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

RED HILL BULK FUEL STORAGE FACILITY, JOINT BASE PEARL HARBOR-HICKAM, O‘AHU, HAWAI‘I

Latitude: 21°22’15”N
Longitude: 157°53’33”W

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

July 2012

Department of the Navy
Naval Facilities Engineering Command, Hawai‘i
400 Marshall Road
JBPHH HI 96860-3139

Environmental Technical Services
Contract Number N62742-08-D-1930, CTO HC21

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Prepared for:

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Prepared under:

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List of Acronyms

µg/L	micrograms per liter
%	percent
amsl	above mean sea level
bTOC	below top of casing
COPC	chemical of potential concern
CTO	Contract Task Order
DL	detection limit or method detection limit (MDL)
DLNR	Department of Land and Natural Resources
DOH	State of Hawai‘i Department of Health
DON	Department of the Navy
DRO	diesel range organics
EAL	Environmental Action Level
EPA	U.S. Environmental Protection Agency
EPH	extractable petroleum hydrocarbon
F-76	marine diesel fuel
FLC	Fleet Logistics Center
GRO	gasoline range organics
HAR	Hawai‘i Administrative Rules
IDW	investigation-derived waste
J	Estimated result. Indicates that the compound was identified, but the concentration was above the DL and below the LOQ.
JBPHH	Joint Base Pearl Harbor-Hickam
JP	Jet Propellant
LOD	limit of detection
LOQ	limit of quantitation or reporting limit (RL)
MADEP	Massachusetts Department of Environmental Protection
MS	matrix spike
MSD	matrix spike duplicate
NA	not available
NAVFAC	Naval Facilities Engineering Command
NAVSUP	United States Naval Supply Systems Command
ND	not detected
PAHs	polycyclic aromatic hydrocarbons
pH	hydrogen activity
PHWS	Pearl Harbor Water System
PPE	personal protective equipment
Q	data qualifier
QC	quality control
RHSF	Red Hill Bulk Fuel Storage Facility
RPD	relative percent difference
TEC	The Environmental Company, Inc.
TPH	total petroleum hydrocarbons
U	Indicates the compound or analyte was analyzed for, but not detected. The result is reported as ND.
U.S.	United States
USGS	United States Geological Survey
UST	underground storage tank
VOC	volatile organic compound

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Executive Summary

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

The United States (U.S.) Navy implemented a groundwater monitoring program, which includes collecting quarterly groundwater samples from U.S. Navy Well 2254-01 (RHMW2254-01) and four groundwater monitoring wells (RHMW01, RHMW02, RHMW03, and RHMW05) installed in the RHSF lower access tunnel. The U.S. Navy Well 2254-01 is located approximately 3,000 feet downgradient from the RHSF and provides approximately 24 percent (%) of the potable water to the Pearl Harbor Water System (PHWS). The groundwater samples are analyzed for petroleum constituents and compared against State of Hawai‘i Department of Health (DOH) Drinking Water Environmental Action Levels (EALs) (DOH, 2009).

In response to increasing concentrations of chemicals of potential concern (COPCs) in the groundwater monitoring wells within the facility (specifically RHMW02) during 2008, plans were made to conduct four quarterly monitoring events starting in August 2009 and ending in April 2010 at the following outside (non-tunnel) monitoring well locations:

- RHMW04;
- Oily Waste Disposal Facility Monitoring Well 01 (OWDFMW01); and
- Hālawa Deep Well 2253-03 (HDMW2253-03).

The four consecutive quarterly monitoring events indicated that all COPC concentrations were below the EALs for samples collected at monitoring well RHMW04. In January 2010, concentrations of total petroleum hydrocarbons (TPH) diesel range organics (DRO) were above the EALs at OWDFMW01 and HDMW2253-03. As a result, quarterly monitoring was discontinued at RHMW04 and continued at the two remaining outside monitoring wells. This groundwater monitoring report presents the analytical results for samples collected on April 26, 2012 at the two outside monitoring wells (OWDFMW01 and HDMW2253-03).

Laboratory analytical results indicate that all COPC concentrations during the April 2012 monitoring event were below the DOH Drinking Water EALs with the exception of TPH-DRO at a concentration of 220 micrograms per liter (µg/L) in monitoring well OWDFMW01. TPH-DRO was detected at a concentration of 160 µg/L in monitoring well HDMW2253-03 above the DOH Groundwater Gross Conatamination EAL but below the DOH Drinking Water EAL. Lead was detected at a concentration of 0.71 µg/L in monitoring well HDMW2253-03. Acetone was detected at an estimated concentration of 2.8 µg/L in monitoring well OWDFMW01. Benzene was detected at estimated concentrations of 0.71 µg/L in monitoring well OWDFMW01 and 0.20 µg/L in monitoring well HDMW2253-03. All other COPCs were not detected at or above the limits of detection (LODs) or the limits of quantitation (LOQs). LODs and LOQs were below the EALs for the majority of COPCs. In the case where an EAL for a specific COPC is less than the LOQ, it is generally acceptable to consider the LOQ in place of the EAL (DOH, 2009).

All COPC concentrations prior to the April 2012 monitoring event had been below EALs for at least the past six consecutive quarterly monitoring events dating back to October 2010. However, the April 2012 event showed TPH-DRO concentrations increase above the DOH Drinking Water EAL in monitoring well OWDFMW01 and above the DOH Gross Contamination EAL in both monitoring wells. In both of these TPH-DRO results, the analyst noted that the chromatogram of the samples were mainly non-diesel hydrocarbons within the boiling point range of diesel fuel. Massachusetts Department of Environmental Protection (MADEP) extractable petroleum hydrocarbon (EPH) analytical results in the October 2011 monitoring event indicated that the detected hydrocarbons were most likely from non-petroleum sources. The reported TPH-DRO concentrations are not considered TPH-DRO, but non-petroleum hydrocarbons. The groundwater monitoring program results still indicate that concentrations of COPCs detected within the facility are not impacting the two outside monitoring wells. It is recommended that quarterly sampling remain the same and attention be paid to COPC concentrations at both monitoring wells for signs of contaminant migration.

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Section 1 Introduction

This report presents the results of the April 2012 quarterly groundwater monitoring event at the two outside monitoring wells (OWDFMW01 and HDMW2253-03) at the RHSF, Joint Base Pearl Harbor-Hickam (JBPHH), O‘ahu, Hawai‘i (Figure 1-1). The groundwater monitoring was performed by Environet for the Department of the Navy (DON), Naval Facilities Engineering Command (NAVFAC) Hawai‘i under Environmental Technical Services, Contract Number N62742-08-D-1930, Contract Task Order (CTO) HC21.

This groundwater monitoring event is considered supplemental to the quarterly groundwater monitoring program conducted within the tunnels of the RHSF. This supplemental groundwater monitoring was conducted in response to increasing concentrations of COPCs in a groundwater monitoring well within the RHSF, specifically RHMW02, during the October 2008 groundwater monitoring event. The field activities performed for the April 2012 quarterly groundwater monitoring event were conducted in accordance with the procedures described in the *Work Plan, Long-Term Monitoring, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, O‘ahu, Hawai‘i* (Environet, 2010).

1.1 Project Objective

The groundwater monitoring was performed to evaluate the presence of COPCs in groundwater surrounding the RHSF. The groundwater monitoring was conducted to ensure that the DON remains in compliance with DOH UST release response requirements as described in Hawai‘i Administrative Rules (HAR) 11-281 Subchapter 7, Release Response Action.

1.2 Background

The U.S. Navy implemented a groundwater monitoring program, which includes collecting quarterly groundwater samples from U.S. Navy Well 2254-01 (RHMW2254-01) and four groundwater monitoring wells (RHMW01, RHMW02, RHMW03, and RHMW05) installed in the RHSF lower access tunnel. The U.S. Navy Well 2254-01 is located approximately 3,000 feet downgradient from the RHSF and provides approximately 24% of the potable water to the PHWS. The groundwater samples are analyzed for petroleum constituents and compared against DOH Drinking Water EALs (DOH, 2009).

In response to increasing concentrations of COPCs in the groundwater monitoring wells within the facility (specifically RHMW02) during 2008, plans were made to conduct four quarterly monitoring events starting in August 2009 and ending in April 2010 at the following outside (non-tunnel) monitoring well locations:

- RHMW04;
- Oily Waste Disposal Facility Monitoring Well 01 (OWDFMW01); and
- Hālawa Deep Well 2253-03 (HDMW2253-03).

The four consecutive quarterly monitoring events indicated that all COPC concentrations were below the EALs for samples collected at monitoring well RHMW04. In January 2010 concentrations of TPH-DRO were above the EALs at OWDFMW01 and HDMW2253-03. As a result, quarterly monitoring was discontinued at RHMW04 and continued at the two remaining outside monitoring wells. This groundwater monitoring report presents the analytical results for samples collected on April 26, 2012 at the two outside monitoring wells (OWDFMW01 and HDMW2253-03). The following sections provide a description of the site and information on the RHSF and USTs.

1.2.1 *Site Description*

The RHSF is located on the island of O‘ahu, Hawai‘i, approximately 2.5 miles northeast of Pearl Harbor in Hālawa Heights (Figure 1-1). Land adjacent to the north of the RHSF is occupied by the Hālawa Correctional Facility and private businesses. Land to the south and west of the facility includes the Coast Guard Reservation and other residential neighborhoods. Moanalua Valley is located east of the facility (Environet, 2010).

