



**UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105**



**STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378**

September 2, 2021

Captain Gordie Meyer, CEC, USN
Regional Engineer, Navy Region Hawaii
850 Ticonderoga St., Suite 110
Joint Base Pearl Harbor Hickam, Hawaii 96860-5101

Re: Notice of Deficiencies - Section 8.2 Risk/Vulnerability Assessment Phase 2 Scope of Work dated December 23, 2020

Dear Captain Meyer:

The United States Environmental Protection Agency (“EPA”) and the Hawaii Department of Health (“DOH”), collectively the “Regulatory Agencies,” have reviewed the document titled “Section 8.2 – Risk/Vulnerability Assessment Phase 2 Scope of Work” dated 23 December 2020 and submitted by the U.S. Department of the Navy (“Navy”) and Defense Logistics Agency (“DLA”) to satisfy the requirements in section 8.2 of the Red Hill Administrative Order on Consent (“AOC”) Statement of Work (“SOW”).

On November 19, 2019, the Navy submitted the September 6, 2019 SOW for Phase 2 of the Risk/Vulnerability Assessment (RVA), and after numerous scoping discussions, the Regulatory Agencies responded in writing on October 23, 2020 to document deficiencies in the Phase 2 SOW and request a revision. On December 23, 2020, the Navy submitted a revised SOW.

Although the revised SOW submitted generally reflects a change in approach to the RVA that appears to be consistent with well-established enterprise risk management frameworks, the SOW lacks specific details on how the described tools and methods will be used for risk assessment and mitigative decisions at the Red Hill facility. While the revised SOW addresses many of the comments submitted in the Regulatory Agency’s October 23, 2020 comment letter, comments that were not addressed are reiterated in this letter. Please ensure that the deficiencies noted in this letter, the deficiencies from our October 2020 letter, as well as our consultant’s comments (attached) are incorporated in any future revision.

Based on the review of the SOW document by the Regulatory Agencies and our consultants with expertise in risk assessment and decision science, we have identified the following deficiencies in the revised SOW.

Qualifications of the subject matter expert(s) that will oversee the risk management process are not adequately described.

In our experience related to assessing risk in the public interest, developing an effective RVA requires engaging subject matter experts with expertise in developing, facilitating, and managing a risk assessment and risk management framework. The SOW should be revised to include information on the Navy's technical team and their expertise in facilitation and modeling to support large-scale risk assessments and management of risk in the public interest. It is further recommended that such an expert or team of experts be contracted to assist the Navy in updating this SOW to provide the level of detail requested by the Regulatory Agencies.

Interim deliverables and opportunities for stakeholder input and regulatory concurrence should be described in the SOW.

Given that many risk assessment techniques involve numerous decision points and feedback opportunities, the SOW should define interim deliverables and decision points in the risk assessment and risk management process, including those where regulatory concurrence will be sought. The SOW should also allow for sufficient flexibility in the process to allow for the incorporation of stakeholder and regulatory input.

The SOW should describe how and when the Navy intends to communicate information, seek feedback or concurrence, or share interim deliverables with the regulatory agencies and stakeholders. For example, describe how meetings and their respective agendas will be constructed to support stakeholder input being obtained, recorded, and documented to ensure interested parties can audit how stakeholder engagement influenced risk management decisions. Please include a preliminary schedule of the Phase 2 work in the SOW with these interim deliverables and opportunities for feedback and concurrence included.

The SOW should identify key decision points including, but not limited to, identifying the list of plausible release scenarios developed from the Phase 2 scope of initiating events, identifying the list of required input parameters necessary to feed into the contaminant fate and transport (CFT) model, and identifying priorities or importance of given scenarios. As currently written, the SOW proposes to involve AOC parties, with input from non-AOC stakeholders, to prepare the RVA, particularly in the identification of plausible scenarios. While the Regulatory Agencies agree that an approach that integrates stakeholder input is preferred, the full list of specific risk scenarios should be identified by the Navy's subject matter experts (SMEs) who are most familiar with the facility's design and operations with input from Regulatory Agency SMEs. These release scenarios and the process in which they were selected should then be vetted during a workshop with the Regulatory Agencies and their SMEs and external stakeholders prior to initiating risk evaluations. Regulatory agencies and external stakeholders should be involved in determining threshold levels of concern. Please refer to the attached comments from the Regulatory Agency's consultant for further detail and clarity.

