



DEPARTMENT OF THE NAVY

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28 JAN 2020

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Mr. Omer Shalev
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

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Ms. Roxanne Kwan
State of Hawaii Department of Health
Solid and Hazardous Waste Branch
2827 Waimano Home Road, Suite 100
Pearl City, HI 96782

Dear Mr. Shalev and Ms. Kwan:

SUBJECT: US ENVIRONMENTAL PROTECTION AGENCY (EPA) AND STATE OF HAWAII DEPARTMENT OF HEALTH (DOH) LETTER OF DECEMBER 19, 2019, APPROVAL OF REQUEST FOR EXTENSION TO COMPLETE INVESTIGATION AND REMEDIATION OF RELEASES REPORT AND GROUNDWATER MODELING REPORT FOR THE RED HILL ADMINISTRATIVE ORDER ON CONSENT (AOC) – APPENDIX A STATEMENT OF WORK (SOW)

The Navy is in receipt of the Regulatory Agencies' approval letter granting a delivery-date extension for both the Groundwater Flow Model (GWFM) Report and the Investigation and Remediation of Releases (IRR) Report, which are now due no later than March 25, 2020. The respective redacted, Section 508-compliant reports will be submitted no later than April 8, 2020. The Navy greatly appreciates the collaboration with the Regulatory Agencies and their understanding of the technical issues beyond control of the Navy relative to the groundwater flow modeling that necessitated the submittal extension request dated September 20, 2019.

The Navy further understands that the Regulatory Agencies do not characterize this extension as implying that alignment with the AOC parties has been reached. The Navy will continue to proceed with the multiple model approach that is currently being used to address Regulatory Agencies' concern regarding uncertain field conditions.

The new data that will be incorporated into the modeling effort include the following:

- The addition of new calibration targets associated with three additional wells (as discussed in the July 2019 AOC Technical Working Group meetings)
- The development of new transfer function-noise (TFN) analyses for RHMW11 (Zones 1–5) and other wells (see response to comment #5 of the enclosed Navy Comments on the October 19, 2019 S.S. Papadopoulos & Associates Letter, Comments on Draft Meeting Summaries for AOC Parties Face-to-Face Meetings Day 1 and Day 2, AOC Statement of Work Sections 6 and 7, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam (JBPHH), Oahu, Hawaii)
- Revised TFN analysis for all targets (improving the analyses by further minimizing residual drawdowns as compared to observed data)
- Development of multiple versions of various models to further improve understanding of key factors (such as anisotropy, tuff damming effects, and gradients) raised by the Agencies and their subject matter experts (SMEs)

To facilitate review of the ongoing modeling effort, preliminary models were sent out to the Regulatory Agencies for their review. As stated in transmittal documents, these models were in draft form, and have not been fully reviewed. However, they do provide a good basis for the Agencies to understand what the Navy's modeling efforts are based on, and how the Navy's modeling efforts are progressing. The final models may be adjusted to address internal quality assurance/quality control (QA/QC) as part of the GWFM Report preparation.

The Regulatory Agencies' continued participation in the modeling process have been very helpful in developing the current modeling efforts at Red Hill. To facilitate the Agencies' and SMEs' model review process, the Navy suggests the following meeting schedule:

- TWG Meeting with AOC Parties – Pre-Report Submittal (early to mid-March 2020): This meeting would be by webinar or teleconference, and would be to familiarize the reviewers with key aspects of the models and the report.
- TWG Meeting with AOC Parties – Post-Report Submittal (June or July 2020): This meeting is recommended to be face to face, and would be to provide any clarification on any aspects of the models, to the reviewing parties, and to solicit advanced comments or concerns.
- GWMWG Meeting with AOC Parties and External Stakeholders (June or July 2020, in conjunction with the TWG Meeting) - Overview of Initial Modeling Reviews, and to have reviewers present their initial thoughts on the current modeling effort. Potential issues can be discussed and clarified to help focus final comments from the reviewers.

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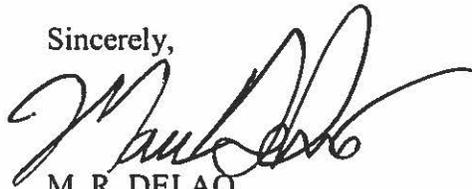
The Regulatory Agencies have expressed interest in having the USGS review and comment on the Navy's models and simulations. The Navy believes that USGS review of the groundwater flow models may have merit, subject to satisfactory resolution of the following concerns:

- Sensitivity of portions of the information to be provided to USGS, since much of the modeling information is sensitive relative to national security
- Measures to be taken to avoid disclosure of sensitive information provided to USGS, such as inability to publish, disseminate or discuss reports containing such information in a public forum, since much of the modeling information is sensitive relative to national security
- USGS reviewers would need to be informed of AOC Party discussions related to the Conceptual Site Model (CSM) report (Revision 01; June 2019) and modeling, and review the CSM report in its un-redacted form to understand the development of various models and help frame the basis for certain aspects of the modeling effort. Model development since August of 2018 has included addressing the regulators top ten concerns as well as including updated information reported in CSM Revision 1. Of particular interest are CSM sections 5 and 6, which describe the site geology and hydrogeology.