The Navy Public Works Department operates a potable water infiltration tunnel approximately 1,550 feet hydraulically downgradient from the RHSF (Environet, 2010). The U.S. Navy Well 2254-01 is located approximately 3,000 feet downgradient (west) of the RHSF and provides approximately 24% of the potable water to the PHWS, which serves approximately 52,200 military consumers (The Environmental Company, Inc. (TEC), 2008).

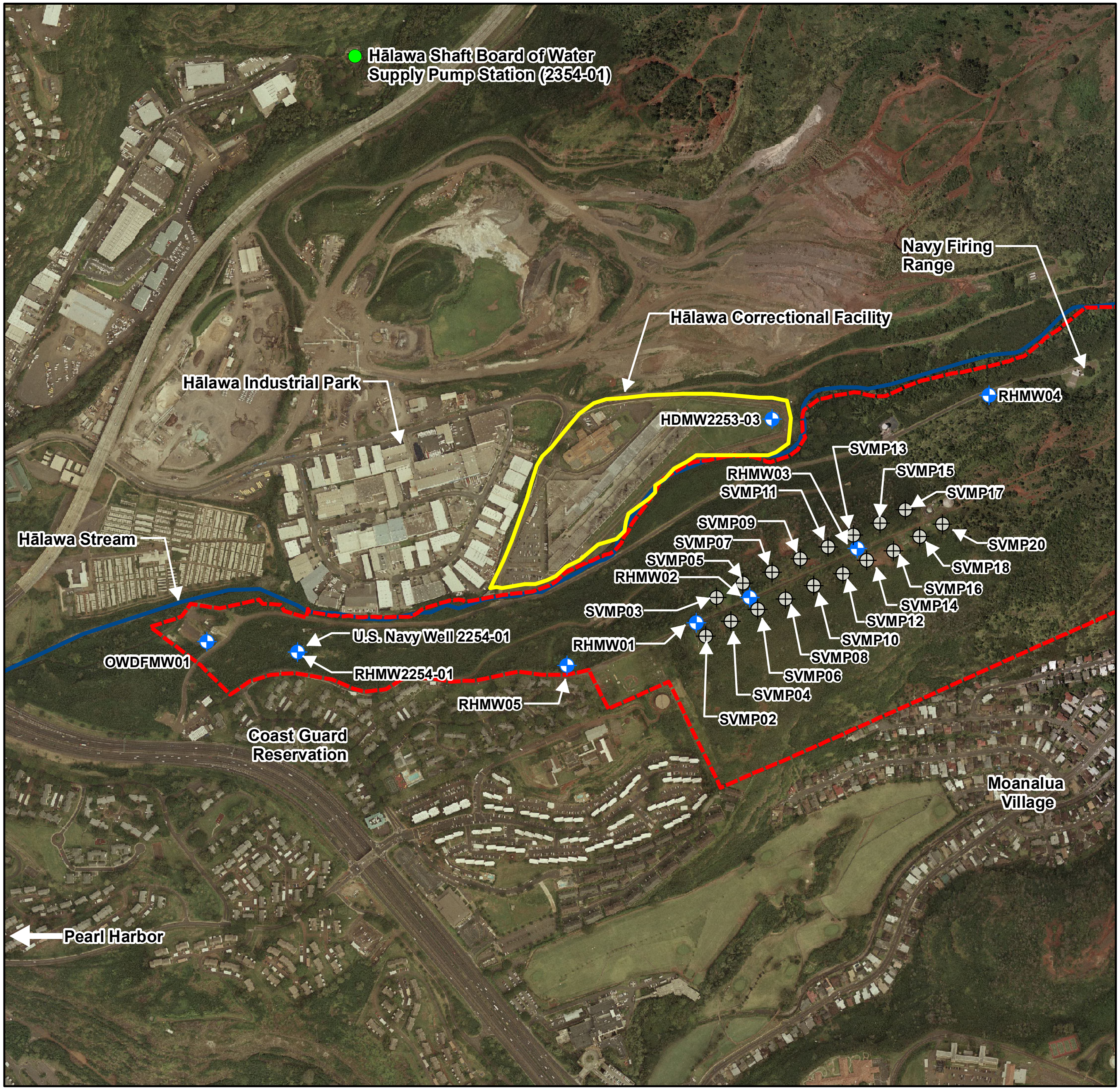
1.2.2 *Facility Information*

The RHSF consists of 18 active and two inactive USTs operated by the United States Naval Supply Systems Command (NAVSUP) Fleet Logistics Center (FLC) Pearl Harbor. Each UST has a capacity of 12.5 million gallons. The RHSF is located approximately 100 feet above the basal aquifer (Dawson Group, Inc., 2006).

In 2002, the U.S. Navy installed a groundwater monitoring well (RHMW01) into the basal aquifer, directly down-gradient from the RHSF, within the lower access tunnel. Groundwater samples from this well indicated that petroleum from the RHSF has migrated to the basal aquifer (AMEC Earth and Environmental, Inc., 2002). In 2005, the U.S. Navy began quarterly monitoring of the aquifer to protect their down-gradient drinking water resource associated with the U.S. Navy Well 2254-01.

By September 2005, the U.S. Navy had installed two more groundwater monitoring wells (RHMW02 and RHMW03) within the RHSF UST system, a groundwater monitoring well (RHMW04) north of the RHSF (adjacent to the U.S. Navy Firing Range), and a groundwater monitoring well within the U.S. Navy Well 2254-01 infiltration gallery (RHMW2254-01). Since 2005, RHMW01, RHMW02, RHMW03, and RHMW2254-01 have been sampled quarterly for TPH-DRO, TPH-gasoline range organics (GRO), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and dissolved lead.

Due to increasing concentrations of COPCs at the groundwater monitoring wells within the RHSF (specifically RHMW02) during 2008, response measures were warranted. In April 2009, another groundwater monitoring well (RHMW05) was installed within the lower access tunnel



LEGEND

⊕ Soil Vapor Monitoring Points
⊕ Groundwater Monitoring Wells
● Board of Water Supply Pump Station
▭ Hālawa Correctional Facility
▭ Red Hill Naval Reservation
— Hālawa Stream

SOURCE

USGS, 2005

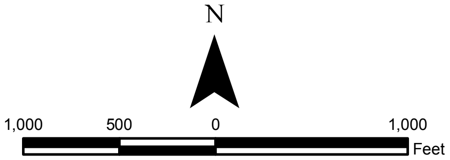


Figure 1-1
Groundwater Monitoring Well Location Map
Quarterly Groundwater Monitoring Report-Outside (Non-Tunnel) Wells, Red Hill Bulk Fuel Storage Facility, JBPHH, O'ahu, Hawai'i

between RHMW01 and RHMW2254-01. It was installed to identify the extent of contaminant migration in groundwater before it reaches the infiltration gallery at RHMW2254-01.

Additionally, plans were made to sample three monitoring wells surrounding and outside of RHSF: RHMW04, OWDFMW01, and HDMW2253-03 (Figure 1-1 and Table 1-1). RHMW04 was installed to evaluate groundwater within the basal aquifer upgradient from RHSF. 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 U.S. Navy Well 2254-01. HDMW2253-03 is controlled by the State of Hawai‘i Commission on Water Resource Management. HDMW2253-03 is located between the RHSF and the municipal drinking water supply well, which is operated by the City and County of Honolulu Board of Water Supply (Hālawa Shaft Pumping Station 2354-01) (Figure 1-1).

Table 1-1: Outside Monitoring Well Information

Groundwater Monitoring Well	bTOC Elevation (feet amsl)	Depth to Water (feet bTOC)	Total Depth of Well (feet)
RHMW04	313.03	---	320
OWDFMW01	138.94	120.29	142.8
HDMW2253-03	225	207. 76*	1,575

Notes:
*Depth to water provided by the Department of Land and Natural Resources (DLNR) on April 26, 2012.
--- Depth to water was not gauged at RHMW04 on April 26, 2012 because it is no longer a part of the sampling program.
amsl - above mean sea level
bTOC - below top of casing

1.2.3 *UST Information*

The USTs were constructed in the early 1940s. The tanks were constructed of steel and currently contain Jet Propellant (JP)-5 fuel, JP-8, and marine diesel fuel (F-76). 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).

1.2.4 *Regulatory Updates*

During the summer and fall of 2008, DOH 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 U.S. Environmental Protection Agency (EPA). As a result, DOH 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 one in a million cancer risk (DOH, 2009). Also, the drinking water EAL for naphthalene was increased from 6.2 µg/L to 17 µg/L (DOH, 2009). Finally, the DOH Drinking Water EAL for TPH-DRO was increased from 100 µg/L to 210 µg/L, although the DOH Groundwater Gross Contamination EAL for TPH-DRO remains 100 µg/L.

1.3 Previous Reports

The following groundwater monitoring reports were previously submitted to the DOH for the groundwater monitoring wells within the RHSF:

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);
19. Groundwater Monitoring Results, April 2010 (submitted May 2010);
20. Groundwater Monitoring Results, July 2010 (submitted August 2010);
21. Groundwater Monitoring Results, October 2010 (submitted December 2010);
22. Groundwater Monitoring Results, January 2011 (submitted March 2011);
23. Groundwater Monitoring Results, April 2011 (submitted June 2011);
24. Groundwater Monitoring Results, July 2011 (submitted September 2011);
25. Groundwater Monitoring Results, October 2011 (submitted December 2011); and
26. Groundwater Monitoring Results, January-February 2012 (submitted March 2012).