The revised SOW is missing a consequence analysis.

Our letter dated October 23, 2020, in response to the September 2019 RVA Phase 2 SOW, indicated that this phase of risk assessment requires the inclusion of a description of risk in terms of environmental consequences. The revised SOW indicates on page 3-6 that an environmental consequence analysis will be completed after the CFT model deliverable is complete. Please note that this RVA will not meet the AOC requirements unless it adequately describes potential releases in terms of environmental consequences. Given the Regulatory Agencies' Environmental SME comments during our May 10, 2021 meeting, we anticipate a potential delay on the completion of the Groundwater Flow Model (GWFM) report, and thus the CFT modeling.

Since the consequence analysis is driven by the fuel migration behavior in the vadose zone, the Navy should consider beginning work on CFT through the vadose zone now and develop inputs to the final approved GWFM that are essential to CFT and risk analyses. The Navy may also explore alternative options, with input from Regulatory Agency SMEs, for conducting an interim or alternative analysis for the purpose of providing an adequate Phase 2 RVA that communicates risk in terms of environmental consequences. If the Navy plans to do so, this alternative analysis must be described in the SOW. The Navy should be advised that prior agency reviews of the limitations of the Navy's fuel modeling approaches remain and approaches with more conservatism will need to be considered.

Similarly, the Regulatory Agencies' letter dated September 23, 2019, which approved in part, the work completed under Section 8.3 - Risk/Vulnerability Assessment Report, "*Quantitative Risk and Vulnerability Assessment Phase 1 (Internal Events without Fire and Flooding)*," specified additional work requirements that included the consequence analysis of the Phase 1 events. The current proposed SOW should also include the missing Phase 1 work associated with risk estimates/environmental consequences from internal events.

The Regulatory Agency's October 23, 2020 comment letter further describes the types of inputs that inform the CFT model that should be addressed in the SOW. Please see the attached comments from the Regulatory Agency's consultant that further discusses the need to connect the RVA products with the CFT model.

The SOW needs to clarify how the risk identification and assessment process will be used to inform risk management decisions and mitigative measures.

The SOW document needs to describe how the risk assessment process will inform risk management decisions, and how any limitations and uncertainty regarding risk will be considered when making risk management decisions.

In addition, the SOW document needs to discuss how the risk assessment process will be used to identify potential mitigative measures that may ultimately reduce risk.

External Stakeholder Comments

As mentioned in your December 23, 2020 letter, “Navy/DLA have considered the recommendation that the revised approach be discussed with external stakeholders beyond the Regulatory Agencies. At this time, Navy/DLA do not intend to seek input from external stakeholders. However, Navy/DLA would be willing to consider input submitted to EPA/DOH on behalf of external stakeholders. This input can be discussed in the risk workshop proposed by EPA/DOH.” The Regulatory Agencies find that creating an auditable and methodologically based approach for including stakeholder input in the risk assessment process will support a more efficient review and approval of AOC deliverables. The Regulatory Agencies welcome a meeting with Navy and DLA to discuss approaches for stakeholder engagement that would satisfy all AOC parties.

Additional areas of descriptive text are lacking.

The SOW document should be strengthened by more detailed narrative that describes the context of the effort, defines geographic boundaries, elaborates on the specific methodologies that will be used, and describes how the results of the assessment will be communicated.

The Regulatory Agencies received comments on the Navy’s SOW from the Board of Water Supply in a letter dated April 6, 2021. We are enclosing a copy for your review.

Pursuant to Paragraph 7(d) of the AOC, the Navy and DLA are given the opportunity to cure deficiencies and resubmit the Scope of Work within 60 days of the date of this letter or request a meeting within 30 days if additional clarifying information is required. If you are unable to meet this deadline, please notify us immediately and suggest an alternative resubmittal date.

