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August 23, 2023

Rear Admiral Stephen Barnett  
Commander, Navy Region Hawai'i  
850 Ticonderoga St., Ste. 110  
Joint Base Pearl Harbor Hickam, HI 96860-5101  
(Sent via Electronic Mail)

**Subject: Partial Conditional Approval of Draft Shallow Soil Vapor Extraction and Air Sparging Work Plan**

Dear Rear Admiral Barnett:

Thank you for submitting the *Draft Shallow Soil Vapor Extraction and Air Sparging Work Plan, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O'ahu, HI* (Work Plan), dated January 2023. The Hawai'i Department of Health (DOH) and U.S. Environmental Protection Agency (EPA), collectively the Regulatory Agencies (RAs), have reviewed the Work Plan. The 2015 Administrative Order on Consent (2015 AOC) requires Navy and Defense Logistics Agency to address the investigation and remediation of all past releases of petroleum or other substances at the Red Hill Bulk Fuel Storage Facility (Red Hill Facility). In accordance with Paragraph 7 of the 2015 AOC, the RAs conditionally approve the shallow soil vapor extraction portion of the plan, but disapprove the proposed air sparging work.

The RAs appreciate the Navy's interest in completing pilot-scale tests at the Red Hill Facility to obtain real world, site-specific data to evaluate the effectiveness of the two proposed remediation technologies, and we support active, interim remediation. However, full evaluation of existing data is required to establish baseline conditions that can be compared to the data collected during and after the pilot study. This comparison of data is imperative to fully understanding whether a remedial pilot study is effective (see General Comment 1).

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The first of the two technologies proposed in this work plan, soil vapor extraction (SVE), typically uses above-ground blowers or vacuum pumps to extract vapor from subsurface soil and rock not saturated with groundwater. SVE is frequently used to remove volatile chemicals at contaminated sites and has the potential to remove contamination from the Red Hill Facility, but the technology's effectiveness at the Facility is uncertain. The RAs agree that a pilot-scale test at the Red Hill Facility is the appropriate next step to determine the effectiveness and implementability of the technology. The conditional approval of the SVE pilot study is contingent upon the Navy incorporating the RAs' enclosed comments into the planned work.

The second of the two technologies, air sparging, involves the injection of air into the groundwater to remove and help degrade subsurface contaminants. The RAs disapprove, at this time, the proposed pilot-scale test of air sparging, due to the uncertainties identified in the enclosed comments. After the SVE pilot study is completed, a technical memorandum documenting the results and evaluation the SVE system, as well as an evaluation of the appropriateness of air sparging based on the SVE pilot study data, shall be submitted to the RAs for review and approval before the Navy commences the air sparging pilot test. If the RAs agree the Navy can proceed with the air sparging pilot test, the Navy will submit a revised air-sparging work plan.

If you have any questions regarding this letter, please contact Grant Scavello, EPA Red Hill Project Coordinator, at [Scavello.Grant@epa.gov](mailto:Scavello.Grant@epa.gov) or (415) 972-3556; or Kelly Ann Lee, DOH Red Hill Project Coordinator, at [KellyAnn.Lee@doh.hawaii.gov](mailto:KellyAnn.Lee@doh.hawaii.gov) or (808) 586-4226.

Sincerely,

Grant Scavello  
Red Hill Project Coordinator  
U.S. Environmental Protection Agency, Region 9

Kelly Ann Lee  
Red Hill Project Coordinator  
State of Hawai'i, Department of Health

Enclosure

cc: VADM John Wade, Commander, Joint Task Force – Red Hill  
Sherri Eng, Environmental Director, Navy Region Hawai'i  
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**Conditions for Soil Vapor Extraction Pilot Study Approval**

1. **General:** As described in the *Draft Shallow Soil Vapor Extraction and Air Sparging Work Plan, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam, O‘ahu, HI* (Work Plan), the U.S. Department of the Navy (Navy) began efforts to determine the nature and extent of subsurface contamination in the Red Hill tunnel system near Adit 3 after the November 20, 2021 Jet Propellant 5 (JP-5) release. These efforts have included the installation of temporary groundwater monitoring wells and soil vapor probes and sampling of soil, groundwater, and soil vapor. In a letter dated August 8, 2022, the Regulatory Agencies (RAs) requested Adit 3 site characterization data to support our independent technical analyses of the 2021 fuel releases’ impacts on the aquifer. On October 3, 2022, the RAs received the Navy’s response. However, based on the data the Navy recently provided to the RAs, we now assess that a significant portion of data was initially withheld from the October 3, 2022 response and was not used to evaluate baseline conditions for this pilot project. To best understand the effectiveness of this pilot study, the Navy should use the full baseline dataset for comparison.
  
2. **Section 5, Project Quality Objectives, PDF Pages 17 and 18.** The study questions in Table 2 include an estimate of the proposed soil vapor extraction (SVE) system’s zone of influence, evaluation of the spatial distribution of air permeability, and calculation of initial petroleum hydrocarbon mass removal rates. The study questions are to be clarified or new study questions added to:
  - Estimate the zone of effectiveness achieved by the SVE pilot system; and
  - Evaluate changes in contaminant flux removed by the SVE pilot and changes in the mass and distribution of subsurface vapor over time, including an evaluation of rebound if the contaminant flux shows an asymptotic decrease over the duration of the test (estimated at two to four months).