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

1. Groundwater Monitoring Results, August 2009 (submitted September 2009);
2. Groundwater Monitoring Results, October 2009 (submitted December 2009);
3. Groundwater Monitoring Results, January 2010 (submitted April 2010);
4. Groundwater Monitoring Results, April 2010 (submitted May 2010);
5. Groundwater Monitoring Results, July 2010 (submitted August 2010);
6. Groundwater Monitoring Results, October 2010 (submitted December 2010);
7. Groundwater Monitoring Results, January 2011 (submitted March 2011);
8. Groundwater Monitoring Results, April 2011 (submitted June 2011);
9. Groundwater Monitoring Results, July 2011 (submitted September 2011);
10. Groundwater Monitoring Results, October 2011 (submitted December 2011); and
11. Groundwater Monitoring Results, January 2012 (submitted March 2012).

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Section 2 Monitoring Activities

Groundwater monitoring was conducted on April 26, 2012 in accordance with the site specific Work Plan (Environet, 2010). Field activities were documented in the field notebook (Appendix B).

2.1 Groundwater Gauging

Groundwater gauging measurements were taken at the two monitoring wells (OWDFMW01 and HDMW2253-03) prior to purging and sample collection. A Solinst® water level meter was used to measure the depth to groundwater (to the nearest 0.01 foot) within monitoring well OWDFMW01, according to the procedures described in Procedure I-C-3, *Monitoring Well Sampling* (DON, 2007). The depth to groundwater for monitoring well HDMW2253-03 was measured by a Department of Land and Natural Resources (DLNR) employee prior to well purging (Table 1-1).

2.2 Groundwater Sampling

Groundwater samples were collected from the two monitoring wells according to the procedures described in Procedure I-C-3, *Monitoring Well Sampling* (DON, 2007).

2.2.1 *Monitoring Well Purging*

Due to the well construction characteristics of OWDFMW01 (total depth of 142.8 feet below top of casing (bTOC)) and HDMW2253-03 (large casing diameter of approximately 12 inches from the top of casing to approximately 50 feet below the groundwater surface, and the well is open [not cased] from approximately 50 feet bTOC to 1,575 feet bTOC), three well casing volumes were not purged prior to sampling. Instead, water was purged using disposable bailers until three or more successive water quality parameter measurements had stabilized within 10%. A Horiba® U-22 multi-parameter water quality meter was used to measure hydrogen activity (pH), temperature, specific conductivity, dissolved oxygen, turbidity, and oxidation reduction potential. Readings were recorded on Groundwater Sampling Log data sheets (Appendix C).

2.2.2 *Groundwater Sample Collection*

Groundwater samples were collected from OWDFMW01 using four-inch and two-inch disposable bailers directly into laboratory provided, specially cleaned sample containers.

Groundwater samples were collected from HDMW2253-03 using a four-inch double stop disposable bailer directly into laboratory provided, specially cleaned sample containers. Due to the well construction characteristics of HDMW2253-03, 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. Dissolved lead samples collected from HDMW2253-03 required laboratory filtration due to the double stop bailer required to collect the sample.

2.2.3 *Sample Management and Shipment*

Each sample container sent to the laboratory was assigned a project-specific chain of custody identification number and a descriptive identification number. The sample identifiers provided specific data unique to each sample and were entered into the field notebook. The samples were labeled according to the procedures described in Procedure III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody* (DON, 2007).

Following sample collection and labeling, the sample containers were packaged with bubble wrap and placed into individual ZipLoc® bags, then immediately into insulated coolers with ice for preservation. The samples were shipped via FedEx to the laboratory on the same day of collection. The samples were managed under standard chain-of-custody protocol and documentation from collection to delivery to the laboratory. Sample handling, storage, and transport were performed according to the requirements described in Procedure III-F, *Sample Handling, Storage, and Shipping* (DON, 2007).

2.3 Analytical Program

During the April 2012 groundwater monitoring event, two sets of primary groundwater samples, one set of duplicate groundwater samples and one set of quality control (QC) groundwater samples were submitted to APPL, Inc. located in Clovis, California. Groundwater samples were analyzed for VOCs and TPH-GRO by EPA Method 8260B, TPH-DRO by EPA Method 8015B, PAHs by EPA Method 8270D SIM, and dissolved lead by EPA Method 6020. The results of the laboratory analyses are presented and discussed in Section 3.

2.4 Field Quality Control Samples

Field QC procedures were followed to ensure viability and integrity of sample analytical data. Field duplicates were collected according to the procedures described in Procedure III-B, *Field QC Samples (Water, Soil)* (DON, 2007) and the Work Plan (Environet, 2010). Field duplicate samples were collected at a minimum of 10% of primary samples and analyzed for the same COPCs. Field rinsate samples were not required since disposable bailers were used.

2.5 Laboratory Quality Control Samples

Laboratory QC samples were analyzed as part of the standard laboratory QC protocols as presented in the Work Plan (Environet, 2010). Laboratory QC for the groundwater monitoring event consisted of matrix spike (MS)/matrix spike duplicate (MSD) samples for organic analysis. Laboratory QC samples were collected and analyzed according to the procedures described in Procedure III-A *Laboratory QC Samples (Water, Soil)* (DON, 2007). Laboratory QC MS/MSD samples are an aliquot (i.e., a subset) of the field sample; they are not separate samples, but a special designation of an existing sample. Laboratory QC MS/MSD samples were analyzed for the same constituents as the standard samples. At a minimum, one MS/MSD sample pair was required per 20 samples, including duplicates.

2.6 Equipment Decontamination

Decontamination of monitoring equipment was performed to ensure data quality, to prevent cross contamination, and to prevent the potential introduction of contaminants into previously un-impacted areas. Decontamination of monitoring equipment (i.e., Solinst® water level meter and Horiba® U-22 water quality meter) was conducted between monitoring locations according to the procedures described in Procedure I-F, *Equipment Decontamination* (DON, 2007). Decontamination water generated at monitoring well OWDFMW01 was disposed of in the RHSF’s lower tunnel oil/water separator sump.

2.7 Investigation-Derived Waste Management

Investigation-derived waste (IDW) was managed in accordance with the procedures described in Procedure I-A-6, *IDW Management* (DON, 2007). The various potential waste streams included the following:

- personal protective equipment (PPE), including: nitrile gloves, etc.;
- liquids, including: equipment rinse water and purged groundwater; and
- disposable sampling equipment and supplies, including: bailers, poly sheeting, etc.

Equipment rinse water and purge water from OWDFMW01 was disposed of in the RHSF’s lower tunnel oil/water separator sump. Purge water from monitoring well HDMW2253-03 was disposed of in the surrounding grass (as directed by DLNR) since it was of drinking water quality. Spent PPE and non-contaminated sample jars and bottles (acid-free) were disposed of on a daily basis as solid waste.

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Section 3 Groundwater Analytical Results

This section provides a summary of analytical results for groundwater samples collected from the two outside monitoring wells on April 26, 2012. Complete analytical laboratory reports are provided in Appendix D.

3.1 Summary of Groundwater Analytical Results

OWDFMW01

TPH-DRO was detected in monitoring well OWDFMW01 at a concentration of 220 µg/L, which was above both the DOH Drinking Water EAL (210 µg/L) and Groundwater Gross Contamination EAL (100 µg/L) (Table 3-1). The analyst flagged the result noting that the chromatogram of this sample was mainly non-diesel hydrocarbons within the boiling point range of diesel fuel. The true TPH-DRO concentration is likely lower, but is reported at a higher concentration due to non-diesel hydrocarbons being detected by the analytical method.

Acetone was detected in monitoring well OWDFMW01 at an estimated concentration of 2.8 µg/L, which is below the DOH Drinking Water EAL (22,000 µg/L) and Groundwater Gross Contamination EAL (20,000 µg/L). Benzene was detected in monitoring well OWDFMW01 at an estimated concentration of 0.71 µg/L, which is below the DOH Drinking Water EAL (5 µg/L) and Groundwater Gross Contamination EAL (170 µg/L).

No other COPCs were detected at or above the LODs and LOQs in monitoring well OWDFMW01. All LODs and LOQs were generally below the EALs. In the case where an EAL for a specific COPC is less than the LOQ, it is generally acceptable to consider the LOQ in place of the EAL (DOH, 2009).

HDMW2253-03

TPH-DRO was detected in monitoring well HDMW2253-03 at a concentration of 160 µg/L, which was below the DOH Drinking Water EAL (210 µg/L) and above the Groundwater Gross Contamination EAL (100 µg/L) (Table 3-1). The analyst flagged the result noting that the chromatogram of this sample was mainly non-diesel hydrocarbons within the boiling point range of diesel fuel. The true TPH-DRO concentration is likely lower, but is reported at a higher concentration due to non-diesel hydrocarbons being detected by the analytical method.

Lead was detected in monitoring well HDMW2253-03 at a concentration of 0.71 µg/L, which was below both the DOH Drinking Water EAL (15 µg/L) and Groundwater Gross Contamination EAL (5,000 µg/L). Benzene was detected in monitoring well HDMW2253-03 at an estimated concentration of 0.20 µg/L, which is below the DOH Drinking Water EAL (5 µg/L) and Groundwater Gross Contamination EAL (170 µg/L).

No other COPCs were detected at or above the LODs and LOQs in HDMW2253-03. All LODs and LOQs were generally below the EALs. In the case where an EAL for a specific COPC is less than the LOQ, it is generally acceptable to consider the LOQ in place of the EAL (DOH, 2009).

3.1.1 *Data Quality Control Results*

The laboratory quality control results were generally within the control limits. The relative percent difference (RPD) of field duplicates for all analytes were within the 50% criteria, except for 1-methylnapthalene, 2-methylnapthalene, naphthalene, ethylbenzene, and lead. These analyte concentrations ranged from not detected to very low concentrations below the EALs. Small variation in concentrations at very low (approaching decimal) levels will likely result in RPDs greater than 50%. The RPDs greater than 50% reported for this event would thus not have a significant effect on the overall data quality. The trip blank that accompanied the outside well samples did not contain detectable levels of any COPCs. Therefore, the data quality control results indicate that the data obtained for this monitoring event are suitable for their intended use (Table 3-2).