If you have any questions regarding this letter, please contact us.

Sincerely,



Gabriela Carvalho
Red Hill Project Coordinator
EPA Region 9



Roxanne Kwan
Interim Red Hill Project Coordinator
State of Hawaii, Department of Health

Enclosures: Regulatory Agencies’ Notice of Deficiency and Opportunity to Cure letter dated October 23, 2020
Comments on Red Hill Sec 8.2, RVA Phase 2 SOW dated January 20, 2021 by PEMY Consulting
Board of Water Supply Comments dated April 6, 2021



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**STATE OF HAWAII
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October 23, 2020

Captain Gordie Meyer
Commander Navy Region Hawaii
850 Ticonderoga St., Suite 110
Joint Base Pearl Harbor Hickam, Hawaii 96860-5101

Re: Risk and Vulnerability Assessment (“RVA”) Phase 2 Proposed Scope of Work for the Red Hill Administrative Order on Consent (“AOC”) Statement of Work (“SOW”) Section 8, Notice of Deficiency and Opportunity to Cure

Dear Captain Meyer,

The United States Environmental Protection Agency (“EPA”) and the Hawaii Department of Health (“DOH”), collectively the “Regulatory Agencies,” have reviewed the report submitted by the U.S. Department of the Navy (“Navy”) and Defense Logistics Agency (“DLA”) *8.2 Risk/Vulnerability Assessment Phase 2 Scope of Work, Red Hill Bulk Fuel Storage Facility NAVSUP FLC Pearl Harbor, HI (PRL)* (“RVA SOW”), dated September 6, 2019 and accompanied with a cover letter dated November 19, 2019. Pursuant to Paragraph 7(b)(d) of the AOC, the Regulatory Agencies require modifications to address the Regulatory Agencies’ concerns outlined in our September 23, 2019 letter, *Section 8 of the Red Hill Administrative Order on Consent (“AOC”) Statement of Work (“SOW”) Approval of Section 8.3 and Requirements to Complete Additional Work*.

As you are aware, the Regulatory Agencies have been in discussion with the Navy on how to best complete the work required under Section 8 of the AOC. As indicated in the discussions, the Regulatory Agencies are open to a change in approach from that identified in Phase I of the work. The Regulatory Agencies would like to correct Navy’s RVA SOW statement on page 1-1, *“In March 2019, the Regulatory agencies and the Navy agreed to utilize a qualitative approach to the Risk and Vulnerability Assessment over a quantitative one to satisfy the intent of the AOC Scope of Work (SOW)....”* Instead, it should be noted that the Regulatory Agencies agreed to consider a change in the original RVA SOW to a hybrid approach of using both a qualitative and

quantitative approach with proper justification to expedite the RVA final phases without compromising the intent of the original approved RVA SOW.

As discussed in our September 23, 2019 letter, we understood that the approach is to utilize both qualitative and quantitative evaluations. The qualitative phase would utilize qualified subject matter experts to identify key vulnerabilities and prioritize areas for potential risk mitigation. The Navy would prepare expert qualitative evaluations to help assess whether these hazards pose a material risk to the Facility and the environment or determine if they can be eliminated through a screening analysis. Following these qualitative evaluations, expert quantitative analyses will help to assess the level of risk and consequences posed by specific fuel release vulnerabilities or initiating events of concern.

As was discussed during recent scoping meetings, future risk assessment reports need to present risk in terms of environmental consequences. Plausible release scenarios from the full range of initiating events (all Phases identified in the original RVA Scope) should be described in terms of environmental consequences, and if consequences could be great enough to impact drinking water quality or availability, should be analyzed for probability. Those release scenarios should be vetted with the agencies prior to initiating risk evaluations. Tools including but not limited to contaminant fate and transport (CF&T) modeling should be utilized to identify environmental consequences. Environmental consequences should be described in terms of potential contaminant concentrations at existing groundwater extraction locations including, but not limited to Red Hill Shaft, Halawa Shaft, and Moanalua Wells.

