 during all four sampling events;
- Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene exceeded HDOH Drinking Water EALs at RHMW02 in February 2009, however only 1-methylnaphthalene exceeded the HDOH Drinking Water EALs in May and July 2009 and only naphthalene exceeded the HDOH Drinking Water EAL in October 2009;
- TPH-DRO exceeded HDOH Drinking Water EALs at RHMW03 in February, but not in May, July, or October; and
- TPH-DRO exceeded HDOH Drinking Water EAL at RHMW05 during the July and October 2009 sampling events.

2010 – Groundwater Sampling: Groundwater samples were collected in January and April 2010 (and TPH-DRO was resampled for at RHMW02 in February and March, 2010). Analytical results indicated the following:

- No chemicals have been detected above HDOH Drinking Water EALs at US Navy Well 2254-01;
- Trace naphthalene at US Navy Well 2254-01 was detected above the laboratory MDL and significantly below the laboratory reporting limit and HDOH Drinking Water EAL, in January;
- TPH-DRO exceeded HDOH Drinking Water EALs at RHMW01;
- TPH-DRO exceeded HDOH Drinking Water EALs at RHMW02 in January, February, March, April, and July however, significant increases in January and February were attributed to tentatively identified compounds (TICs) apparently not associated with petroleum from the Facility;
- Naphthalene and 1-methylnaphthalene exceeded HDOH Drinking Water EALs in RHMW02 in January, April, and July;

- TPH-DRO exceeded HDOH Drinking Water EALs at RHMW05 in January, however, the significant increase was attributed to TICs apparently not associated with petroleum from the Facility; and
- TPH-DRO at RHMW03 has not been detected above the laboratory MDL.

1.5 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).

Also, the drinking water EAL for naphthalene was increased from 6.2 μg/L to 17 μg/L (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.

1.6 RHMW05 Installation

In April 2009, a new groundwater monitoring well, RHMW05, was installed by TEC under US Navy Contract Number N47408-04-D-8514, Task Order No. 54. RHMW05 is located within the lower access tunnel between RHMW01 and RHMW2254-01(located at the US Navy Well 2254-01). It was installed to identify any contamination migrating past RHMW01 prior to it reaching the US Navy Well 2254-01.

2.0 Sample Collection and Analyses

Field activities relating to groundwater sample collection were conducted on July 13, 2010. Groundwater samples were collected from four monitoring wells located inside the Facility lower access tunnel and one monitoring well located at the US Navy Pump Station. Sampling and analysis were conducted according to *Red Hill Bulk Fuel Storage Facility Groundwater Protection Plan* (TEC, 2009). A total of eight samples were collected as follows:

- one environmental sample from RHMW2254-01 (i.e., located at the US Navy Well 2254-01), RHMW01, RHMW02, RHMW03, and RHMW05;
- one duplicate sample from RHMW02 (sampled as RHMWA01 and reported as RHMW02D); and
- one matrix spike and matrix spike duplicate from RHMW2254-01.

2.1 Monitoring Well Purging

All groundwater monitoring wells 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. Purge water was collected and disposed in the Facility oil/water separator system.

2.2 Groundwater Sample Collection

Each monitoring well was sampled immediately following purging. All wells were sampled directly from their dedicated bladder pump system. 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 four monitoring wells located in the lower access tunnel of the Facility and one monitoring well located at the US Navy Pump Station. Duplicate sample results from monitoring well RHMW02 are reported in this document as RHMW02D. A summary of groundwater analytical results for TPH-DRO, TPH-GRO, VOCs, PAHs, and dissolved lead is included in Table 1. Complete analytical laboratory reports are provided in Appendix A.

3.1 July 2010 Sample Analytical Results

Groundwater samples were analyzed for TPH-DRO, TPH-GRO, VOCs, PAHs, and dissolved lead. Data qualifier "F" indicates the result is between the laboratory MDL and reporting limit (RL), therefore, should be considered an estimated value. The results for each groundwater monitoring well are discussed below.

RHMW01

TPH-DRO at 228F µg/L exceeded the HDOH Drinking Water EALs of 210 µg/L. Estimated trace concentrations of acenaphthene and flourene were detected at 0.0321F µg/L and 0.035F µg/L, respectfully (Table 1). Naphthalene was detected via USEPA Method 8270C SIM at 0.184 µg/L. These concentrations are significantly below the HDOH Drinking Water EALs for each constituent. No other constituents were detected above the laboratory MDL.