3.2 Groundwater Contaminant Trend

Concentrations of PAHs and VOCs were previously not detected above the EALs during the August 2009, October 2009, January 2010, April 2010, July 2010, October 2010, January 2011, April 2011, July 2011, October 2011, and January 2012 groundwater monitoring events. These constituents were also not detected above the EALs during this current groundwater monitoring event (April 2012).

TPH-DRO concentrations in OWDFMW01 significantly decreased from January 2010 (1,490 μg/L) to April 2010 (288 μg/L). The concentrations of TPH-DRO at this monitoring well have decreased to non-detect in the previous six (October 2010, January 2011, April 2011, July 2011, October 2011, and January 2012) consecutive monitoring events (Table 3-3). During the April 2012 monitoring event, the TPH-DRO concentration increased to a level above the EAL. However, the elevated concentration was mainly due to non-diesel hydrocarbons detected by the analytical method.

The concentrations of TPH-DRO at HDMW2253-03 decreased to non-detect for eight consecutive groundwater monitoring events from April 2010 to January 2012 (Table 3-3). During the April 2012 monitoring event, the TPH-DRO concentration increased slightly to a level below the EAL. However, the elevated concentration was mainly due to non-diesel hydrocarbons detected by the analytical method.

The October 2010 detection of acetone at an estimated concentration below the DOH Drinking Water EAL was the first at monitoring well OWDFMW01. Acetone was also detected at an estimated concentration in the trip blank sample during that same event. This suggested that acetone was introduced to the samples during transport to and from the laboratory and was not representative of groundwater at OWDFMW01. The concentration of acetone decreased to non-detect for five consecutive monitoring events from January 2011 to January 2012. Acetone was again detected at an estimated concentration at monitoring well OWDFMW01 in the April 2012 monitoring event. The April 2012 detection marked the second event in which acetone was detected at an estimated concentration at the monitoring well. However, none of the trip blanks for this monitoring event contained traces of the analyte, indicating that acetone was present at very low levels in the groundwater.

The October 2010 detections of lead at concentrations below the DOH Drinking Water EAL were the first at these two monitoring wells (OWDFMW01 and HDMW2253-03). Lead was not detected in any of the samples in the January 2011 monitoring event or during April 2011. Estimated concentrations of lead below the DOH Drinking Water EAL were detected at both wells during the July 2011 and October 2011 monitoring events. Lead was detected at estimated concentrations below the DOH Drinking Water EAL in monitoring well HDMW2253-03 and in monitoring well OWDFMW01 in the January 2012 monitoring event. In the April 2012 monitoring event, lead was detected at a concentration below the DOH Drinking Water EAL at HDMW2253-03 and was not detected at OWDFMW01. Lead concentrations in both monitoring wells have fluctuated below the DOH Drinking Water EAL. The concentrations, at which lead has been detected, were very low to be of concern relative to the DOH Drinking Water EAL.

The January 2011 detection of benzene at an estimated concentration below the DOH Drinking Water EAL in OWDFMW01 was the first at this monitoring well. Benzene was detected at an estimated concentration in the duplicate sample collected from OWDFMW01 in April 2011; however, it was not detected in the July 2011 monitoring event. It was detected at an estimated concentration below the DOH Drinking Water EAL in HDMW2253-03 in the October 2011 monitoring event. During the January 2012 monitoring event, benzene was detected at an estimated concentration below the Drinking Water EAL in monitoring well OWDFMW01. During the April 2012 monitoring event, benzene was detected at estimated concentrations below the Drinking Water EAL at both OWDFMW01 and HDMW2253-03 (Table 3-1). Benzene concentrations have fluctuated below the DOH Drinking Water EAL in monitoring wells HDMW2253-03 and OWDFMW01. The estimated concentrations, at which benzene has been detected, were very low to be of concern relative to the DOH Drinking Water EAL.

The April 2011 detections of xylenes and toluene below the DOH Drinking Water EALs in OWDFMW01 were the first at these monitoring wells. Xylenes and toluene were not detected in the July 2011, October 2011, January 2012, and April 2012 monitoring events (Table 3-1). Xylene and toluene concentrations have exhibited no trends in both monitoring wells. The April 2011 xylene and toluene detections were estimated concentrations and were very low to be of concern relative to the DOH Drinking Water EALs.

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Table 3-1: Analytical Results for Quarterly Groundwater Monitoring-Outside (Non-Tunnel) Wells, April 2012

Method	Chemical	DOH Drinking Water EALs for Human Toxicity[a]	DOH Groundwater Gross Contamination EALs[a]	OWDFMW01 (ES077)					HDMW2253-03 (ES076)				
				Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL
EPA 8015B (Petroleum)	TPH-DRO	210	100	**220**	++	150	80.8	40.4	**160**	++	150	80.8	40.4
EPA 8260B (Petroleum)	TPH-GRO	100	100	ND	U	20.0	12.12	6.06	ND	U	20.0	12.12	6.06
EPA 8270D SIM (PAHs)	Acenaphthene	370	20	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06
	Acenaphthylene	240	2000	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06
	Anthracene	1800	22	ND	U	0.2	0.10	0.05	ND	U	0.2	0.10	0.05
	Benzo(a)anthracene	0.092	4.7	ND	U	0.2[b]	0.14	0.07	ND	U	0.2[b]	0.14	0.07
	Benzo(g,h,i)perylene	1500	0.13	ND	U	0.2[b]	0.16	0.08	ND	U	0.2[b]	0.16	0.08
	Benzo(a)pyrene	0.2	0.81	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06
	Benzo(b)fluoranthene	0.092	0.75	ND	U	0.2[b]	0.12	0.06	ND	U	0.2[b]	0.12	0.06
	Benzo(k)fluoranthene	0.92	0.4	ND	U	0.2	0.14	0.07	ND	U	0.2	0.14	0.07
	Chrysene	9.2	1	ND	U	0.2	0.10	0.05	ND	U	0.2	0.10	0.05
	Dibenzo(a,h)anthracene	0.0092	0.52	ND	U	0.2[b]	0.10	0.05	ND	U	0.2[b]	0.10	0.05
	Fluoranthene	1500	130	ND	U	0.2	0.16	0.08	ND	U	0.2	0.16	0.08
	Fluorene	240	950	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06
	Indeno(1,2,3-cd)pyrene	0.092	0.095	ND	U	0.2[b]	0.14	0.07	ND	U	0.2[b]	0.14	0.07
	1,-Methylnaphthalene	4.7	10	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06
	2,-Methylnaphthalene	24	10	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06
	Naphthalene	17	21	ND	U	0.2	0.10	0.05	ND	U	0.2	0.10	0.05
	Phenanthrene	240	410	ND	U	0.2	0.14	0.07	ND	U	0.2	0.14	0.07
	Pyrene	180	68	ND	U	0.2	0.16	0.08	ND	U	0.2	0.16	0.08
EPA 8260B (VOCs)	1,1,1-Trichloroethane	200	970	ND	U	1.0	0.28	0.14	ND	U	1.0	0.28	0.14
	1,1,2-Trichloroethane	5	50,000	ND	U	1.0	0.40	0.20	ND	U	1.0	0.40	0.20
	1,1-Dichloroethane	2.4	50,000	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	1,1-Dichloroethylene (1,1-Dichloroethene)	7	1,500	ND	U	1.0	0.60	0.30	ND	U	1.0	0.60	0.30
	1,2,3-Trichloropropane	0.6	50,000	ND	U	2.0[b]	0.78	0.39	ND	U	2.0[b]	0.78	0.39
	1,2,4-Trichlorobenzene	70	3,000	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21
	1,2-Dibromo-3-chloropropane	0.04	10	ND	U	2.0[b]	1.52	0.76	ND	U	2.0[b]	1.52	0.76
	1,2-Dibromoethane	0.04	50,000	ND	U	1.0[b]	0.40	0.20	ND	U	1.0[b]	0.40	0.20
	1,2-Dichlorobenzene	600	10	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17
	1,2-Dichloroethane	0.15	7,000	ND	U	1.0[b]	0.28	0.14	ND	U	1.0[b]	0.28	0.14
	1,2-Dichloropropane	5	10	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17
	1,3-Dichlorobenzene	180	5	ND	U	1.0	0.22	0.11	ND	U	1.0	0.22	0.11
	1,3-Dichloropropene (total of cis/trans)	0.43	50,000	ND	U	1.0	0.36	0.18	ND	U	1.0	0.36	0.18
	1,4-Dichlorobenzene	75	5	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	Acetone	22,000	20,000	2.8	J	10.0	1.90	0.95	ND	U	10.0	1.90	0.95
	Benzene	5	170	0.71	J	1.0	0.32	0.16	0.20	J	1.0	0.32	0.16
	Bromodichloromethane	0.12	50,000	ND	U	1.0[b]	0.28	0.14	ND	U	1.0[b]	0.28	0.14
	Bromoform	80	510	ND	U	1.0	0.28	0.14	ND	U	1.0	0.28	0.14
	Bromomethane	8.7	50,000	ND	U	2.0	0.48	0.24	ND	U	2.0	0.48	0.24
	Carbon Tetrachloride	5	520	ND	U	1.0	0.20	0.10	ND	U	1.0	0.20	0.10
	Chlorobenzene	100	50	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21
	Chloroethane	21,000	16	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21
	Chloroform	70	2,400	ND	U	1.0	0.14	0.07	ND	U	1.0	0.14	0.07
	Chloromethane	1.8	50,000	ND	U	1.0	0.84	0.42	ND	U	1.0	0.84	0.42
	cis-1,2-Dichloroethylene (cis-1,2-Dichloroethene)	70	50,000	ND	U	1.0	0.32	0.16	ND	U	1.0	0.32	0.16
	Dibromochloromethane (Chlorodibromomethane)	0.16	50,000	ND	U	1.0[b]	0.38	0.19	ND	U	1.0[b]	0.38	0.19
	Ethylbenzene	700	30	ND	U	1.0	0.46	0.23	ND	U	1.0	0.46	0.23
	Hexachlorobutadiene	0.86	6	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	Methyl ethyl ketone (2-Butanone)	7,100	8,400	ND	U	10.0	1.20	0.60	ND	U	10.0	1.20	0.60
	Methyl isobutyl ketone (4-Methyl-2-pentanone)	2,000	1,300	ND	U	10.0	3.80	1.90	ND	U	10.0	3.80	1.90
	Methyl tert-butyl Ether	12	5	ND	U	1.0	0.52	0.26	ND	U	1.0	0.52	0.26
	Methylene chloride	4.8	9,100	ND	U	5.0	0.70	0.35	ND	U	5.0	0.70	0.35
	Styrene	100	10	ND	U	1.0	0.50	0.25	ND	U	1.0	0.50	0.25
	Tetrachloroethane, 1,1,1,2-	0.52	50,000	ND	U	1.0	0.26	0.13	ND	U	1.0	0.26	0.13
	Tetrachloroethane, 1,1,2,2-	0.067	500	ND	U	1.0[b]	0.20	0.10	ND	U	1.0[b]	0.20	0.10
	Tetrachloroethylene (Tetrachloroethene)	5	170	ND	U	1.0	0.48	0.24	ND	U	1.0	0.48	0.24
	Toluene	1,000	40	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17
	trans-1,2-Dichloroethylene (trans-1,2-Dichloroethene)	100	260	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	Trichloroethylene (Trichloroethene)	5	310	ND	U	1.0	0.32	0.16	ND	U	1.0	0.32	0.16
	Vinyl chloride	2	3,400	ND	U	1.0	0.46	0.23	ND	U	1.0	0.46	0.23
	Xylenes	10,000	20	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
EPA 6020	Lead	15	5,000	ND	U	0.5	0.22	0.11	0.71		0.5	0.22	0.11