We suggest the Navy consider a risk workshop approach to help define the appropriate range of release scenarios for analysis utilizing Navy experts, regulatory agency experts, and stakeholder experts. In addition, the Navy shall provide intermediary submissions, such as after identified milestones, for regulatory agency and stakeholder review and comment. Release scenarios should include rates, volumes, and location of releases. Then the release scenarios should be analyzed to estimate the potential environmental consequences for each release scenario. The fuel release transport characteristics should consider chemical composition associated with a particular release scenario and should also consider the existing fuel mass in-place, as well as the release history at all tanks and associated infrastructure, including the lower tunnel.

Current risk mitigation measures such as release detection and response should be considered as part of the release consequence analysis. However, the reliability of any risk mitigation measure should also be presented in the analysis.

The Regulatory Agencies expect the remaining RVA analysis and deliverables shall include:

1. The comprehensive range of plausible fuel release scenarios and the associated release volumes and rates for each using conservative assumptions. These assumptions and the basis for the assumptions shall be provided and justified.

2. Estimates of potential release rates, volumes, durations, locations and frequencies, and consequences (include cascading scenarios).
3. Evaluation of the likelihood of release events that may result in the release of fuel to the environment that could impact to the quality or availability of drinking water.
4. Identification of potential mitigation measures for identified scenarios with potential to impact drinking water quality or availability.

In accordance with Section 7(d) of the AOC, the Regulatory Agencies are requiring the Navy to revise and resubmit the RVA SOW to address the above deficiencies within 60 days of this letter.

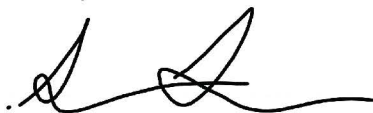
The Regulatory Agencies suggest the Navy look to produce deliverables that characterize risk for a comprehensive range of release scenarios for all appropriate initiating events as expeditiously as practicable. This risk analysis is critical in helping to inform tank upgrade, release detection, operational procedures, maintenance procedure, and repair procedures in order to identify appropriate risk mitigation.

We reiterate that the RVA process should allow for Regulatory Agency, Regulatory Agency subject matter experts, and stakeholder review during various stages of the RVA process. The finished product should be as transparent as possible, and we request early and ongoing input on the table of contents of the planned reporting to be contained in deliverables.

Included for your review and consideration are the Board of Water Supply comments dated January 23, 2020 (Enclosure). We look forward to discussing with the Navy/DLA a path forward to fulfilling the next phase of the RVA.

If you have any questions, please contact us.

Sincerely,



Steven Linder, P.E.
Red Hill Project Coordinator
EPA Region 9



Roxanne Kwan
Interim Red Hill Project Coordinator
State of Hawaii, Department of Health


Enclosure: Honolulu Board of Water Supply (BWS) Comments on ABS Consulting (ABS) document "8.2 Risk/Vulnerability Assessment Phase 2 Scope of Work" dated September 6, 2019 and associated Navy's Cover Letter "Risk and Vulnerability Assessment (RVA) Phase 2 for the Red Hill Administrative Order On Consent (AOC) Statement of Work (SOW) Section 8" dated November 19, 2019.

BOARD OF WATER SUPPLY

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January 23, 2020


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Mr. Omer Shalev
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and

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

Dear Mr. Shalev and Ms. Kwan:

Subject: Honolulu Board of Water Supply (BWS) Comments on ABS Consulting (ABS) document "8.2 Risk/Vulnerability Assessment Phase 2 Scope of Work" dated September 6, 2019 and associated Navy's Cover Letter "Risk and Vulnerability Assessment (RVA) Phase 2 for the Red Hill Administrative Order On Consent (AOC) Statement of Work (SOW) Section 8" dated November 19, 2019.

The BWS offers our comments to the latest two documents submitted by the Navy under Red Hill Bulk Fuel Storage Facility (RHBFSF) AOC Section 8. The first document is the "8.2 Risk/Vulnerability Assessment Phase 2 Scope of Work" dated September 6, 2019 (Navy 2019a). The second document is the Navy's associated cover letter to the Scope of Work document entitled "Risk and Vulnerability Assessment (RVA) Phase 2 for the Red Hill AOC SOW Section 8" dated November 19, 2019 (Navy 2019b).