Table 1. Analytical Results for Quarterly Groundwater Monitoring Release Response Report (July 13, 2010)
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	RHMW01 UG/L July 13, 2010				RHMW02 UG/L July 13, 2010				RHMW02D UG/L July 13, 2010				RHMW03 UG/L July 13, 2010				RHMW05 UG/L July 13, 2010				RHMW2254-01 UG/L July 13, 2010			
				Result	Q	MDL	RL	Result	Q	MDL	RL	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	***228***	F	163	435	***3060***		163	435	***3110***		160	426	ND	U	162	432	ND	U	160	426	ND	U	160	426
	TPH as GASOLINE RANGE ORGANICS	100	100	ND	U	30	100	46.5	F	30	100	45.4	F	30	100	ND	U	30	100	ND	U	30	100	ND	U	30	100
8270C SIM (PAHs)	1-METHYLNAPHTHALENE	4.7	10	ND	U	0.0158	0.0526	***7.43***		0.645	2.15	***7.05***		0.628	2.09	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	2-METHYLNAPHTHALENE	24	10	ND	U	0.0158	0.0526	1.06		0.0161	0.0538	0.937		0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	ACENAPHTHENE	370	20	0.0321	F	0.0158	0.0526	0.287		0.0161	0.0538	0.309		0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	ACENAPHTHYLENE	240	2000	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	ANTHRACENE	1800	22	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	BENZO(a)ANTHRACENE	0.092	4.7	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	BENZO(a)PYRENE	0.2	0.81	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	BENZO(b)FLUORANTHENE	0.092	0.75	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	BENZO(g,h,i)PERYLENE	1500	0.13	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	BENZO(k)FLUORANTHENE	0.92	0.4	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	CHRYSENE	9.2	1	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	DIBENZ(a,h)ANTHRACENE	0.0092	0.52	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	FLUORANTHENE	1500	130	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	FLUORENE	240	950	0.035	F	0.0158	0.0526	0.159		0.0161	0.0538	0.165		0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	INDENO(1,2,3-c,d)PYRENE	0.092	0.095	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	NAPHTHALENE	17	21	0.184		0.0326	0.105	***59.9***		1.33	4.3	***61.1***		1.3	4.19	ND	U	0.0333	0.108	0.0643	F	0.0326	0.105	ND	U	0.0332	0.107
	PHENANTHRENE	240	410	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
	PYRENE	180	68	ND	U	0.0158	0.0526	ND	U	0.0161	0.0538	ND	U	0.0157	0.0524	ND	U	0.0161	0.0538	ND	U	0.0158	0.0526	ND	U	0.016	0.0535
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	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	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	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	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	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	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	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	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	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	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	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	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	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	ND	U	0.15	0.5	ND	U	0.15	0.5
	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	ND	U	1	5	ND	U	1	5
	NAPHTHALENE	17	21	ND	U	0.62	2	***107***		6.2	20	***102***		6.2	20	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	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	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	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	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	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	ND	U	0.31	1	ND	U	0.31	1
	XYLENES, TOTAL	10000	20	ND	U	0.94	3	ND	U	0.94	3	ND	U	0.94	3	ND	U	0.94	3	ND	U	0.94	3	ND	U	0.94	3
6020	LEAD	15	50000	ND	U	0.31	1	ND	U	0.31	1	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
U - Indicates that the compound was analyzed for but not detected at or above the stated limit
F - Indicates that the compound was identified but the concentration was above the MDL and below the RL
200 - Result exceeds one or both HDOH EALs
[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

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

RHMW02
In July 2010, TPH-DRO was detected in RHMW02 in the normal and duplicate samples at 3,060 µg/L and 3,110 µg/L, respectively. These results exceeded the HDOH Drinking Water EAL of 210 µg/L, but not the site-specific risk based level (SSRBL) of 4,500 µg/L. The average concentration between the normal and duplicate samples for TPH-DRO was 3,085 µg/L, slightly greater than half of the SSRBL. The concentration of TPH-GRO detected in the normal and duplicate sample from RHMW02 averaged 45.95F µg/L, less than the HDOH Drinking Water EAL of 100 µg/L.

Naphthalene was analyzed by USEPA Method 8270C SIM and USEPA Method 8260B. USEPA Method 8260B produced the highest naphthalene concentrations, which averaged 104.5 µg/L from the normal and duplicate sample (HDOH Drinking Water EAL is 17 µg/L). In addition, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, and flourene were detected in the normal and duplicate samples at averaged concentrations of 7.24 µg/L, 0.9985 µg/L, 0.298 µg/L, and 0.162 µg/L, respectively (Table 1). All of these concentrations are below the HDOH Drinking Water EALs for each constituent, except for 1-methylnaphthalene (HDOH Drinking Water EAL is 4.7 µg/L). No other constituents were detected above the laboratory MDL.

