BOARD OF WATER SUPPLY

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October 4, 2016

Mr. Bob Pallarino
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and

Mr. Steven Chang, P.E.
DOH Red Hill Project Coordinator
State of Hawaii
Department of Health
P.O. Box 3378
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Dear Messrs. Pallarino and Chang:

Subject: Board of Water Supply (BWS) Comments to the United States Environmental Protection Agency and Hawaii Department of Health Letter Disapproving the United States Navy's Statement of Work ("SOW") Deliverable for Sections 6 and 7 – Work Plan/Scope of Work, Investigation and Remediation of Releases and Groundwater Protection and Evaluation, Red Hill Bulk Fuel Storage Facility ("Facility"), Dated May 4, 2016

The BWS has reviewed the above-referenced letter dated 15 September 2016 from the United States Environmental Protection Agency (EPA) and the Hawaii Department of Health (DOH) to the United States Navy and we offer our comments below for your consideration and response.

The BWS is encouraged by the regulatory agencies' decision to not accept the draft work plan for SOW Sections 6 and 7. Our review also found errors and omissions that threatened successful achievement of the defensible scientific and engineering work needed to protect our drinking water supplies from past and future fuel releases from the Red Hill Bulk Fuel Storage Facility (RHBFSF). Many of the regulatory agencies' findings contained in the disapproval letter match findings listed in our letter to you dated 3 June 2016, but many of our findings in that and other previous BWS response letters that we consider important were apparently ignored.

We commend the regulatory agencies for taking this important step. The BWS believes that the disapproval letter is only one of many steps needed to protect our drinking water supply from the ongoing corrosion and likely failures of the underground storage tanks at the RHBFSF. The AOC Parties should finalize the work plan for SOW Sections 6 and 7 tasks using all of our comments and guidance, as well as, any comments from our fellow stakeholders as requested by the EPA and DOH so that the final work plan is based on sound science and site-specific data. We also request that the final work plan is executed properly with active involvement and review by the BWS (as primary stakeholder and subject matter expert), other stakeholders, and the regulatory agencies.

In our view, the Navy should promptly follow the recommendations from the regulatory agencies, BWS, and other stakeholders for revising this work plan. The significant overlap in criticisms by the BWS and others regarding the draft work plan for SOW Sections 6 and 7 should be a strong indication to the Navy that these criticisms are valid and important. The BWS strongly recommends that the Navy does not challenge the required changes to the work plan and not begin the dispute resolution process described in AOC Section 14. The dispute resolution process has no apparent limit on duration, potentially continuing for many months or years, thereby delaying implementation of the needed protections for our drinking water supply (see our letter with comments on the draft AOC sent to the Parties on 20 July 2015). We urge the Navy to comply with the regulatory requests to revise the draft work plan within the stipulated 30-day period. Taking such a path is not in the best interest of protecting our underground sources of drinking water.

Important Omissions from Regulatory Agencies' Requested Revisions

The BWS requests that the AOC Parties address the following flaws and concerns that were either not included or not given enough detail in the disapproval letter for the final SOW Sections 6 and 7 work plan.

- Comment 1) in disapproval letter: We agree that the work plan should be reorganized to permit an "iterative and scientifically robust approach". The revisions requested by the regulatory agencies in this comment should be expanded to require consultation and the opportunity for feedback from the BWS and other SMEs on all data products and deliverables, whether draft or final, and that the schedule should be constructed to allow sufficient time for SME review and commenting.
- Comment 2) in disapproval letter: We agree that the draft conceptual site model (CSM) is "incomplete" and that the Navy must provide a plan for developing and updating a CSM. The BWS has repeatedly described data gaps and large

uncertainties about several important geologic and hydrogeologic features and processes that are critical to devising a defensible CSM, but the requested revisions omit any requirement to specifically address and resolve these uncertainties. We strongly urge the regulatory agencies direct the Navy to describe all key data gaps, uncertainties, and alternative features and processes for the Red Hill CSM. Specifically, the CSM development plan must state that data gaps are to be identified, the full ranges of uncertainty be defined for key inputs, and alternative conceptualizations be described. In all cases of uncertainty, the conceptual model should adopt approaches or conceptualizations that are conservative compared to other alternatives.