Please note that the BWS has submitted letters in the past that commented on various Quantitative Risk and Vulnerability Assessment (QRVA) documents submitted previously by the Navy under RHBFSF AOC Section 8 (Lau, 2016; Lau, 2017a; Lau, 2017b; Lau, 2017c; Lau, 2017e; Lau, 2018c; and Lau, 2019c). We are referencing

these past letters as they provide context and historical perspective to our comments contained herein.

Prior to discussing the Navy's cover letter and the Navy's Proposed RVA Phases 2, 3 and 4 Scope of Work, a brief summary of AOC Section 8 and related documents is provided as follows:

- Section 8 of the AOC SOW requires the Navy to perform a risk/vulnerability assessment of the RHBFSF determine the level of risk to the drinking water aquifer and to inform other AOC decisions (EPA/DOH 2015).
- The original scope of AOC Section 8 included a full QRVA using rigorous engineering methods commonly used for nuclear power plants and other critical infrastructure (NAVFAC 2017). This type of risk assessment employs a comprehensive quantitative engineering evaluation performed by specialty consultants. The first of four phases of that work were completed by ABS in November 2018 and took approximately 17 months to complete (ABS 2018).
- After reviewing the unacceptably high probabilities of large fuel releases from ABS' QRVA Phase 1 results, the Navy disputed its own engineering consultant's findings and proposed that AOC Section 8.3 SOW be "modified" to eliminate the rigorous risk assessment for the remaining QRVA phases in favor of a "qualitative approach" (Navy 2019c).
- Notwithstanding the BWS' objections (Lau 2019c), the U.S. Environmental Protection Agency (EPA) and Hawaii Department of Health (DOH) (collectively, "Regulatory Agencies") approved the Navy's reduced scope but required a plan be submitted that would demonstrate certain minimum requirements would be met (EPA/DOH 2019).
- The Navy RVA Phase 2 scope of work (Navy 2019a), as described in its cover letter (Navy 2019b), does not set forth an approach that meets the minimum requirements placed on the Navy by the Regulatory Agencies as conditions of their approval of the Phase 1 RVA Report (EPA/DOH, 2019).

Given that the Navy's qualitative RVA approach cannot determine the risks of fuel releases or aquifer contamination, cannot meaningfully inform a potential tank upgrade alternative (TUA) decision, and does not even satisfy the minimum requirements set forth by the Regulatory Agencies, the BWS urges the Regulatory Agencies to reject the Navy's RVA Phase 2 scope of work unless and until these flaws are corrected. The BWS' detailed comments on the Navy's cover letter and the proposed RVA Phase 2 scope of work are presented below.

Comments on the Navy's Cover Letter

The Navy's cover letter dated November 19, 2019, (Navy 2019b) to the Scope of Work document entitled "Risk and Vulnerability Assessment (RVA) Phase 2 for the Red Hill AOC SOW Section 8" dated September 6 (Navy 2019a) does not describe a plan that would satisfy the AOC or the Regulatory Agencies' conditions of approval (EPA/DOH, 2019). The proposed work scope falls short in three ways:

