

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
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and

Mr. Steven Chang, P.E.
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Dear Messrs. Pallarino and Chang:

Subject: Honolulu Board of Water Supply (BWS) Recommendations to the United States Environmental Protection Agency (EPA) for Characterization Activities While the Navy Red Hill Shaft is Pumping at Low Volumes

The Honolulu Board of Water Supply (BWS) recently learned that pumping at the Navy's Red Hill Shaft was suspended since February 2016 due to an inoperable electrical transformer. Since then the Navy has been pumping only small volumes for maintenance purposes. As a result of the minimal pumping at Red Hill Shaft for nearly one year, the groundwater flow patterns in the area has likely switched from a system governed by pumping at both Halawa Shaft and Red Hill Shaft to a system governed by only Halawa Shaft pumping. In the absence of the drawdown beneath the Red Hill tanks caused by Red Hill Shaft for nearly one year, the fuel contaminant plume configuration has likely changed and is following a new groundwater flow pattern.

The BWS is disappointed that the Navy did not to share this important information with the BWS in a timely manner so that we can respond and plan appropriately. The Navy's current monitoring well network was designed to monitor contaminant migration toward Red Hill Shaft. With Red Hill Shaft not pumping, this monitoring well network is poorly positioned to capture the changed configuration of the plume and so, as EPA has previously stated, more sentinel wells are needed. Consequently, the BWS strongly believes that the Navy should immediately install more monitoring wells in Halawa and Moanalua Valleys to find the plume's new location, including installing the proposed monitoring well RHMW11 now.

If the Navy has not resumed normal pumping at the Red Hill Shaft, the current groundwater flow system presents a unique opportunity to collect needed information about how pumping at Halawa Shaft affects groundwater levels beneath the Red Hill Facility and Moanalua and Halawa Valleys and, conversely, when Red Hill Shaft pumping is reinitiated, how pumping at Red Hill Shaft affects groundwater levels beneath the valleys. The data collected means obtaining a clearer understanding of how contaminants of potential concern (COPCs) migrate away from the Red Hill Facility. This, in turn, will provide an improved assessment of risk posed by contaminants at the Red Hill facility to receptors such as Halawa Shaft, Moanalua wells as well as Red Hill Shaft.

BWS would like to see the following site characterization activities, such as data collection and aquifer testing be implemented immediately while Red Hill Shaft is pumping very low volumes and after normal pumping resumes.

1. The frequency of water quality monitoring in all monitoring wells must be immediately increased to intervals of at least once per month. Monthly water quality monitoring has been previously requested several times (BWS, 2015, 2016a, b) and monthly monitoring should be required under the Ground Water Protection Plan (TEC, 2008). Monthly monitoring will help determine if significant changes in the contaminant plume location and migration rate have occurred compared to when Red Hill shaft was pumping. These water quality data will provide a baseline for constituent concentrations representing periods when Red Hill shaft is not pumping.
2. Split samples need to be taken during all future sampling events for Navy monitoring wells. We recommend that the DOH immediately begin collecting split samples with the BWS present as an observer. The BWS is willing to collect split samples alongside the Navy once agreements between BWS and the Parties are in place.
3. As we have previously recommended and requested, the list of chemicals of potential concern (COPCs) to be measured in groundwater should be increased to include reporting of the full range of volatile and semi-volatile organic compounds and polycyclic aromatic hydrocarbons detected since 2010 (Table 1). Fuel additives associated with Navy fuels stored at the Red Hill Facility should also be measured, including EGME, DiEGME, 2,6-di-tert-butyl-4-methylphenol, 6-tert-butyl-2,4- dimethylphenol, 2,6-di-tert-butylphenol, N,N'-disalicylidene-1,2-propanediamine, tertiary butylated phenol, and phenol (Table 1). The list of compounds to be measured also includes the inorganic compounds nitrate, iron, manganese, and sulfate (Table 2). These compounds are indicators of the degradation of organic compounds and each has an established regulatory groundwater limit. In order to understand the complexities of fate, transport, and attenuation of petroleum hydrocarbons at the RHBFSF, the inclusion of these analytes is essential.
4. Pressure transducers should be installed immediately in all Navy monitoring wells and selected BWS wells in Halawa and Moanalua valleys, including the following wells:

Halawa Group:

- 2255-33 Halawa T-45
- 2256-10 Aiea USN

- 2355-15 Kaamilo Deep

Moanalua Group

- 2253-02 Moanalua DH43
- TAMC MW02
- 2153-02 Moanalua Deep
- 2153-09 Manaiki T-24

Red Hill Group

- 2253-03 CWRM Halawa Deep
- OWDFMW01
- Red Hill Shaft
- Red Hill monitoring wells RHMW01 through RHMW09
- Red Hill monitoring wells RHMW10 and RHMW11 once installed

The transducers should all be connected to data loggers to continuously record water level data with all measurements synchronized in time. Water level data should be collected at least hourly prior to conducting any aquifer tests on Halawa Shaft or Red Hill Shaft in order to establish baseline conditions. Water levels should be collected at 1-minute intervals during an aquifer test proposed for Halawa Shaft and following startup of pumping at Red Hill Shaft until drawdown stabilizes and again during water recovery. Installation of transducers should follow accepted protocols and it is suggested that the United States Geological Survey (USGS) conduct all transducer installations with BWS present to observe and take notes, and EPA to photo document the set up.