For example, we have identified that lack of data about the thickness and properties of the valley fill sediments and the Navy should not be allowed to simply assume these sediments act as a barrier to contaminant transport from Red Hill. Instead of using unjustified assumptions about the extent and properties of the valley fill sediments in Halawa and Moanalua valleys, the regulatory agencies should direct the Navy to fully evaluate this data gap. If the Navy elects not to conduct a drilling and hydraulic testing program to determine the hydraulic properties and three-dimensional extent of the valley fill sediments, work plans for the CSM (and all numerical models) must acknowledge this key uncertainty and adopt conservative assumptions about valley fill, such as the "no valley fill" scenario evaluated by Oki (2005). The Parties should adopt the conservative "no valley fill" scenario until the physical dimensions and properties of the valley fill units in Halawa and Moanalua valleys have been defensibly determined. However, the BWS would like to see the work plan specifically evaluate the presence and absence of valley fill effects on groundwater flow in the Moanalua and Halawa valleys.

The CSM development plan should also address other key data gaps and uncertainties, such as the direction and rates of regional groundwater flow, light non-aqueous phase liquid (LNAPL) migration within the vadose and saturated zones, and the large areas within which LNAPLs can act as contamination sources to our drinking water aquifer. In all cases of uncertainty, the Parties should adopt the more conservative conceptualization or interpretation of data.

- Comment 3) in disapproval letter: We agree that the work plan must evaluate the potential for LNAPL migration within the vadose and saturated zones. However,

the work plan must be revised to evaluate different size releases and to carry out all evaluations using site-specific data. This means that the regulatory agencies must direct the Navy to collect and analyze cores, vapor, and liquids from the Red Hill vadose and saturated zones. Carrying out the evaluations in the absence of defensible, site-specific data should be explicitly prohibited.

- Comment 4) in disapproval letter: We agree that the work plan must include a deliverable that compiles all available data and evaluates the suitability for purpose of that data. The work plan should list the data types and quality needed to construct the CSM. This list should include but is not limited to accurate groundwater heads over time, all geologic data used to construct hydrogeologic framework, and groundwater concentration data with appropriately conservative validation. The work plan should also be revised to explicitly list all key data gaps and describe how they are to be remedied.

  It is very important that the data package deliverable should also evaluate the suitability of the available data for developing the conceptual model and constructing and calibrating the numerical flow model. An example of our concern about data suitability is the groundwater head data to be used to calibrate the numerical groundwater flow model. Inaccuracies in surveyed top of casing elevations must be adequately resolved. This deliverable should also focus on how many more wells will be needed to calibrate the flow model given the uncertainty surrounding valley fill sediments in the Moanalua and Halawa valleys. The most defensible groundwater flow model to date, Oki (2005), has shown that the groundwater head data available for flow model calibration cannot be used to determine whether valley fill sediments in Halawa or Moanalua Valleys impede groundwater flow. Without the addition of monitoring points within and alongside the valley fill sediments, no future model calibration will be able to resolve whether the sediments impede groundwater flow from the RHBFSF toward Halawa shaft or toward the Moanalua wells.
- Comment 5) in disapproval letter: BWS agrees that this is a fatal flaw in the draft work plan and requests that the work plan revisions be expanded to insist on evaluations that are based on area-specific data such as new wells for monitoring groundwater heads.
- Comment 6) in disapproval letter: The BWS also found that the draft work plan descriptions for the groundwater flow modeling task were inadequate and flawed. As we stated above, the numerical flow model section of the revised work plan

must directly address present-day uncertainties concerning regional groundwater flow rate and direction, effects of valley fill sediments on groundwater flow from Red Hill to Halawa shaft and Moanalua wells, and the suitability of groundwater head data for calibration. The work plan should explicitly state that only conservative interpretations or conceptualizations will be selected if uncertainty in the available data allows several interpretations. A single non-conservative conceptualization should not be permissible for conceptual or numerical modeling.

The BWS is a stakeholder and has no regulatory function in the AOC process. Ultimately, it falls to the regulatory agencies to make responsible decisions based on site-specific data, conservative interpretations, and input from the BWS and other stakeholders to protect our drinking water supply.

The BWS does not agree that desired expertise for the flow and transport modeling should be heavily weighted toward staff with Hawaii geologic experience. As we have repeatedly stated, the available boreholes and data are too sparse and no amount of familiarity with Hawaii geology will remedy that lack. Instead, the BWS would like the work plan be revised to require that all boreholes be logged by staff with sufficient experience in Hawaii geology to identify correctly all the preferential pathway features known for Oahu basalts. The required modeling expertise should instead emphasize experience with modeling and predictions given the large uncertainties in important features and processes governing flow and migration of contaminants from Red Hill.