RHMW03
No parameters were detected above the laboratory MDLs in RHMW03 (Table 1).

RHMW05
Naphthalene was detected above the laboratory MDL, but below the RL, at an estimated concentration of 0.0643F µg/L. This concentration is below the HDOH Drinking Water EAL for this compound (17 µg/L). No other constituents were detected above the laboratory MDL (Table 1).

US Navy Well 2254-01
No parameters were detected above the laboratory MDLs in RHMW2254-01 (Table 1).

3.2 Groundwater Contaminant Trend

Groundwater samples have been collected and analyzed by TEC since September 2005. Figure 1 shows TPH trends in groundwater at the Facility. Figure 2 shows PAH trends in groundwater at the Facility. In these figures, open icons (without data) represent locations where the compounds being analyzed were not detected.

The following is a discussion of compounds that exceeded HDOH Drinking Water EALs during two or more recent consecutive sampling events of increasing or decreasing concentrations, thus establishing a trend:

RHMW01
At RHMW01, concentrations of TPH-DRO have been greater than the HDOH Drinking Water EAL since September 2005, but less than 25 percent of the SSRBL of 4,500 µg/L. TPH-DRO had exhibited a decreasing trend since October 2008 with the lowest historical concentration (i.e., 248F µg/L) recorded in July 2009. Since July 2009, this trend began increasing with 299F µg/L,

312F µg/L, and 377 µg/L detected in October 2009, January 2010, and April 2010, respectively. In July 2010, TPH-DRO decreased to 228F µg/L the lowest concentration detected at RHMW01 to date.

RHMW02

At RHMW02, from September 2005 through February 2009, TPH-DRO exceeded the HDOH Drinking Water EAL and was greater than 50 percent of the SSRBL (estimated solubility limit of 4,500 µg/L). Specifically, the concentration of TPH-DRO was relatively stable at RHMW02 until July 2008, ranging from 2,250 to 2,995 µg/L. However, during the July and October 2008 sampling events, these average concentrations increased. The July 2008 average concentration was 4,055 µg/L and the October 2008 average concentration was 5,420 µg/L. Both of these values were significantly above the HDOH Drinking Water EAL of 210 µg/L, with the October 2008 average also exceeding the SSRBL of 4,500 µg/L.

However, TPH-DRO at RHMW02 had shown a decreasing trend from October 2008 through July 2009. In May and July 2009, TPH-DRO remained above the HDOH Drinking Water EAL, but was below 50 percent of the SSRBL of 4,500 µg/L. In October 2009, TPH-DRO began an increasing trend greater than 50 percent of the SSRBL which continued through February 2010 when it exceeded the SSRBL due to tentatively identified compounds (TICs) apparently not associated with petroleum from the Facility (TEC, 2010). In March and April 2010, TPH-DRO exhibited a decreasing trend and the TICs detected in the two previous sampling events were not observed (i.e., average TPH-DRO concentrations of 2,490 µg/L and 2,215 µg/L respectively). During July 2010, TPH-DRO concentrations at RHMW02 increased to an averaged concentration of 3,085 µg/L, above 50 percent of the SSRBL of 4,500 µg/L.

For other parameters, the average concentration in July 2010 for 1-methylnaphthalene (i.e., 7.24 µg/L) exhibited an increase, after decreasing in April 2010 (to 6.255 µg/L) from the January 2010 average concentration (i.e., 8.65 µg/L). Consequently, the July 2010 1-methylnaphthalene concentration remains above the HDOH Drinking Water EAL of 4.7 µg/L. Naphthalene had shown an increasing trend through 2008 before decreasing to its lowest average concentration in May 2009 (1.125 µg/L). Since October 2009, average naphthalene concentrations in RHMW02 have remained relatively stable between 20 µg/L and 22 µg/L, exceeding the HDOH Drinking Water EAL of 17 µg/L. In July 2010, the naphthalene concentration increased significantly to an average of 104.5 µg/L, however remains less than the concentrations observed during 2008 (e.g., October 2008 average concentration was 242 µg/L).

RHMW03

At RHMW03, historically, concentrations of TPH-DRO have fluctuated around the HDOH Drinking Water EAL, but have been significantly lower than corresponding values observed at RHMW01 and RHMW02. However, TPH-DRO concentrations have decreased since October 2008 dropping below the laboratory MDL in May 2009. Inclusive of the July 2010 sampling event, there has been no detectable TPH-DRO result since May 2009.