1. The Regulatory Agencies' approval letter allows for "an approach utilizing both qualitative and quantitative evaluations developed by qualified subject matter experts" followed by "expert **quantitative analyses** will help to **assess the level of risk** posed by specific vulnerabilities or initiating events of concern" (EPA/DOH, 2019) (emphasis added). However, the Navy's proposed scope as described in the cover letter does not satisfy the Regulatory Agencies requirement to "assess the level of risk" and serve as "an extension to the RVA" Nor does the Navy's proposal meet the stated purpose of the AOC SOW, which requires that RVA work must "assess the level of risk the [RHBFSF] may pose to the groundwater and drinking water aquifers and [] inform ... subsequent development of [TUA] decisions." Instead the Navy proposes that the "targeted quantitative analysis will utilize standard engineering calculations." Standard engineering equations compare simplified, nominal strengths to minimum demands contained in general standards (e.g., a building code) but they are not used to assess levels of risk.
2. The Navy acknowledges the requirement to assess the risk to our irreplaceable groundwater aquifer with only a vague reference to "the required fate and transport model used for evaluation of chemicals of potential concern (COPCs) in groundwater" (Navy, 2019a). The Navy does not indicate that the RVA will "simulate consequences of potential uncontrolled releases" as required by the EPA and DOH (EPA/DOH, 2019). As such, the proposed scope does not satisfy the AOC or the Regulatory Agencies' requirements.
3. In addition to describing a process that falls short of the approval conditions, the cover letter contains complete disregard of the Regulatory Agencies' directive that the Navy and Defense Logistics Agency (DLA) discuss the proposed approach with all stakeholders. Instead the Navy states: "At this time, Navy/DLA do not intend to seek input from external stakeholders.... Comments will be reviewed and considered when the assessment is publicly released." As such, the Navy's cover letter violates both the letter and the spirit of the Regulatory Agencies' conditional approval and prevents a review from all stakeholder subject matter experts (SMEs). This is inexcusable and should not be tolerated. The Navy's decision to adopt such a posture after its unconvincing disavowal of the results from its own consultant's rigorous Phase 1 quantitative risk evaluation

also does not foster transparency or confidence among interested third parties as the Navy conducts its follow-on work associated with AOC Section 8.

Comments on the Navy's Proposed RVA Phase 2 Scope of Work

Consistent with its cover letter, the proposed RVA Phase 2 scope of work fails to describe a process for conducting a technically defensible quantitative RVA or that meets the Regulatory Agencies' minimum additional work requirements.

First, the "targeted quantitative analyses" described in the proposed RVA Phase 2 scope of work will not provide new information to aid in assessing the level of risk posed by specific initiating events of concern. Such analyses are proposed only for selected seismic events and certain accident scenarios affecting the lower access tunnel. More importantly, even when such analyses are undertaken, they will not produce a quantitative estimate of risk. The Navy's proposed scope of work explicitly states that, in such instances, the report "will not include analyses previously included in the full scope QRVA, such as ... Risk Quantification." Such exercises are not conducive to conducting technically sound quantitative risk analyses, targeted to focus on the initiating events of greatest concern, and thus do not meet the Regulatory Agencies' additional work requirements.

In its May 29, 2019 letter to the Regulatory Agencies (Navy 2019c), the Navy summarized its intention to abandon the previously approved approach to the AOC SOW Section 8 risk assessment. Upon review, and as described in their September 23, 2019 letter to the Navy (EPA/DOH, 2019), the Regulatory Agencies have approved of this approach to satisfy AOC Section 8.3 subject to two conditions for additional work.

The first of the Regulatory Agencies' two requirements relates to how opinions would be used in lieu of engineering analysis to determine which risks can be ignored. The approach described by the Regulatory Agencies' conditional approval is one in which a qualitative evaluation involving expert opinion would be used to eliminate some possible damage mechanisms from consideration (screening) but would then be followed by quantitative risk assessment of the unscreened hazards. However, the Navy does not seem to be proposing this at all. The current Navy proposal would most certainly and purposely screen hazards from consideration based on opinion, but the unscreened hazards would be evaluated using standard engineering equations such as those found in a building code. While assessments using standard engineering equations might indeed be quantitative in nature, their use is not applicable for performing quantitative risk assessment. The proposed approach is unsatisfactory because the results of this proposed phase of AOC Section 8 work could not be combined with or otherwise inform the quantitative results of RVA Phase 1, nor could they inform the risks of product releases or aquifer contamination in any meaningful (quantitative) way.

For instance, on Page 3-4 of the Navy proposal we find that the seismic analysis will not include “detailed analysis of facility specific component fragility.” In this context, “fragility” means a curve that quantifies through engineering analysis how the probability of component failure increases with increasing earthquake ground shaking intensity. A fragility curve is a key component of any quantitative risk assessment, and explicitly precluding it is a clear indication that such assessment is not intended. In short, the analysis as described by the Navy proposal cannot lead to meaningful quantitative risk assessment or expand the efforts completed in the Phase 1 work.