- Comment 7) in disapproval letter: We urge the work plan be further revised to require site-specific data for all attenuation studies. The hydrogeochemical conditions beneath Red Hill differ sufficiently from other contamination sites that the scientific literature will not be applicable for determining attenuation processes and rates.
- Comment 8) in disapproval letter: We agree that a sentinel well network should be appropriately designed and constructed. However, the work plan and your disapproval letter should make it clear which water supplies this new sentinel well network will protect.
- Comment 9) in disapproval letter: We agree that the work plan should describe how the findings from groundwater investigations and modeling will be used to develop and guide the risk assessment in task 8 of the SOW. The BWS requests

clarification about how the Groundwater Protection Plan (GWPP) will be implemented under the AOC and particularly as the SOW tasks are carried out. The AOC states:

"**Groundwater Protection and Evaluation** The purpose of the deliverables to be developed and work to be performed under this Section is to monitor and characterize the flow of groundwater around the Facility. Navy and DLA shall update the existing Groundwater Protection Plan to include response procedures and trigger points in the event that contamination from the Facility shows movement toward any drinking water well. The collective work done in this Section shall be used to inform subsequent changes to the Groundwater Protection Plan. The deliverables and work to be performed under this Section may include the installation of additional monitoring wells as needed."

Does the AOC supersede the GWPP? Which version of the GWPP is active, 2008, 2009, or 2014? Did the DOH approve the 2014 interim update? The GWPP is specifically limited to chronic releases of less than 10 gallons per minute, but the AOC includes all release volumes. How will releases of more than 10 gallons per minute be regulated under the AOC and the GWPP? It is our view that the GWPP must be revised to deal with all release volumes.

- Comment 10) in disapproval letter: We agree that uncertainties must be addressed in the groundwater flow and transport models. However, these uncertainties must be first addressed in the CSM, before the numerical models are constructed, so that construction of the numerical models will capture these important uncertainties. While we also believe that aquifer testing will help reduce uncertainty, it will **not** reduce uncertainty about the role of the valley fill sediments in Moanalua and Halawa valleys unless new groundwater monitoring wells are first installed in appropriate locations.
- Comment 11) in disapproval letter: As we stated above, we request that the work plan and schedule be revised to specifically include review and commenting by stakeholders and SMEs.

Concerns About Regulatory Agencies' Detailed Comments

Our review of Attachment A Regulatory Agencies Detailed Technical Comments found the following concerns that we request be addressed in the final Work Plan.

- Comment 7) in Attachment A: As we have repeatedly stated, the Rotzoll and El Kadi (2007) flow model and particle tracking did not conclude that the valley fill sediments in Halawa valley will or may impede contaminant migration from Red

Hill to Halawa shaft or Moanalua wells. Rotzoll and El Kadi assumed one configuration of valley fill sediments and unlike Oki (2005) did not test other configurations. Such a foundational assumption should be **explicitly tested** before accepting any conclusion from their modeling results. As above, we request that the work plan be revised to address the uncertainty in the hydraulic properties and three-dimensional extent of the valley fill sediments in Moanalua and Halawa valleys.

- Comment 14) in Attachment A: Perched aquifers are prevalent in the Koolau basalt and should also be included in this section.
- Comment 29) in Attachment A: The commenter stated that the head changes in monitoring well RHMW07 showed effects from changes in pumping at Halawa shaft. Our preliminary analysis showed that the observed head changes in this well were tightly coupled to barometric changes in the atmosphere and show little evidence of the time changes expected from Halawa shaft pumping rate variations. We recommend that the regulatory agencies consider the barometric changes in their analysis and the Navy consider this as they finalize the Work Plan.
- Comment 30) in Attachment A: While we agree that dikes are rarely found in this part of the Koolau basalt, the regulatory agencies should also direct the Navy to review the detailed geologic mapping conducted by Sherrod et al. (2007) to find evidence for or against dikes in this locale.
- Comment 47A) in Attachment A: We request that the work plan add the USGS as a stakeholder. The Navy is the Responsible Party, not a stakeholder, so this list should be revised to remove the Navy. We also request clarification about the roles, responsibilities, and make up of the modeling Team.
- Comment 58) in Attachment A: We disagree that "groundwater flow patterns modeled by Rotzoll and El-Kadi were generally accepted as being correct at the time and accepted by the HBWS". Our review of all BWS correspondence and other records finds no instance of the BWS accepting this groundwater flow pattern or the results from the Rotzoll and El-Kadi model. Please remove any and all references to the BWS accepting their results.

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

Very truly yours,

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References

Oki, D. 2005. Numerical Simulation of the Effects of Low-Permeability Valley-Fill Barriers and the Redistribution of Ground-Water Withdrawals in the Pearl Harbor Area, Oahu, Hawaii. USGS Scientific Investigations Report 2005-5223.

Rotzoll, K., and A.I. El-Kadi. 2007. Numerical Ground-Water Flow Simulation for Red Hill Fuel Storage Facilities NAVFAC Pacific, Oahu, Hawaii. Prepared for TEC Inc., August 2007. Honolulu, Hawaii.

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