RHMW05

At RHMW05 there had been an increasing trend for TPH-DRO since it was first sampled in May 2009. Starting with the July 2009 sampling event, TPH-DRO concentrations at RHMW05 were greater than the HDOH Drinking Water EAL (i.e., 210 µg/L) with the highest concentration of 2,060 µg/L being observed in January 2010. It is important to note that the January 2010 concentration contained TICs apparently not associated with petroleum from the Facility. However, in April and July 2010, TPH-DRO concentrations exhibited a significant decrease and in both sampling events, were not detected above the laboratory MDL.

US Navy Well 2254-01

At US Navy Well 2254-01 (i.e., RHMW2254-01), no compounds were detected above the laboratory MDLs during July 2010. Additionally, no compounds have ever been detected at this sample location at concentrations greater than any of the HDOH Drinking Water EALs.

3.3 Results of Oil/Water Interface Measurements

The presence and thickness of light-non aqueous phased liquids (LNAPL), otherwise known as "free product", released from the USTs is monitored at the Facility (see Table 2). Static water levels and fuel thickness is measured to a precision of ± 0.01 feet.

In January 2008, fuel was measured in monitoring wells RHMW01 and RHMW02 at a thickness of less than 0.01 ft, but has not been observed in other monitoring wells. Measurements to determine the presence and thickness of fuel were conducted at RHMW01, RHMW02, RHMW03, and RHMW05 prior to and following the July 2010 sampling round. Since the trace amounts observed in January 2008, no free product has been observed in any of these Facility wells (Table 2).

Table 2. Oil/Water Interface Measurements

Date	RHMW01		RHMW02		RHMW03		RHMW05	
	SWL (ft)	LNAPL (ft)	SWL (ft)	LNAPL (ft)	SWL (ft)	LNAPL (ft)	SWL[6] (ft)	LNAPL (ft)
January 2008	17.74	< 0.01	18.78	< 0.01	NT[1]	NT[1]	----	----
July 2008	19.04	0.00	18.91	0.00	18.86	0.00	----	----
October 2008	18.61	0.00	18.56	0.00	18.82	0.00	----	----
November 2008	18.50	0.00	18.45	0.00	18.51	0.00	----	----
January 2009	19.28	0.00	19.22	0.00	19.27	0.00	----	----
February 2009	NT[2]	NT[2]	18.66	0.00	18.75	0.00	----	----
March 2009	18.59	0.00	18.57	0.00	18.67	0.00	----	----
May 2009[3]	18.69	0.00	18.64	0.00	18.72	0.00	NT[5]	NT[5]
May 2009	18.91	0.00	18.86	0.00	18.90	0.00	NT[5]	NT[5]
July 2009[4]	18.66	0.00	18.59	0.00	18.64	0.00	18.63	0.00
August 2009	18.37	0.00	18.30	0.00	18.47	0.00	18.21	0.00
September 2009	18.20	0.00	18.17	0.00	18.24	0.00	18.11	0.00
October 2009	18.17	0.00	18.14	0.00	18.24	0.00	18.10	0.00
November 2009	18.50	0.00	18.45	0.00	18.50	0.00	18.47	0.00
December 2009	18.29	0.00	18.26	0.00	18.31	0.00	18.19	0.00
January 2010	18.05	0.00	18.01	0.00	18.09	0.00	17.97	0.00
February 2010	18.17	0.00	18.12	0.00	18.17	0.00	18.12	0.00
March 2010	17.88	0.00	17.86	0.00	17.93	0.00	17.76	0.00
April 2010	17.66	0.00	17.64	0.00	17.71	0.00	17.55	0.00
May 2010	17.61	0.00	17.58	0.00	17.65	0.00	17.49	0.00
June 2010	17.54	0.00	17.50	0.00	17.57	0.00	17.42	0.00
July 2010	17.38	0.00	17.35	0.00	17.42	0.00	17.24	0.00