Notes:

All units are in micrograms per liter (µg/L).

[a] DOH EALs (DOH, 2009): Table D-1b. Groundwater Action Levels (Groundwater is a current or potential drinking water resource; surface water body is not located within 150 meters of release site).

[b] In the case where an EAL for a specific chemical is less than the LOQ for a commercial laboratory, it is generally acceptable to consider the LOQ in place of the action level (DOH, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater 2008, updated March 2009).

++ - Analyst has noted that the chromatogram of this sample is mainly non-diesel hydrocarbons within the boiling point range of diesel fuel.

DL - detection limit or method detection limit (MDL)

DRO - diesel range organics

GRO - gasoline range organics

J - Estimated result. Indicates that the compound was identified, but the concentration was above the DL and below the LOQ.

LOD - limit of detection

LOQ - limit of quantitation or reporting limit (RL)

ND - not detected

PAHs - polycyclic aromatic hydrocarbons

Q - data qualifier

TPH - total petroleum hydrocarbons

U - Indicates the compound or analyte was analyzed for, but not detected. The result is reported as ND.

VOC - volatile organic compound

LODs will be included in the final report.

Bold - Result exceeds one or both DOH EALs

Table 3-2: Field QC Results-Outside Wells, April 2012

Method	Chemical	DOH Drinking Water EALs for Human Toxicity[a]	DOH Groundwater Gross Contamination EALs[a]	RHMW02 ES071					RHMW02 ES072					RPD Duplicate (%)	Trip Blank (04/26/2012)					Trip Blank 1 (04/26/2012)				
				Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL		Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL
EPA 8015B (Petroleum)	TPH-DRO	210	100	**1,200**	++	150[b]	80.8	40.4	**1,100**	++	150[b]	80.8	40.4	8.69	--	--	--	--	--	--	--	--	--	--
EPA 8260B (Petroleum)	TPH-GRO	100	100	ND	U	20.0	12.12	6.06	ND	U	20.0	12.12	6.06	0	ND	U	20.0	12.12	6.06	ND	U	20.0	12.12	6.06
EPA 8270D SIM (PAHs)	Acenaphthene	370	20	0.26		0.2	0.12	0.06	0.23		0.2	0.12	0.06	12.2	--	--	--	--	--	--	--	--	--	--
	Acenaphthylene	240	2000	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06	0	--	--	--	--	--	--	--	--	--	--
	Anthracene	1800	22	ND	U	0.2	0.10	0.05	ND	U	0.2	0.10	0.05	0	--	--	--	--	--	--	--	--	--	--
	Benzo(a)anthracene	0.092	4.7	ND	U	0.2[b]	0.14	0.07	ND	U	0.2[b]	0.14	0.07	0	--	--	--	--	--	--	--	--	--	--
	Benzo(g,h,i)perylene	1500	0.13	ND	U	0.2[b]	0.16	0.08	ND	U	0.2[b]	0.16	0.08	0	--	--	--	--	--	--	--	--	--	--
	Benzo(a)pyrene	0.2	0.81	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06	0	--	--	--	--	--	--	--	--	--	--
	Benzo(b)fluoranthene	0.092	0.75	ND	U	0.2[b]	0.12	0.06	ND	U	0.2[b]	0.12	0.06	0	--	--	--	--	--	--	--	--	--	--
	Benzo(k)fluoranthene	0.92	0.4	ND	U	0.2	0.14	0.07	ND	U	0.2	0.14	0.07	0	--	--	--	--	--	--	--	--	--	--
	Chrysene	9.2	1	ND	U	0.2	0.10	0.05	ND	U	0.2	0.10	0.05	0	--	--	--	--	--	--	--	--	--	--
	Dibenzo(a,h)anthracene	0.0092	0.52	ND	U	0.2[b]	0.10	0.05	ND	U	0.2[b]	0.10	0.05	0	--	--	--	--	--	--	--	--	--	--
	Fluoranthene	1500	130	ND	U	0.2	0.16	0.08	ND	U	0.2	0.16	0.08	0	--	--	--	--	--	--	--	--	--	--
	Fluorene	240	950	0.14	J	0.2	0.12	0.06	0.12	J	0.2	0.12	0.06	15.4	--	--	--	--	--	--	--	--	--	--
	Indeno(1,2,3-cd)pyrene	0.092	0.095	ND	U	0.2[b]	0.14	0.07	ND	U	0.2[b]	0.14	0.07	0	--	--	--	--	--	--	--	--	--	--
	1,-Methylnaphthalene	4.7	10	0.3		0.2	0.12	0.06	1.2		0.2	0.12	0.06	120	--	--	--	--	--	--	--	--	--	--
	2,-Methylnaphthalene	24	10	ND	U	0.2	0.12	0.06	0.61		0.2	0.12	0.06	134	--	--	--	--	--	--	--	--	--	--
	Naphthalene	17	21	0.86		0.2	0.10	0.05	2.9		0.2	0.10	0.05	109	--	--	--	--	--	--	--	--	--	--
	Phenanthrene	240	410	ND	U	0.2	0.14	0.07	ND	U	0.2	0.14	0.07	0	--	--	--	--	--	--	--	--	--	--
	Pyrene	180	68	ND	U	0.2	0.16	0.08	ND	U	0.2	0.16	0.08	0	--	--	--	--	--	--	--	--	--	--
EPA 8260B (VOCs)	1,1,1-Trichloroethane	200	970	ND	U	1.0	0.28	0.14	ND	U	1.0	0.28	0.14	0	ND	U	1.0	0.28	0.14	ND	U	1.0	0.28	0.14
	1,1,2-Trichloroethane	5	50,000	ND	U	1.0	0.40	0.20	ND	U	1.0	0.40	0.20	0	ND	U	1.0	0.40	0.20	ND	U	1.0	0.40	0.20
	1,1-Dichloroethane	2.4	50,000	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19	0	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	1,1-Dichloroethylene (1,1-Dichloroethene)	7	1,500	ND	U	1.0	0.60	0.30	ND	U	1.0	0.60	0.30	0	ND	U	1.0	0.60	0.30	ND	U	1.0	0.60	0.30
	1,2,3-Trichloropropane	0.6	50,000	ND	U	2.0[b]	0.78	0.39	ND	U	2.0[b]	0.78	0.39	0	ND	U	2.0[b]	0.78	0.39	ND	U	2.0[b]	0.78	0.39
	1,2,4-Trichlorobenzene	70	3,000	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21	0	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21
	1,2-Dibromo-3-chloropropane	0.04	10	ND	U	2.0[b]	1.52	0.76	ND	U	2.0[b]	1.52	0.76	0	ND	U	2.0[b]	1.52	0.76	ND	U	2.0[b]	1.52	0.76
	1,2-Dibromoethane	0.04	50,000	ND	U	1.0[b]	0.40	0.20	ND	U	1.0[b]	0.40	0.20	0	ND	U	1.0[b]	0.40	0.20	ND	U	1.0[b]	0.40	0.20
	1,2-Dichlorobenzene	600	10	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17	0	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17
	1,2-Dichloroethane	0.15	7,000	ND	U	1.0[b]	0.28	0.14	ND	U	1.0[b]	0.28	0.14	0	ND	U	1.0[b]	0.28	0.14	ND	U	1.0[b]	0.28	0.14
	1,2-Dichloropropane	5	10	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17	0	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17
	1,3-Dichlorobenzene	180	5	ND	U	1.0	0.22	0.11	ND	U	1.0	0.22	0.11	0	ND	U	1.0	0.22	0.11	ND	U	1.0	0.22	0.11
	1,3-Dichloropropene (total of cis/trans)	0.43	50,000	ND	U	1.0[b]	0.36	0.18	ND	U	1.0[b]	0.36	0.18	0	ND	U	1.0	0.36	0.18	ND	U	1.0	0.36	0.18
	1,4-Dichlorobenzene	75	5	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19	0	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	Acetone	22,000	20,000	ND	U	10.0	1.90	0.95	ND	U	10.0	1.90	0.95	0	ND	U	10.0	1.90	0.95	ND	U	10.0	1.90	0.95
	Benzene	5	170	ND	U	1.0	0.32	0.16	ND	U	1.0	0.32	0.16	0	ND	U	1.0	0.32	0.16	ND	U	1.0	0.32	0.16
	Bromodichloromethane	0.12	50,000	ND	U	1.0[b]	0.28	0.14	ND	U	1.0[b]	0.28	0.14	0	ND	U	1.0[b]	0.28	0.14	ND	U	1.0[b]	0.28	0.14
	Bromoform	80	510	ND	U	1.0	0.28	0.14	ND	U	1.0	0.28	0.14	0	ND	U	1.0	0.28	0.14	ND	U	1.0	0.28	0.14
	Bromomethane	8.7	50,000	ND	U	2.0	0.48	0.24	ND	U	2.0	0.48	0.24	0	ND	U	2.0	0.48	0.24	ND	U	2.0	0.48	0.24