Achieving these objectives will require periodic laboratory analysis of samples collected from soil vapor monitoring wells, not just the soil vapor exhaust from the SVE system. Please collect vapor samples and have them analyzed via methods TO-3, TO-15, and TO-17. Prior to beginning the study, be sure to collect a statistically relevant set of baseline samples and have them analyzed via the same methods.

The study questions and analytical approach shall also include estimates of the contaminant mass targeted by the SVE pilot and the fraction of targeted mass removed during the pilot study or explain why such an analysis is not appropriate.

3. **Section 6.5.1 Hume Line Investigation and SVE Point Installation, PDF Page 23.** The Work Plan describes using the Hume Line, a 6-inch diameter concrete drainage pipe that runs horizontally beneath the tunnel floor, as a horizontal extraction point during the SVE pilot

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test. The Hume Line was initially installed as a water management system and is set 2.5 to 3 feet below the tunnel floor to act as a conduit for groundwater to migrate to the sump and limit tunnel flooding. The top of the pipe is unsealed to allow for groundwater to migrate into the pipe and flow to the sump. While the RAs appreciate the creativity of utilizing existing infrastructure to serve as a horizontal extraction point, we are concerned the Hume Line may short-circuit and extract atmospheric air from the tunnel rather than extract vapors from the subsurface, which may reduce the overall effectiveness of SVE. Additionally, we are concerned that limiting the evaluation of SVE implementability to the Hume Line and one SVE extraction well may limit the chances for a successful pilot test. We recommend adding one additional SVE extraction well to the study.

4. **Section 6.8 Baseline Monitoring, PDF Page 26.** The Work Plan proposes baseline sampling of soil and perched water prior to initiating any portion of the SVE pilot test. Parameters include petroleum hydrocarbons (total petroleum hydrocarbon-gasoline, total petroleum hydrocarbon-diesel, benzene, toluene, ethylbenzene, xylenes, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene), geochemical parameters (nitrate, sulfate, dissolved iron, dissolved manganese, and dissolved methane), and field parameters (fluid levels, dissolved oxygen, oxidation-reduction potential, pH, conductivity, and temperature). The parameters shall also include TPH-o, trimethylbenzenes, tetra-methylbenzenes, and relevant fuel additives.
5. **Section 8, Project Schedule and Reporting, PDF Page 33.** The Work Plan proposes submitting a technical memorandum (TM) four weeks after field activities are completed. The project schedule, included as Appendix E, appears to indicate the TM will be submitted after completing the air sparging and SVE constant rate test. A revised project schedule shall be submitted to the RAs prior to the start of the SVE pilot study. The project schedule shall be updated to include line items for:
  - The short-term operation phase of the shallow SVE system;
  - Submittal of a TM with initial results from the short-term operation phase of the shallow SVE system and recommendations for the continued operation of the pilot (e.g., duration of operation, evaluation of the vacuum, radius of influence, rebound study results, proposal whether to pursue air sparging or not);
  - Justification for the recommendations; and
  - Submittal of a TM after completing the short-term operation phase.

All available data (groundwater, soil, and soil vapor) collected from Adit 3 since the November 2021 release shall be uploaded onto the Navy’s Environmental Data Management System (EDMS) as soon as available, provided in both tabular and lab report formats, and included as an appendix in the TM. Analytical results from this pilot shall be included in the TM in both tabular and lab report formats. Raw and validated data shall be uploaded to the EDMS as soon as available. A special purpose meeting between the Navy and RAs shall be

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scheduled in advance of the TM submittal to provide a preview of data, review results of the pilot, and discuss next steps.

**6. Section 8, Project Schedule and Reporting, PDF Page 33.** The project schedule included as Appendix E includes a line item for installation of shallow vapor monitoring wells. Please modify the schedule to show installation of the intermediate depth and deep vapor monitoring wells described or depicted in the Work Plan (e.g., in Section 3.7, Figures 1 and 2). The proposed vapor monitoring wells shall be installed and sampled before vapor extraction begins.

**7. Typos and minor editorial comments**

- **Table 6.** TO is incorrectly defined as “task order” in a footnote to the table.
- **Section 6.6.** Provide the RAs clarification as to which portions of the Operations and Maintenance (O&M) Plan, included as Appendix C, apply to the proposed SVE pilot study.

**Basis for Air Sparging Pilot Disapproval**

**1. Section 1, Introduction and Purpose, PDF Page 9.** The Work Plan proposes to evaluate SVE in the first phase of the pilot study, followed by evaluating air sparging in the second phase of the study. Air sparging systems are designed to remove volatile contaminants from groundwater by moving contaminants into the vapor phase, where they can be removed with SVE. The RAs do not, at this time, support the proposed air sparging pilot-scale test due to the uncertainty of the planned SVE system’s ability to capture volatile contaminants mobilized by the injected air. There is also concern that air sparging could potentially increase the mobility of residual fuel present in the subsurface. A decision on the potential benefits, risks, and implementability of air sparging should only be made after the completed SVE pilot study results have been evaluated. The air sparging pilot scope is not approved at this time.

Upon completion of the SVE pilot study and review of the associated TM, a revised air sparging work plan shall be submitted to the RAs for review and approval before the air sparging pilot test may commence.