SWL - Static water level, elevation above mean sea level
LNAPL - Light Non-Aqueous Phased Liquid, fuel product on groundwater attributed to the Facility
ft - Feet
NT - Not Taken
[1] - The January 2008 measurement at RHMW03 was not taken due to equipment malfunction
[2] - During the February 2009 measurements, RHMW01 was inaccessible due to extensive work being conducted at Tank 02
[3] - The measurements scheduled for April 2009 were postponed until May 6, 2009 due to RHMW05 drilling activities
[4] – The June 2009 measurements were skipped due to the installation of dedicated oil/water interface probes
[5] - Oil/water interface measurements were not taken at RHMW05 until the installation of the oil/water interface probe was completed
[6] – Elevation at RHMW05 is estimated from the difference between RHMW01 and RHMW05 during a survey conducted in January 2010
---- - Time period prior to the installation of RHMW05
Oil/water interface measurements were not taken in April 2008

3.4 Groundwater Status

Facility-specific contaminants of concern are defined as petroleum-related chemicals that have been observed in the groundwater samples above the HDOH Drinking Water EALs. In accordance with the *Red Hill Bulk Fuel Storage Facility Final Groundwater Protection Plan* (TEC, 2008), Table 3 defines these Facility-specific compounds and their associated SSRBLs and updated EALs (HDOH 2008).

Table 3. Action Levels for Contaminants of Concern

Chemical	EAL (µg/L)	SSRBL (µg/L)
Petroleum Mixtures		
TPH-DRO	210	4,500
TPH-GRO	100	4,500
Semi-Volatile Compounds		
1-Methylnaphthalene	4.7	NA
2-Methylnaphthalene	24	NA
Naphthalene	17	NA

NA – Not applicable or not determined
SSRBLs are applicable at RHMW01, RHMW02, RHMW03, and RHMW05
EALs are applicable at US Navy Well 2254-01

In addition, the Plan defines four Results Categories of groundwater status for the Facility, based on concentrations of constituents of concern in RHMW01, RHMW02, RHMW03, RHMW05 and the US Navy Well 2254-01, and requires specific responses when these categories are observed during quarterly groundwater sampling. Table 4 describes each of the four Results Categories and identifies response actions to be taken in accordance with the Plan.

Table 4. Results Categories and Response Actions to Changes in Groundwater Status

Results Category	RHMW02 RHMW03 or RHMW05*	RHMW01	US Navy Pumping Well 2254-01
Results Category 1: Result above detection limit but below drinking water EAL and trend for all compounds stable or decreasing	A	A	A,D,M,E
Results Category 2: Trend for any compound increasing or drinking water EAL exceeded	A, B	A, B	A,B,C,D,E,F,G,K, L,O
Results Category 3: Result Between 1/10X SSRBL and SSRBL for benzene, or between 1/2X SSRBL and SSRBL for TPH	A,B,G,H,I,J	A,B,E,G,H,I,J	A,B,C,D,E,F,G,I,J, K,L,O
Results Category 4: Result Exceeding any SSRBL or petroleum product observed	A,C,D,E,F,I,J, K,M,N	A,C,D,E,F,I, J,K,M,N,O	A,C,D,E,F,G,I,J,K, L,O

*RHMW05 was installed in April 2009 and has been subsequently been added to this Table.
Specific Responses:
A. Send quarterly reports to HDOH.
B. Begin program to determine the source of leak.
C. Notify HDOH verbally within 1 day and follow with written notification in 30 days.
D. Notify FISC Chain of Command within 1 day.
E. Send Type 1 Report (see box below) to HDOH.
F. Send Type 2 Report (see box below) to HDOH.

G. Increase monitoring frequency to once per month (if concentrations increasing).
H. Notify HDOH verbally within 7 days and follow with written notification in 30 days.
I. Remove sampling pumps, measure product in pertinent wells with interface probe, re-install pumps if product is not detected.
J. Immediately evaluate tanks for leaks.
K. Collect samples from nearby Halawa Deep Monitoring Well (2253-03) and OWDF MW01. For permission to sample 2253-03, call DLNR Commission on Water Resource Management 808-587-0214, DLNRCWR@Hawaii.gov.
L. Provide alternative water source at 2254-01.
M. Prepare for alternative water source at US Navy Well 2254-01.
N. Re-measure for product every month with reports to HDOH.
O. Install additional monitoring well downgradient.

Report Types
HDOH Type 1 Report

- Re-evaluate Tier 3 Risk Assessment/groundwater model results
- Proposal to HDOH on a course of action

HDOH Type 2 Report

- Proposal for groundwater treatment

Free Product Measurements
In response to the previous Category 3 status at RHMW02, free product measurements have been collected at the Facility monitoring wells. As Table 2 indicates, free product has been observed only during the January 2008 monitoring event (i.e., at both RHMW01 and RHMW02 at less than 0.01 foot each). Since the trace amounts observed in January 2008, no free product has been observed in any of these Facility wells (Table 2).