The Navy appreciates the Regulatory Agencies' approval of the Navy's extension request for the GWFM and IRR Reports to March 25, 2020, and looks forward to continued collaboration. We hope we have adequately addressed all of your concerns, and that the clarification provided is helpful. We have provided specific comments to the S.S. Papadopoulos & Associates, Inc. letter of October 7, 2019, that was included in your letter. Please let us know if you would like to discuss anything further.

Should you have any questions, please contact Mr. Cory Waki of our Regional Environmental Department at (808) 471-3866 or at cory.waki@navy.mil.

Sincerely,



M. R. DELAO
Captain, CEC, U.S. Navy
Regional Engineer
By direction of the
Commander

Enclosure: Response to Comments of S.S. Papadopoulos & Associates, Inc. memo of October 7, 2019, Comments on Draft Meeting Summaries for AOC Parties Face-to-Face Meetings, Day 1 and Day 2, AOC Statement of Work Sections 6 and 7, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam (JBPHH), Oahu, Hawaii

Navy Comments on the October 19, 2019 S.S. Papadopoulos & Associates Letter, Comments on Draft Meeting Summaries for AOC Parties Face-to-Face Meetings Day 1 and Day 2, AOC Statement of Work Sections 6 and 7, Red Hill Bulk Fuel Storage Facility, Joint Base Pearl Harbor-Hickam (JBPHH), Oahu, Hawaii

Response to “Specific Comments on Draft Meeting Summaries”:

- The multi-model approach has been designed to consider various aspects of the CSM (with input from Agency SMEs) to help bound potential flow conditions. In this regard, particle track and capture zone output from all model versions indicate that Red Hill Shaft establishes a capture zone (under normal pumping conditions) beneath the tank farm that is adequate to capture dissolved-phase contaminants from a potential future release.
- The capture zone established by Red Hill Shaft under normal (permitted) pumping conditions appears to be adequate for potential plume capture, negating the need for additional pumping wells to support capture.
- Regarding parameterization related to a light nonaqueous-phase liquid (LNAPL) model, the Navy recognizes (as do the Agencies) that parameterization of any LNAPL model is complex and uncertain. Adding complexity of a (hypothetical) heterogeneous geological structure and then developing literature-based parameter values for each of these structural components will not support any valid prediction. Therefore, these LNAPL models will necessarily need to be exploratory and not predictive models. These models should help bound a range of reasonably conservative conditions in the effort to evaluate potential future releases. The Navy looks forward to continuing to work with Agency SMEs in better establishing a range of parameters that will assist in this effort.
- Regarding calibration of an LNAPL model relative to distal detections in monitoring wells, the Navy has undertaken a highly detailed analysis of the data as outlined in the CSM report and IRR Report. In addition to the various overlapping lines of evidence suggesting that the vast majority of early detects is likely related to drilling and well installation, additional analyses using a multi-component approach indicate that chemicals of potential concern (COPCs)/water quality parameters in outlying wells do not resemble the chemical signatures of wells located near the tanks. While the Navy understands that the Agencies do not necessarily agree with this position, it seems possible to calibrate the LNAPL model relative to the 2014 release and the absence of LNAPL in monitoring wells. The Navy looks forward to collaborating with the Agency SMEs in further consideration of ways to calibrate a multi-phase model for this site.
- Regarding development of the multifactor analysis, the Navy has further developed this analysis. A wide range of COPCs and water quality parameters (14 in total) were included in this analysis that relate to conditions at Red Hill. With that said, the primary focus was on total petroleum hydrocarbons (TPH) and dissolved oxygen (DO). This refined analysis was presented during the July 2019 AOC Technical Working Group (TWG) meetings and is also included as a subappendix in the forthcoming IRR Report. Similarity between wells was considered for both individual parameters as well as clustering to help better characterize the whole system. This approach is useful in minimizing “false-negative bias,” by looking at conditions from a holistic perspective.