	Carbon Tetrachloride	5	520	ND	U	1.0	0.20	0.10	ND	U	1.0	0.20	0.10	0	ND	U	1.0	0.20	0.10	ND	U	1.0	0.20	0.10
	Chlorobenzene	100	50	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21	0	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21
	Chloroethane	21,000	16	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21	0	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21
	Chloroform	70	2,400	ND	U	1.0	0.14	0.07	ND	U	1.0	0.14	0.07	0	ND	U	1.0	0.14	0.07	ND	U	1.0	0.14	0.07
	Chloromethane	1.8	50,000	ND	U	1.0	0.84	0.42	ND	U	1.0	0.84	0.42	0	ND	U	1.0	0.84	0.42	ND	U	1.0	0.84	0.42
	cis-1,2-Dichloroethylene (cis-1,2-Dichloroethene)	70	50,000	ND	U	1.0	0.32	0.16	ND	U	1.0	0.32	0.16	0	ND	U	1.0	0.32	0.16	ND	U	1.0	0.32	0.16
	Dibromochloromethane (Chlorodibromomethane)	0.16	50,000	ND	U	1.0[b]	0.38	0.19	ND	U	1.0[b]	0.38	0.19	0	ND	U	1.0[b]	0.38	0.19	ND	U	1.0[b]	0.38	0.19
	Ethylbenzene	700	30	ND	U	1.0	0.46	0.23	0.23	J	1.0	0.46	0.23	66.7	ND	U	1.0	0.46	0.23	ND	U	1.0	0.46	0.23
	Hexachlorobutadiene	0.86	6	ND	U	1.0[b]	0.38	0.19	ND	U	1.0[b]	0.38	0.19	0	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	Methyl ethyl ketone (2-Butanone)	7,100	8,400	ND	U	10.0	1.20	0.60	ND	U	10.0	1.20	0.60	0	ND	U	10.0	1.20	0.60	ND	U	10.0	1.20	0.60
	Methyl isobutyl ketone (4-Methyl-2-pentanone)	2,000	1,300	ND	U	10.0	3.80	1.90	ND	U	10.0	3.80	1.90	0	ND	U	10.0	3.80	1.90	ND	U	10.0	3.80	1.90
	Methyl tert-butyl Ether	12	5	ND	U	1.0	0.52	0.26	ND	U	1.0	0.52	0.26	0	ND	U	1.0	0.52	0.26	ND	U	1.0	0.52	0.26
	Methylene chloride	4.8	9,100	ND	U	5.0[b]	0.70	0.35	ND	U	5.0[b]	0.70	0.35	0	ND	U	5.0	0.70	0.35	ND	U	5.0	0.70	0.35
	Styrene	100	10	ND	U	1.0	0.50	0.25	ND	U	1.0	0.50	0.25	0	ND	U	1.0	0.50	0.25	ND	U	1.0	0.50	0.25
	Tetrachloroethane, 1,1,1,2-	0.52	50,000	ND	U	1.0[b]	0.26	0.13	ND	U	1.0[b]	0.26	0.13	0	ND	U	1.0	0.26	0.13	ND	U	1.0	0.26	0.13
	Tetrachloroethane, 1,1,2,2-	0.067	500	ND	U	1.0[b]	0.20	0.10	ND	U	1.0[b]	0.20	0.10	0	ND	U	1.0[b]	0.20	0.10	ND	U	1.0[b]	0.20	0.10
	Tetrachloroethylene (Tetrachloroethene)	5	170	ND	U	1.0	0.48	0.24	ND	U	1.0	0.48	0.24	0	ND	U	1.0	0.48	0.24	ND	U	1.0	0.48	0.24
	Toluene	1,000	40	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17	0	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17
	trans-1,2-Dichloroethylene (trans-1,2-Dichloroethene)	100	260	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19	0	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	Trichloroethylene (Trichloroethene)	5	310	ND	U	1.0	0.32	0.16	ND	U	1.0	0.32	0.16	0	ND	U	1.0	0.32	0.16	ND	U	1.0	0.32	0.16
	Vinyl chloride	2	3,400	ND	U	1.0	0.46	0.23	ND	U	1.0	0.46	0.23	0	ND	U	1.0	0.46	0.23	ND	U	1.0	0.46	0.23
	Xylenes	10,000	20	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19	0	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
EPA 6020	Lead	15	5000	0.44		0.2	0.11	0.11	ND	U	0.2	0.11	0.11	66.7		--	--	--	--		--	--	--	--

Notes:

All units are in micrograms per liter (µg/L).

[a] DOH EALs (DOH, 2009): Table D-1b. Groundwater Action Levels (Groundwater is a current or potential drinking water resource; surface water body is not located within 150 meters of

[b] In the case where an EAL for a specific chemical is less than the LOQ for a commercial laboratory, it is generally acceptable to consider the LOQ in place of the action level (DOH, and Groundwater 2008, updated March 2009).

++ - Analyst has noted that the chromatogram of this sample is mainly non-diesel hydrocarbons within the boiling point range of diesel fuel.

DL - detection limit or method detection limit (MDL)

DRO - diesel range organics

dup - duplicate

GRO - gasoline range organics

J - Estimated result. Indicates that the compound was identified, but the concentration was above the DL and below the LOQ.

LOD - limit of detection

LOQ - limit of quantitation or reporting limit (RL)

PAHs - polycyclic aromatic hydrocarbons

Q - data qualifier

RPD - relative percent difference

TPH - total petroleum hydrocarbons

U - Indicates the compound or analyte was analyzed for, but not detected. The result is reported as ND.

VOC - volatile organic compound

-- not analyzed

LODs will be included in the final report

Bold - Result exceeds one or both DOH EALs

Table 3-3: Historical and Current Groundwater Sample Analytical Results, August 2009 through April 2012

	OWDFMW01										**HDMW2253-03**									
	TPH-DRO					**TPH-GRO**					**TPH-DRO**					**TPH-GRO**				
	Result	**Q**	**LOQ**	**LOD**	**DL**	**Result**	**Q**	**LOQ**	**LOD**	**DL**	**Result**	**Q**	**LOQ**	**LOD**	**DL**	**Result**	**Q**	**LOQ**	**LOD**	**DL**
August 2009	ND	U	457	NA	171	ND	U	100	NA	30	--	--	--	NA	--	--	--	--	NA	--
October 2009	ND	U	444	NA	167	ND	U	100	NA	30	ND	U	494	NA	185	ND	U	100	NA	30
January 2010	**1,490**		440	NA	165	ND	U	100	NA	30	**322**	J	460	NA	172	ND	U	100	NA	30
April 2010	**288**	J	471	NA	176	ND	U	100	NA	30	ND	U	471	NA	176	ND	U	100	NA	30
July 2010	--	--	--	--	--	--	--	--	--	--	ND	U	426	--	160	ND	U	100	--	30
October 2010	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06
January 2011	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06
April 2011	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06
July 2011	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06
October 2011	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06
January 2012	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06
April 2012	**220**	++	150	80.8	40.4	ND	U	20.0	12.1	6.06	**160**	++	150	80.8	40.4	ND	U	20.0	12.1	6.06

DOH Drinking Water EALs for Human Toxicity [a] *: TPH-DRO = 210 µg/L; TPH-GRO = 100 µg/L*

DOH Groundwater Gross Contamination EALs [a] *: TPH-DRO = 100 µg/L; TPH-GRO = 100 µg/L*

Notes:

All units are in micrograms per liter (µg/L)

[a] DOH EALs (DOH, 2009): Table D-1b. Groundwater Action Levels (Groundwater is a current or potential drinking water resource; surface water body is not located within 150 meters of release site).

-- The monitoring well was not sampled.

++ - Analyst noted that the chromatogram of this sample is mainly non-diesel hydrocarbons within the boiling point range of diesel fuel.

DL - detection limit or method detection limit (MDL)

J - Estimated result. Indicates that the compound was identified, but the concentration was above the DL and below the LOQ.