US Navy Well 2254-01
Based upon the July 2010 sampling event, the US Navy Well 2254-01 is not eligible for any category status change since no compounds were detected above the laboratory MDLs.

RHMW03
Based upon the July 2010 sampling event, RHMW03 is not eligible for any category status change since no compounds were detected above the laboratory MDLs.

Category 1 Status Locations
RHMW05
Based upon the July 2010 sampling event, RHMW05 is assigned a Category 1 status. This is because estimated trace concentrations of naphthalene (i.e., 0.0643F µg/L) was detected above the laboratory MDL, but not above the HDOH EAL of 17 µg/L for this compound.

Category 1 response for RHMW05 requires:
1. Quarterly reports to be sent to HDOH

Category 2 Status Locations
RHMW01
The July 2010 sampling event indicates that RHMW01 should remain in Category 2 status. This is because the TPH-DRO concentration of 228F μg/L is greater than the HDOH Drinking Water EAL (210 μg/L), but less than half the SSRBL of 4,500 μg/L (estimated solubility limit of JP-5).

Category 2 response for RHMW01 requires:
1. Quarterly reports to be sent to HDOH; and
2. Initiation of a leak determination program to identify if tanks are leaking.

Category 3 Status Locations
RHMW02
Based upon the July 2010 sampling event, RHMW02 has been upgraded to Category 3 status. TPH-DRO concentrations remain greater than the HDOH Drinking Water EAL (210 μg/L) and the July 2010 averaged concentration (3,085 μg/L) is greater than half the SSRBL of 4,500 μg/L. However, the July 2010 TPH-DRO average concentration is within the historical range for this well.

Category 3 response for RHMW02 requires:
1. Send quarterly reports to HDOH.
2. Begin program to determine the source of leak.
3. Increase monitoring frequency to once per month (if concentrations increasing).
4. Notify HDOH verbally within 7 days and follow with written notification in 30 days.
5. Remove sampling pumps, measure product in pertinent wells with interface probe, re-install pumps if product is not detected.
6. Immediately evaluate tanks for leaks.

Category 4 Status Locations
There are no Category 4 status locations.

4.0 Summary and Conclusions

Summary
There is no indication of an immediate threat of disruption to drinking water resources of the US Navy Well 2254-01 as a result of the July 2010 data. Based on the July 2010 sampling event, the US Navy Well 2254-01 does not fall into any Results Category of the Plan.