Response to “General Comments and Additions from Notes”:

- 1) Regarding pairwise head differences relative to RHMW04, discussion about including RHMW01 (not RHMW02) occurred during the July 2019 TWG meetings. The current modeling effort does include evaluation of pairwise head differences relative to RHMW01 as agreed to during that meeting.

- 2a) The current models do not exhibit the mass balance errors in the flow budgets observed in previous models using the old groundwater modeling software platform.
- 2b) As part of the multi-model approach, the Navy has developed particle tracking for visualization of path lines. Each model is evaluated relative to calibration and verification. Several procedures and checks on conducting calibration simulations are made. Particle tracking was done on several draft models before they were finalized. Finally, the Navy team is not judging any particle tracks as "implausible"; rather, they are allowing the model to determine the migration behavior.
- 2c) This effect may be significant in saltwater intrusion or water supply evaluations, but is not relevant to the migration behavior that is the focus of the current modeling effort. Effort was initially expended to ensure that artificially high heads were minimized but expended little further effort on it. However, the Navy team did confirm that the mounds over the tuff cones do not impact migration behavior, so if some may happen to be above land surface, they do not affect the current modeling objectives.
- 2d) The Navy team has been evaluating simulated pumping as compared to conceptualized values and further evaluating where and how much the pumping changes occur, and how that may impact the simulation objectives. This occurs in some simulations in one location only: Kalihi Shaft, which is near the southeastern boundary of the model. As will be discussed in the GWFM Report, the boundary has an impact on its pumping; furthermore, this well does not influence, nor is it in the region of interest for, evaluating migration behavior.
- 2e) The Navy team has conducted several procedures and checks while conducting calibration simulations, including singular value decomposition (SVD), regularization, and tying of parameters.
- 3a) The Navy team determined during preliminary calibration efforts that when recharge was used as a calibration parameter, the Parameter Estimation (PEST) software frequently assigned recharge rate multiplier values that did not match the conceptual model. The conceptual model anticipated mild differences in calibrated recharge rates to accommodate the two sets of synoptic head targets. In practice, PEST tended to make large changes to recharge rates (and therefore to the regional water budget) of 20 percent or more, which suggested that the field data did not constrain the recharge rates sufficiently to permit their use as calibration parameters. The team concluded that achieving a mild improvement in calibration to synoptic heads did not warrant the unrealistic changes to the regional water budget. The final set of models (models 51 through 59) did not use recharge rate as a calibration parameter.
- 3b) The USGS recharge arrays are also models and may include uncertainties. However, the recharge itself is highest in elevated portions of the domain and low in the lower regions where the caprock is present and where rejection of recharge occurs. The simulated impact may be related to high heads due to a small hydraulic conductivity (especially of the tuff cones), but the recharge itself is low and causes little error to the migration behavior under study. Recharge was adjusted in the setup simulations to "reject" some of it above the tuff cones, but no modification of the recharge array was performed because of its lack of impact to the study.
- 4) The Navy previously conducted analyses with the United States Environmental Protection Agency's 3PE tool* during the interim modeling study. Since there were no data on flow,

* Environmental Protection Agency, United States (EPA). 2014. 3PE: A Tool for Estimating Groundwater Flow Vectors. 600/R 14/273. Office of Research and Development | National Risk Management Research Laboratory | Ground Water and Ecosystems Restoration Division. September.

only on heads, the Navy team used it to attempt to estimate head gradients, which were shown to be in different directions underneath the site. Experimentation with anisotropy also showed similar behavior. Greater anisotropy was not needed to have flow consistently directly toward Hālawā Shaft. The Navy's current efforts indicate that greater anisotropy is required regionally to fit the head.

- 5) More wells have been added to the TFN analyses as suggested, to include Manaiki T24, TAMC-MW2, Moanalua DH43, Hālawā Deep Monitor Well, Hālawā Deep Monitor Well Chase Tube, 'Aiea Hālawā Shaft, Hālawā BWS Deep Monitor, 'Aiea Navy, Ka'amilo Deep, and RHMW11 (Zones 1–5). As previously described, the TFN analysis was further enhanced for the wells previously evaluated, as well as those described above.
- 6) The Navy has endeavored to satisfy the requirements that the Agencies raise, has established a very strong modeling team that has worked closely with the Agencies and other parties through various meetings over the last few years, and has accommodated the conceptual ideas suggested by the SMEs and developed the models without presuming migration directions. The question related to model plausibility should be “Has the modeling effort helped us understand the system better so as to help with management decisions?”. As previously stated, the multi-model approach can be used to help address key management questions/decisions. Assuming that all models have a reasonable calibration/verification, particular models (that represent a reasonably conservative approach) can be used to help address specific questions that will help with arriving at management decisions that are protective.