LOD - limit of detection

LOQ - limit of quantitation or reporting limit (RL)

NA - not available

ND - not detected

Q - data qualifier

U - Indicates that the compound was analyzed for, but not detected. The result is reported as ND.

Bold - Result exceeds one or both DOH EALs

Section 4 Summary, Conclusions, and Recommendations

4.1 Summary

TPH-DRO was detected at concentrations of 220 µg/L and 160 µg/L in monitoring wells OWDFMW01 and HDMW2253-03, respectively during the April 2012 groundwater monitoring event. The concentration detected at monitoring well OWDFMW01 was above both the DOH Drinking Water EAL (210 µg/L) and the DOH Groundwater Gross Contamination EAL (100 µg/L). The concentration at monitoring well HDMW2253-03 was above the DOH Groundwater Gross Contamination EAL (100 µg/L). Lead was detected at a concentration of 0.71 µg/L in monitoring well HDMW2253-03, which was below the DOH Drinking Water EAL (5 µg/L) and the DOH Groundwater Gross Contamination EAL (5,000 µg/L). Acetone was detected at an estimated concentration of 2.8 µg/L in monitoring well OWDFMW01, which is below the DOH Drinking Water EAL (22,000 µg/L) and the DOH Gross Contamination EAL (20,000 µg/L). Benzene was detected at a estimated concentrations of 0.71 µg/L and 0.20 µg/L in monitoring wells OWDFMW01 and HDMW2253-03, respectively, which are below the DOH Drinking Water EAL (5 µg/L) and the DOH Groundwater Gross Contamination EAL (170 µg/L). No other COPCs were detected in monitoring wells HDMW2253-03 and OWDFMW01 during the April 2012 monitoring event.

4.2 Conclusions

Concentrations of PAHs and VOCs were previously not detected above the EALs during the August 2009, October 2009, January 2010, April 2010, July 2010, October 2010, January 2011, April 2011, July 2011, October 2011, and January 2012 groundwater monitoring events. PAHs and VOCs were also not detected above the EALs during the April 2012 monitoring event. The data continues to suggest that historically, TPH-DRO was the only COPC present in any notable quantity for the site.

TPH-DRO concentrations in OWDFMW01 significantly decreased from January 2010 (1,490 µg/L) to April 2010 (288 µg/L) and were not detected in the subsequent six monitoring events (Table 3-3). The concentrations of TPH-DRO at HDMW2253-03 decreased from 322 µg/L in January 2010 to non-detectable levels for the eight consecutive quarterly monitoring events from April 2010 to January 2012. During the April 2012 monitoring event, the TPH-DRO concentration from OWDFMW01 increased to a level above the DOH Drinking Water EAL. TPH-DRO concentration in HDMW2253-03 also increased but to a level below the DOH Drinking Water EAL. The laboratory flagged both results noting that the chromatograms of the samples indicated mainly non-diesel hydrocarbons within the boiling point range of diesel fuel. MADEP EPH analytical results in the October 2011 monitoring event indicated that the detected hydrocarbons were most likely from non-petroleum sources. The true TPH-DRO concentrations of the samples are likely lower, but are reported at higher concentrations as a result of non-diesel hydrocarbons detected by the analytical method.

The October 2010 detection of acetone at an estimated concentration below the DOH Drinking Water EAL was the first at monitoring well OWDFMW01. Acetone was also detected at an estimated concentration in the trip blank sample in October 2010. Acetone was not detected in the subsequent five monitoring events. This strongly suggested that acetone was introduced to the samples during transport to and from the laboratory. During the April 2012 monitoring event, acetone was again detected at an estimated concentration in monitoring well OWDFMW01 below the DOH Drinking Water EAL. None of the trip blanks for the April 2012 monitoring event contained traces of the analyte, indicating that acetone was present at very low levels in the groundwater.

The October 2010 detections of lead at concentrations below the DOH Drinking Water EAL were the first at these two monitoring wells (OWDFMW01 and HDMW2253-03). Lead was not detected in any samples during the January 2011 monitoring event or during the April 2011 monitoring event. Lead was detected at estimated concentrations below the DOH Drinking Water EAL at both monitoring wells during the July 2011 monitoring event. Lead was detected in monitoring well HDMW2253-03 at a concentration below the DOH Drinking Water EAL and in monitoring well OWDFMW01 at an estimated concentration below the DOH Drinking Water EAL during the October 2011 monitoring event. Lead was detected in monitoring wells OWDFMW01 and HDMW2253-03 at estimated concentrations below the DOH Drinking Water EAL during the January 2012 monitoring event. Lead was detected in monitoring well HDMW2253-03 below the DOH Drinking Water EAL in the April 2012 monitoring event. Lead concentrations in both monitoring wells have fluctuated at very low levels below the DOH Drinking Water EAL.

The January 2011 detection of benzene at an estimated concentration below the DOH Drinking Water EAL in OWDFMW01 was the first at this monitoring well. Benzene was detected at an estimated concentration in the duplicate sample collected from OWDFMW01 in April 2011; however, it was not detected in the July 2011 and October 2011 monitoring events. It was detected at an estimated concentration below the DOH Drinking Water EAL in HDMW2253-03 in the October 2011 monitoring event. Benzene was detected at an estimated concentration in monitoring well OWDFMW01 during the January 2012 monitoring event, which was below the Drinking Water EAL. Benzene was detected at estimated concentrations below the DOH Drinking Water EAL at monitoring wells OWDFMW01 and HDMW2253-03 during the April 2012 monitoring event. Benzene concentrations have fluctuated in both monitoring wells at very low levels below the DOH Drinking Water EAL.

The April 2011 detections of xylenes and toluene in OWDFMW01 were the first at these monitoring wells. Xylenes and toluene were not detected in the July 2011, October 2011, January 2012, and April 2012 monitoring events. Xylene and toluene concentrations have exhibited no trends, and the April 2011 detections of both analytes were very low to be of concern relative the DOH Drinking Water EALs.

4.3 Recommendations

TPH-DRO was detected above the DOH Drinking Water EAL at monitoring well OWDFMW01 during the April 2012 monitoring event. The TPH-DRO concentration detected above the EAL is believed to be the result of non-diesel hydrocarbons within the boiling point range of diesel fuel being detected by the analytical method. MADEP EPH analytical results in the October 2011 monitoring event indicated that the detected hydrocarbons were most likely from non-petroleum sources. It is recommended that quarterly sampling remain the same and attention be paid to concentration levels at both monitoring wells for signs of contaminant migration.

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Section 5 References

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Environet, 2010. *Work Plan, Long-Term Monitoring, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, O‘ahu, Hawai‘i*. September.

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Appendix A
DOH Correspondence

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

In reply, please refer to:
File:

December 8, 2010

U1217RT

Ms. Raelynn Della Sala
Navy Region Hawaii
850 Ticonderoga Street, Suite 110
Pearl Harbor, Hawaii 96860-5101

Dear Ms. Della Sala:

SUBJECT: Red Hill Tank Complex
Facility ID 9-102271 / Release IDs 990051, 010011, 020028

The Department of Health (DOH) has reviewed the following reports:

1. *Quarterly Groundwater Monitoring Report Red Hill Fuel Storage Facility,* dated May 2008 and prepared by TEC, Inc.

2. *Quarterly Groundwater Monitoring Report Red Hill Fuel Storage Facility,* dated February 2009 and prepared by TEC, Inc.

3. *Quarterly Groundwater Monitoring Report Red Hill Fuel Storage Facility*, dated April 2009 and prepared by TEC, Inc.

4. *Quarterly Groundwater Monitoring Report Red Hill Fuel Storage Facility*, dated July 2009 and prepared by TEC, Inc.

5. *Quarterly Groundwater Monitoring Report Red Hill Fuel Storage Facility,* dated September 2009 and prepared by TEC, Inc.

6. *Quarterly Groundwater Monitoring Report – Outside (Non-Tunnel) Wells*, dated September 2009 and prepared by TEC, Inc.

7. *API 653 Inspection and Repair Records for Red Hill Tank 15*, dated December 7, 2009 and prepared by Dunkin & Bush, Inc.

8. *Quarterly Groundwater Monitoring Report – Outside (Non-Tunnel) Wells*, dated December 2009 and prepared by TEC, Inc.

9. *Quarterly Groundwater Monitoring Report Red Hill Fuel Storage Facility*, dated December 2009 and prepared by TEC, Inc.

10. *Quarterly Groundwater Monitoring Report Red Hill Fuel Storage Facility*, dated April 2010 and prepared by TEC, Inc.

11. *Quarterly Groundwater Monitoring Report – Outside (Non-Tunnel) Wells*, dated April 2010 and prepared by TEC, Inc.

12. *Quarterly Groundwater Monitoring Report Red Hill Fuel Storage Facility*, dated May 2010 and prepared by TEC, Inc.

13. *Quarterly Groundwater Monitoring Report – Outside (Non-Tunnel) Wells*, dated May 2010 and prepared by TEC, Inc.

14. *Type 1 Letter Report – Re-evaluation of the Tier 3 Risk Assessment/Groundwater Model & Proposed Course of Action Red Hill Bulk Fuels Storage Facility*, dated May 4, 2010 and prepared Tec, Inc.

15. *Quarterly Groundwater Monitoring Report Red Hill Fuel Storage Facility*, dated August 2010 and prepared by TEC, Inc.

16. *Quarterly Groundwater Monitoring Report – Outside (Non-Tunnel) Wells*, dated August 2010 and prepared by TEC, Inc.

17. *Work Plan, Long-Term Monitoring*, dated September 2010 and prepared by Naval Facilities Engineering Command.