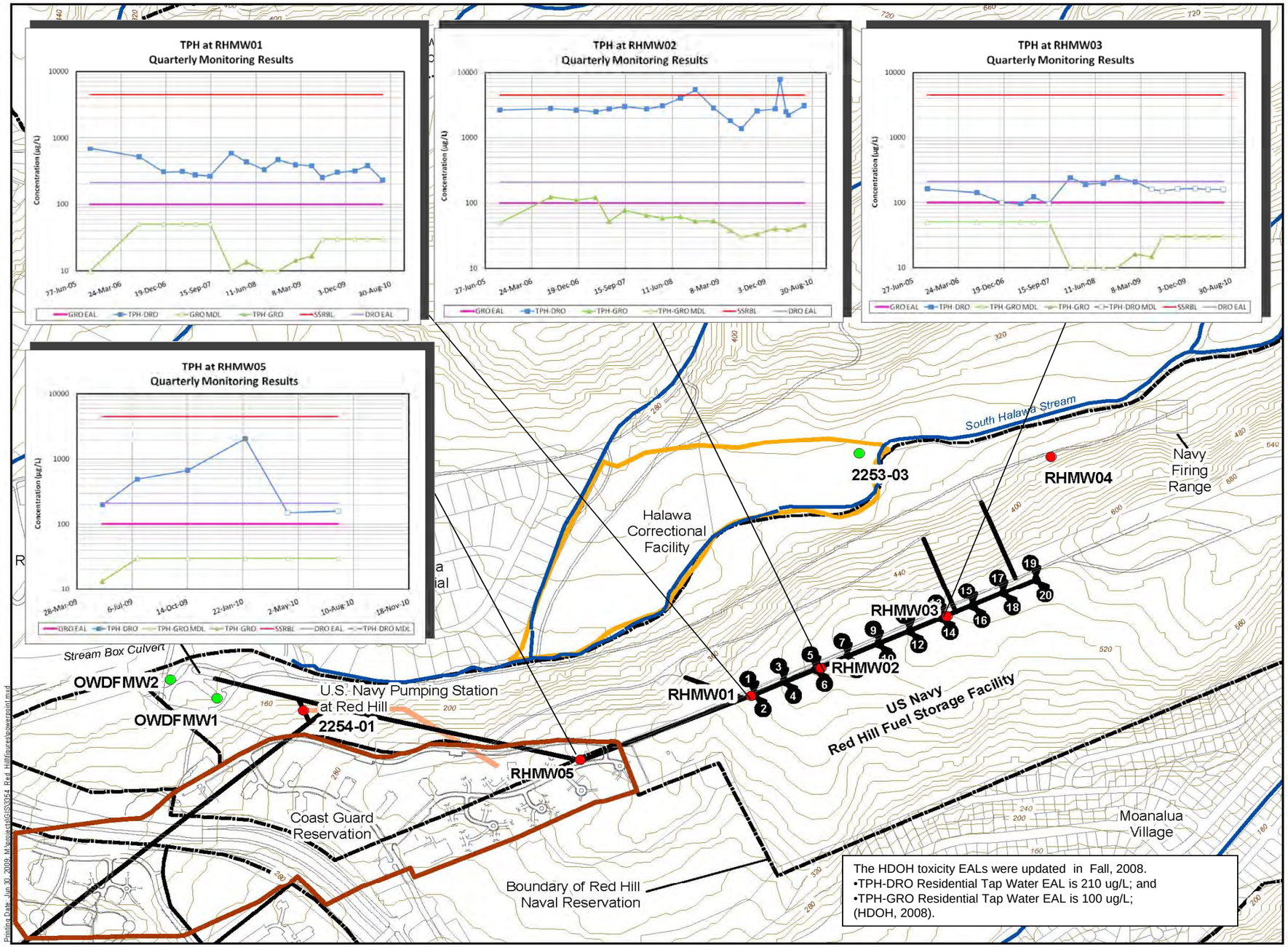
TPH-DRO was detected at RHMW01 during July 2010, at the lowest concentration to date. Although TPH-DRO concentrations at RHMW02 increased relative to the previous respective sampling events (excluding the February 2010 concentration that was elevated due to TICs not associate with fuel from the Facility) it remains well within the historical range. In addition, RHMW02 naphthalene concentrations have increased and remain above the HDOH Drinking Water EAL.

Conclusions/Recommendations

- To date, fuel on the groundwater has been observed only once (i.e., in January 2008 in RHMW01 and RHMW02 at less than 0.01 ft.). Continued monitoring of Facility wells for the presence of fuel on groundwater is recommended.
- The concentration of TPH-DRO measured in the newest monitoring well, RHMW05, has drastically declined since exhibiting an increasing trend between May 2009 and January 2010.
- TPH-DRO at RHMW01 decreased to its lowest concentration at this location to date, while TPH-DRO at RHMW02 has slightly increased since April 2010. However, July 2010 TPH-DRO concentration is within the historical range for RHMW02. It is recommended that quarterly monitoring of the Facility wells continue so that overall groundwater quality trends may be evaluated and proactive action taken if the groundwater quality shows evidence of deterioration.
- The US Navy Well 2254-01 is not imminently threatened at this time; however, sampling should continue to monitor and assess contaminant migration from up-gradient locations.
- Consideration should be given to having future samples analyzed using both Massachusetts Department of Environmental Protection (MADEP) analytical methods in addition to TPH-GRO and TPH-DRO analytical methods.

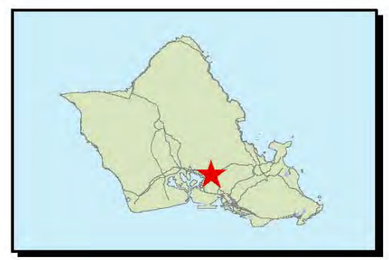
In conclusion, the following activities are recommended to continue to monitor and clarify the groundwater contamination situation at the Facility:

1. Continue monthly free product measurements at RHMW01, RHMW02, RHMW03, and RHMW05;
2. Continue monthly soil vapor monitoring; and
3. Continue quarterly groundwater monitoring of Facility wells for parameters of concern.



