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In reply, please refer to:

August 20, 2024

Rear Admiral Stephen Barnett
Navy Closure Task Force – Red Hill
850 Ticonderoga Street, Suite 110
Joint Base Pearl Harbor-Hickam, Hawai'i 96860
[via email only: stephen.d.barnett.mil@us.navy.mil]

Dear Rear Admiral Barnett:

SUBJECT: **Insufficient time provided to review Draft Groundwater Model Report Volume 1, Volume 2, and hard drive; dated July 17, 2024**

On July 22, 2024, the Hawai'i Department of Health (DOH) received the following submissions from the Navy Closure Task Force – Red Hill (NCTF-RH), hereinafter collectively referred to as the *Draft Groundwater Model Report* (GWM Report):

- Draft Groundwater Model Report, Red Hill Bulk Fuel Storage Facility, Volume 1: Main Report, Appendices A-C, dated July 17, 2024, which included the:
  - Draft Groundwater Model Technical Memorandum;
  - Draft Vadose Zone Model Technical Memorandum; and
  - Draft Contaminant Fate and Transport Technical Memorandum;
- Draft Groundwater Model Report, Red Hill Bulk Fuel Storage Facility, Volume 2: Appendices D-H, dated July 17, 2024; and
- A hard drive of model files.

On August 9, 2024, we also received a revised version of GWM Report, Volume 1 because the original submission on July 22, 2024 was missing Appendix C, Responses to April 16, 2024 Regulator Comments.

As the GWM Report consists of approximately 12,000 pages with more than six terabytes of accompanying model files and the original submission was incomplete, the DOH is unable to conduct a thorough review by the requested date of August 20, 2024. Moreover, the NCTF-RH states in the GWM Report that it plans to refine the models at a later time by incorporating results from ongoing field studies, such as the geophysics, in-well testing, and tracer testing conducted by the University of Hawai'i (UH), as we have suggested previously. We believe the forthcoming real-world data will provide a more accurate understanding of site-specific

subsurface conditions at Red Hill, which the U.S. Department of the Navy (Navy) has struggled to reflect in previous models. Although we recognize that substantial revisions have been made since we required the Navy to submit its "Best Available Model" in June 2023, for these reasons, we have completed a cursory review at this time and have the following general comments.

1. The DOH recognizes the models presented are much more thorough and have substantially better calibration characteristics than the 2020 Navy modeling effort. However, the models still do not appear to reflect key elements observed in the aquifer and transport related site-specific data sets that have been collected over the past two decades. Below are two examples.
    a. The 2021 fuel releases indicated a contaminant migration to the northwest. This plume trajectory is consistent with the regional and cross-ridge hydraulic gradient to the northwest that is not captured by the groundwater model.
    b. The model indicates a hydraulic pathway from the Red Hill Facility to beneath the Department of Agriculture Animal Quarantine Station in Hālawa and eventually passing beneath ʻAiea Bay ultimately being captured by Kalauao Springs (Figure 2-20). However, the recently installed groundwater monitoring well NMW27 indicates there is little flow in this zone as shown in initial hydraulic testing done by the NCTF-RH and colloidal borescope testing conducted by UH. Therefore, the model should be revised to reflect this result from NMW27.

    Similarly, the forward particle flow paths shown in Figures 2-17 through 2-19, which show flow directly down Red Hill Ridge with some divergence to the northwest side of the ridge, do not appear to capture the variability noted in Figure 4-10 of the *Final Report of Findings, Red Hill Shaft Flow Optimization Study* dated September 19, 2023. Prior to the next modeling iteration, it would be useful to overlay the modeled gradients on Figure 4-10, as the calibration charts provided are not gradient triplets, but rather head with distance.

2. While the use of parameter values that deviate from those used by previous modelers or published literature is not in itself incorrect, sufficient basis should be provided and modeled results should reflect field data; in this case the model results do not conform with data collected. Therefore, the values of the parameters should be re-evaluated. Below are some examples.
    a. Basalt hydraulic conductivity – The NCTF-RH model uses a value of 9,310 feet per day (ft/d), while literature values range from 500-5,000 ft/d (Hunt, 1996) with a value of 4,500 ft/d used by the U.S. Geological Survey in its Pearl Harbor Aquifer model (Oki, 2005).
    b. Basalt vertical anisotropy – The NCTF-RH model uses a value of 66, while literature provides a value of 600 (Oki, 2005; Rotzoll and El-Kadi, 2007).
    c. Basalt horizontal anisotropy – The NCTF-RH model uses a value of 10, while literature provides a value of 3 (Oki, 2005).

3. Although fuel/vadose zone modeling was not explicitly specified as an item in the 2015 Administrative Order on Consent, this element is foundational to contaminant transport, risk, and cleanup. The modeling conducted by the NCTF-RH does not allow for an

understanding of where remaining fuel mass may reside in the subsurface and whether it can act as a potential source for future transient impacts. For example, the total petroleum hydrocarbons as oil, polar compounds, and polycyclic aromatic hydrocarbons that were primarily mobilized following the May 2021 release do not appear to be represented by the NCTF-RH's modeling suite.

4. There appears to be an absence in the document of the 3-D lithologic model(s) that served as part of the hydrogeologic framework/parameter distributions in the groundwater and contaminant transport models. While the report notes that geologic fabric explorer coupled with the lava flow simulator were used to create lithologic distributions, there do not appear to be specifics on how this approach was used, nor were any visualizations provided. In future iterations, critical elements, such as site-specific geologic cross-sections from the 3-D lithologic renderings, should be provided as figures and expanded on in the text of the main document.

5. The chosen method to calculate anisotropy assumes a single point source and a spatially expansive aquifer, which differs from conditions at Red Hill (two-line sources and an aquifer that is confined along two sides). This likely leads to a calculated anisotropy that is not representative of the conditions at the site.

6. Some tables that have been provided in the text contain errors. Revise the tables and provide the correct information. For example, Table 2-11 contains errors in reporting the row names, and some variables do not match what is provided in Volume 2, Appendix D.

If you have any questions regarding this letter, please contact Kelly Ann Lee, DOH Red Hill Project Coordinator, at KellyAnn.Lee@doh.hawaii.gov or (808) 586-4226.

Sincerely,

Kathleen Ho

KATHLEEN S. HO
Deputy Director for Environmental Health

References:

Hunt Jr., C.D, 1996. *Geohydrology of the Island of Oahu, Hawaii*. Professional Paper 1412-B. Regional Aquifer-System Analysis – Oahu, Hawaii. U.S. Geological Survey.

Oki, 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.* Scientific Investigations Report 2005-5253. U.S. Geological Survey.

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

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