Please note the reports have been placed with the public record.

Since 2009, groundwater samples from monitoring wells within and outside the Red Hill Tank Complex have revealed low levels of Total Petroleum Hydrocarbons – Gasoline Range Organics (TPH-GRO), Total Petroleum Hydrocarbons – Diesel Range Organics (TPH-DRO), naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. The DOH Hazard Evaluation and Emergency Response (HEER) Office Environmental Action Levels (EALs) are being used at this site, as well as Site Specific Risk Based Levels (SSRBLs) for TPH-DRO.

In addition to TPH-GRO and TPH-DRO, the groundwater samples are analyzed for 18 poly-aromatic hydrocarbon (PAH) compounds, and approximately 40 volatile organic compounds (VOCs), and dissolved Lead. The five specific contaminants mentioned in the previous paragraph were the only compounds detected in these wells during 2009-2010. All others were non-detectable at minimum detection limits below HEER action levels. Due to the nature of the aquifer beneath the site as a current source of drinking water, as well as the

Navy's Drinking Water Pump Station nearby, the most stringent drinking water action levels are employed, the majority in the parts per billion range.

TPH-DRO, naphthalene, and 1-methylnaphthalene continue to be found in monitoring wells RHMW01, RHMW02, and RHMW02D. The July 2010 monitoring event revealed TPH-DRO from 228 to 3,110 parts per billion (ppb) vs. the HEER EAL of 210 ppb and SSRBL of 4,500 ppb. 1-methylnaphthalene was found at 7.05 to 7.43 ppb vs. the HEER EAL of 4.7 ppb. Naphthalene was found at 59 to 61 ppb by Method 8270C and 102 to 107 ppb by Method 8260B vs. the HEER EAL of 17 ppb. Water collected at the Navy's Drinking Water Pump Station was non-detectable for all contaminants above minimum detection limits.

In the wells outside the complex, naphthalene was detected for the first time in monitoring well HDMW2253-03 North of the Red Hill Complex in July 2010 at a concentration of 0.0596 ppb vs. the HEER EAL of 17 ppb. TPH-DRO was detected in this well in January 2010 at 322 ppb vs. the HEER EAL of 210 ppb and SSRBL of 4,500 ppb. TPH-DRO was found at 1,490 ppb vs. the HEER EAL of 210 ppb and SSRBL of 4,500 ppb in monitoring well OWDFMW2 that lies west of the Navy Drinking Water Pump Station.

The DOH concurs that monthly free product checks and soil vapor monitoring should continue as well as quarterly groundwater monitoring of the wells within the complex. It was stated that funding for sampling the wells outside the complex had been completed. The DOH concurs that consideration should be given for periodic sampling of these wells.

Regarding the Type 1 Letter Report, the DOH does not object to additional monitoring wells in the North-West direction. The DOH also concurs with utilizing the MADEP EPH VPH analyses with the current 8260B and 8270C analyses to more accurately determine if the TPH-DRO found is fuel based or from non-petroleum sources.

If you have any questions regarding this letter, please contact Mr. Richard Takaba of our Underground Storage Tank Section at (808) 586-4226.

Sincerely,

STEVEN Y.K. CHANG, P.E., CHIEF
Solid and Hazardous Waste Branch

c: Roger Brewer, DOH-HEER Office
✓Darren Uchima, Navy Region Hawaii
Glenn Yoshinaga, NAVFAC Pacific, Pearl Harbor
Jeff Hart, TEC, Inc., Honolulu

Appendix B
Field Notebook

4-17-12
Activity: Groundwater Sampling
Personell: MS, JT
8:30 - Arrive at Adit 3 conduct health and Safety meeting.
8:45 - Mobilize to pumphouse
9:10 - purge pumphouse MW.
9:30 - sample pumphouse MW (ES074)
took MS/MSD as well (ES074 MS/MSD)
1020 - Mobilize to RHMW01
1100 - Start purge of RHMW01; trouble w/pump at first but got it working after a while.
1230 - Sample RHMW01 (ES075)
1330 - Mobilize out of Red Hill Tunnels
1435 - Arrive at FEDEX and ship samples to APPL, Inc
1500 - Head to Storage, drop off gear
1630 - Arrive back at office.

End of Day

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* Note - need ⑨ VOAs for prim. / MS / MSD - OW - MW
4-26-12
Activity: Groundwater Sampling outer wells
Personell: MS, JT
8:15 - leave office
8:30 - arrive at Storage
9:00 - arrive at HALAWA Prison, check in with guard. Wait for DLNR Staff to clean vegetation.
9:15: conduct health and safety meeting
9:40 - Set up at well
9:50 - begin purging MW.
1030 - Sample HDMW2253-03 (ES076)
1045 - Mobilize to OWMW and begin purge
1130 - Sample OWMW (ES077 MS/MSD)
1209 - Mobilize from OWMW and head to FEDEX.
1258 - Drop off samples at FEDEX, head to Storage

End of Day

Appendix C
Groundwater Sampling Logs

GROUNDWATER SAMPLING LOG

WELL ID: HDMW2253-03 LOCATION: Red Hill Bulk Fuel Storage Facility PROJECT NO: 1022-024

INITIAL WATER LEVEL: 207.76 feet bTOC DATE: 4/26/2012 TIME: 0948

TOTAL DEPTH OF WELL: 1,575 feet bTOC PERSONNEL INVOLVED: MS, JT

LENGTH OF SATURATED ZONE: N/A WEATHER CONDITIONS: Sunny

VOLUME OF WATER TO BE REMOVED: N/A METHOD OF REMOVAL: Bailer

WATER LEVEL AFTER PURGING: N/A PUMPING RATE: 0.75 L/min

WELL PURGE DATA:

TIME	VOLUME REMOVED	pH	COND (mS/cm)	TURBIDITY (NTU)	DO (mg/l)	TEMP (^{o}C)	SALINITY (ppt)	REDOX (ORP) (mV)
0952	3 L	4.35	0.004	184	7.47	25.91	-	263
0955	6 L	6.17	0.437	38.6	2.55	24.91	-	-55
1000	9 L	6.76	0.423	43.3	2.04	24.57	-	-85

SAMPLE RETRIEVAL METHOD: Bailer

SAMPLE ID: ES076

SAMPLE COLLECTION TIME: 1030

SAMPLED BY: MS, JT

APPEARANCE OF SAMPLE:

COLOR Greenish brown

TURBIDITY High

SEDIMENT None

OTHER None

COMMENTS AND OBSERVATIONS: PID = 0.0 ppm

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES: TPH-GRO (EPA 8260B) & VOCs (EPA 8260B) with no preservative
TPH-DRO (EPA8015B) & PAHs (EPA 8270C SIM) with no preservative, and dissolved lead (EPA 6020) with no preservative and not filtered

NUMBER AND TYPES OF SAMPLE CONTAINERS FILLED: (4) - 40 mL VOAs, (4) - 1 L amber bottle, (1) - 500 mL polyethylene bottle

DECONTAMINATION PROCEDURES: Alconox, triple rinse with distilled water

SAMPLES DELIVERED TO: APPL, Inc. TRANSPORTERS: MS, JT

SAMPLE DELIVERY DATE: 4/26/2012 SAMPLE DELIVERY TIME: 1300

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

GROUNDWATER SAMPLING LOG

WELL ID: OWDFMW01 LOCATION: Red Hill Bulk Fuel Storage Facility PROJECT NO: 1022-024

INITIAL WATER LEVEL: 120.29 feet bTOC

DATE: 4/26/2012 TIME: 1057

TOTAL DEPTH OF WELL: 142.8 feet bTOC

PERSONNEL INVOLVED: MS, JT

LENGTH OF SATURATED ZONE: 22.51 feet

WEATHER CONDITIONS: Sunny

VOLUME OF WATER TO BE REMOVED: N/A

METHOD OF REMOVAL: Bailer

WATER LEVEL AFTER PURGING: N/A

PUMPING RATE: 0.64 L/min

WELL PURGE DATA:

TIME	VOLUME REMOVED	pH	COND (mS/cm)	TURBIDITY (NTU)	DO (mg/l)	TEMP (^oC)	SALINITY (%)	REDOX (ORP) (mV)
1104	3 L	11.11	3.25	15.5	5.03	26.04	-	-91
1109	6 L	11.33	3.29	18.5	4.17	26.42	-	-85
1114	9 L	11.35	3.30	17.2	4.19	26.42	-	-80

SAMPLE RETRIEVAL METHOD: Bailer

APPEARANCE OF SAMPLE:

COLOR Clear

TURBIDITY None

SEDIMENT None

OTHER None

SAMPLE ID: ES077 MS/MSD

SAMPLE COLLECTION TIME: 1130

SAMPLED BY: MS, JT

COMMENTS AND OBSERVATIONS: PID = 0.0 ppm

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES: TPH-GRO (EPA 8260B) & VOCs (EPA 8260B) with no preservative

TPH-DRO (EPA8015B) & PAHs (EPA 8270C SIM) with no preservative, and dissolved lead (EPA 6020) with no preservative and not filtered

NUMBER AND TYPES OF SAMPLE CONTAINERS FILLED: Primary: (9) - 40 mL VOAs, (9) - 1 L amber bottle, (1) - 500 mL polyethylene bottle,

DECONTAMINATION PROCEDURES: Alconox, triple rinse with distilled water

SAMPLES DELIVERED TO: APPL, Inc.

TRANSPORTERS: MS, JT

SAMPLE DELIVERY DATE: 4/26/2012

SAMPLE DELIVERY TIME: 1300

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

Appendix D
Laboratory Analytical Results, April 2012 (on CD-ROM)