Legend

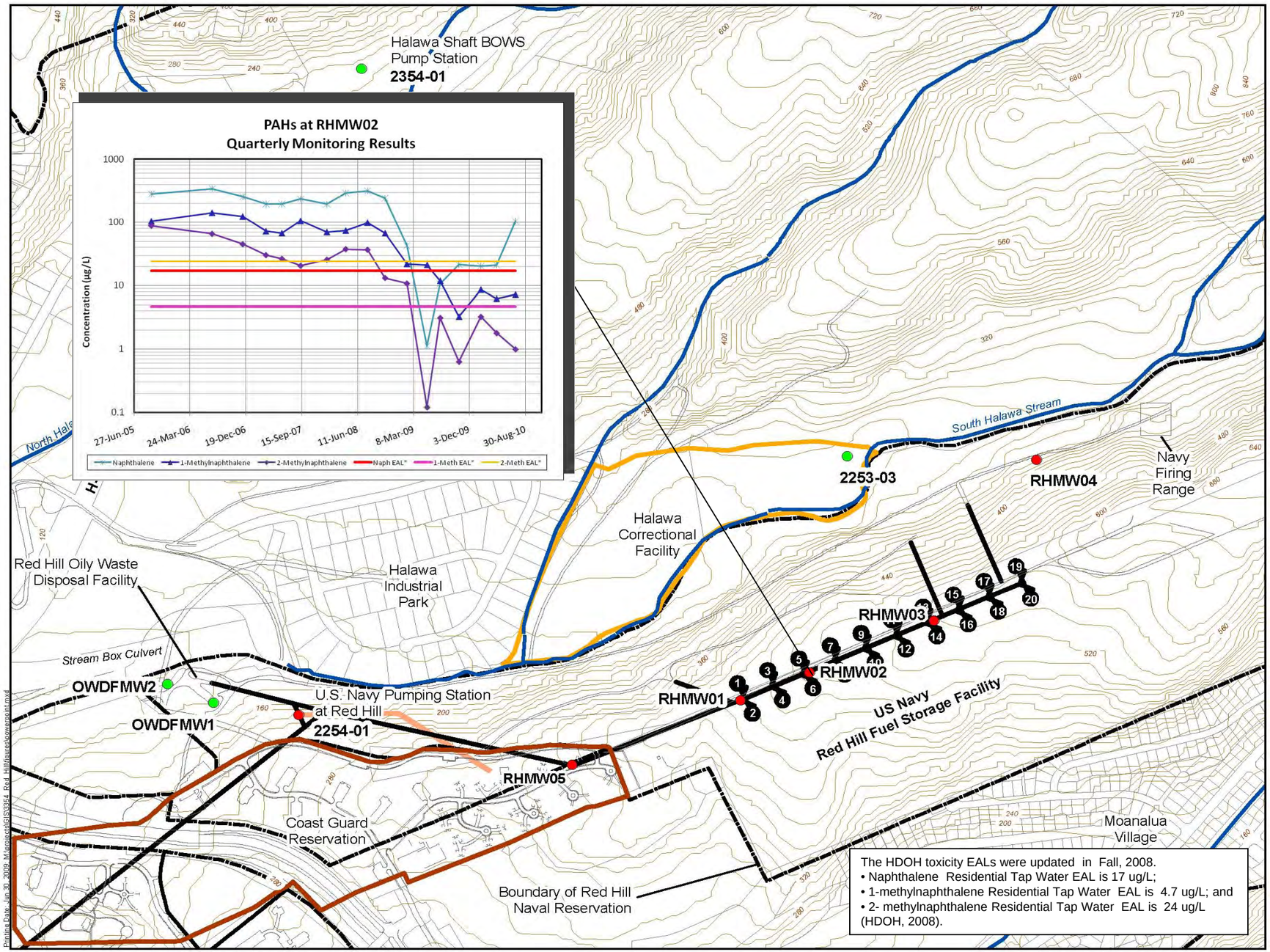
- Red Hill UST ID Number
- Parcel
- 40-foot Interval Contour Line
- Road
- Stream
- Red Hill Navy Installation Boundary
- Red Hill Tunnels
- 2254-01 Infiltration Gallery
- Halawa Correctional Facility Boundary
- Coast Guard Reservation



N

Meters
0 185 370
0 340 680 1,360
Feet

Figure 1
TPH Trends in Groundwater
Round 20 (July 13, 2010)
Red Hill Fuel Storage Facility
Oahu, Hawaii



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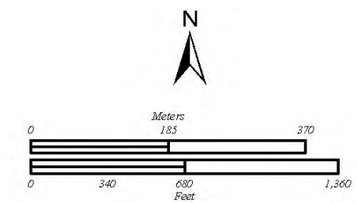

Figure 2
PAH Trends in Groundwater
Round 20 (July 13, 2010)
Red Hill Fuel Storage Facility
Oahu, Hawaii

5.0 References

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Appendix A

Laboratory Analytical Reports