5. The Navy must provide a full description of the pumping operations at Red Hill shaft including volumes pumped and times and duration of pumping. The Navy should also report all pumping conducted at Red Hill shaft (daily basis including volumes pumped and times and duration of pumping) from January 2016 through the time the pumping test(s) start at Red Hill shaft.
6. An aquifer test should be conducted using pumping changes at Halawa Shaft while there is no pumping at Red Hill Shaft. Limited or no pumping at Red Hill shaft during the Halawa Shaft aquifer test will provide the most reliable data for the analysis. The aquifer test conducted at Halawa Shaft should be similar in nature to the aquifer test conducted by the USGS in May 2015. Water levels should be collected at 1-minute intervals throughout the test period.
7. The Navy should limit pumping at Red Hill Shaft to low volumes until the transformers are repaired in order to allow the aquifer to reach and maintain equilibrium, or quasi-equilibrium conditions until the aquifer test is conducted. This is critical in providing baseline conditions in the aquifer with pumping occurring at Halawa Shaft only, and will be used as an initial condition for further analysis of a Halawa Shaft aquifer test.
8. Once transformers are repaired at Red Hill Shaft, another aquifer test should be carried out to quantify changes caused by resumption of pumping at Red Hill Shaft. As such, transducers should be set to collect data at 1-minute intervals until it is established the water level drawdown has stabilized and water quality monitoring should be done at

weekly intervals for at least two months after pumping is started. The Navy should resume normal pumping operations of Red Hill Shaft after the Red Hill Shaft aquifer test is completed.

9. TEC (2010) established that there are significant errors in the elevation measurements for the tops of casings (TOC) for the Red Hill wells. These errors are large enough to create significant errors in groundwater heads and determining flow directions. Given the past surveying errors and the provisional differences identified by the USGS, the TOCs of all wells should be accurately determined. Furthermore, the data set of historical groundwater measurements must be reviewed and adjusted to remove errors from surveys and differences in choice of TOC locations so that groundwater heads and groundwater flow directions can be established with the necessary accuracy. EPA should require the Navy to conduct a geodetic quality First Order leveling survey to establish TOC elevations for all monitoring wells and other relevant monitoring points with BWS present to observe and concurrently recording data, and EPA to photo document the TOC and measurement process.
10. A data-sharing agreement needs to be put in place between the Parties and all subject matter experts to ensure data sharing on a timely basis. In all cases, BWS would like to be present to observe and take notes. We also would like EPA to photo document the various tests and measurements taken.

If you have any questions, please feel free to contact me at 808-748-5061.

Very truly yours,



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References

- Board of Water Supply (BWS). 2015. Board of Water Supply Recommendations to Consider in the Development of Red Hill Administrative Order on Consent (AOC) Work Plans. Letter to EPA, DOH, and Navy. December 3.
- Board of Water Supply (BWS). 2016a. Board of Water Supply (BWS) Comments on the Red Hill Bulk Fuel Storage Facility (RHBFSF) Administrative Order on Consent (AOC) Work Plans and Associated Scoping Meetings. Letter to EPA and DOH. October 3.
- Board of Water Supply (BWS). 2016b. Regulatory Agency Approval of the Navy's Chemicals of Potential Concern List Recommendations for the Red Hill Bulk Fuel Storage Facility. Letter to EPA and DOH. March 29.
- TEC Inc. 2008. Red Hill Bulk Fuel Storage Facility, Final Groundwater Protection Plan, Prepared for Naval Facilities Engineering Command, Pacific, Pearl Harbor, Hawaii. January 2008.
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Table 1. List of COPCs to be Measured in Groundwater

COPCs	
TPH-DRO (middle distillates)	Pyrene
Naphthalene	Chloride
Lead, Dissolved	Fluoranthene
2-Methylnaphthalene	1,1,2,2-Tetrachloroethane
1-Methylnaphthalene	1,2,3-Trichloropropane
TPH-GRO (gasolines)	Anthracene
Fluorene	Benzo(g,h,i)perylene
Acenaphthene	Chloroform
TPH (residual fuels)	Dibenzo(a,h)anthracene
Toluene	Methyl ethyl ketone
Benzene	Trichloroethylene
Xylenes, total	1,2-Dibromoethane (EDB)
Acetone	Ethylene glycol monomethyl ether (EGME)
Ethylbenzene	Diethylene glycol monomethyl ether (DiEGME)
Phenanthrene	2,6-di-tert-butyl-4-methylphenol
Benzo(a)anthracene	6-tert-butyl-2,4-dimethylphenol
Acenaphthylene	2,6-di-tert-butylphenol
1,2-Dichloroethane	N,N'-disalicylidene-1,2-propanediamine
Bromodichloromethane	Tertiary butylated phenol
Chloromethane	Phenol
Methylene chloride	

Table 2. List of Inorganic Compounds to be Measured in Groundwater

Inorganic Compounds
Nitrate
Iron
Manganese
Sulfate