Also, contrary to the Regulatory Agencies’ second requirement, the proposed scope of work will not simulate consequences of potential uncontrolled fuel releases—specifically, acute large releases initiated at the tank nozzle and smaller acute releases initiated at the tank liner—to the groundwater and drinking water aquifers. Such work is explicitly excluded from the scope to be undertaken by the Navy’s authorized contractor, ABS, which “[w]ill not quantify or characterize the impact to the water table.” In its cover letter, the Navy does pledge to conduct “vadose zone modeling ... which will help bound our understanding ... for a range of releases ... [and] will provide a basis for developing the source terms that will be used in the required fate and transport model.” However, this general language falls short of a clear commitment to address the specific releases defined by the Regulatory Agencies as the minimum requisite level of modeling effort. Without specific release volumes generated by the AOC Section 8 work, the Navy will have no factual basis with which to model contaminant releases as required by AOC Section 7.

Summary of Comments

The BWS reiterates our insistence for continuing the rigorous **quantitative risk** approach of Phase 1 for Phases 2 through 4 of the RVA. The reduced approach proposed by the Navy is a significant step backwards that should not be tolerated, and fails the explicit requirements recently established by the Regulatory Agencies (EPA/DOH, 2019). Results from the Navy’s proposed qualitative method cannot be used to meaningfully expand the already completed Phase 1 results. Given the Navy’s failure to fulfill the clear directive provided by both the AOC and the Regulatory Agencies, the BWS urges the Regulatory Agencies to reject the Navy’s RVA Phase 2 scope of work and require the Navy to prepare a scope of work capable of quantitatively assessing the level of risk the RHBFSF poses to our critical drinking water resources and informing a subsequent TUA decision as required by the AOC.

In the interest of, transparency the Navy should release an un-redacted version of the Phase 1 QRVA without requiring signature of a non-disclosure agreement by accessing parties.

Mr. Shalev and Ms. Kwan
January 23, 2020
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Thank you for the opportunity to comment. If you have any questions, please contact Mr. Erwin Kawata, Program Administrator of the Water Quality Division, at 808-748-5080.

Very truly yours,



ERNEST Y.W. LAU, P.E.
Manager and Chief Engineer

CC: Mr. Steve Linder
United States Environmental Protection Agency
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References

ABS Consulting (ABS). 2018. Quantitative Risk and Vulnerability Assessment Phase 1 (Internal Events without Fire and Flooding), Red Hill Bulk Fuel Storage Facility NAVSUP FLC Pearl Harbor, HI. November 12.

AMEC Earth & Environmental, Inc. (AMEC). 2002. Comprehensive Long-Term Environmental Action Navy (CLEAN) for Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, Hawai'i. Red Hill Bulk Fuel Storage Facility Investigation Report (Final) for Fleet Industrial Supply Center O'ahu, Hawai'i. August.

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- Lau, E. Y. W. 2017b. Letter to Mr. Bob Pallarino, United States Environmental Protection Agency (EPA) and Mr. Steven Y.K. Chang, State of Hawaii, Department of Health regarding: Board of Water Supply (BWS) Comments to the EPA and DOH Letter Conditionally Approving the United States Navy's Section 8.2 Scope of Work ("SOW") – Risk and Vulnerability Assessment, Dated May 16, 2017. August 1.
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- Lau, E. Y. W. 2017e. Letter to Mr. Bob Pallarino, United States Environmental Protection Agency (EPA), Ms. Roxanne Kwan, State of Hawaii, Department of Health, and Mr. Mark Manfredi, NAVFAC Hawaii regarding: Honolulu Board of Water Supply (BWS) Comments on the Red Hill Administrative Order on Consent (AOC) Statement of Work (SOW) Section 8 Quantitative Risk and Vulnerability Assessment (QRVA) Phase 1 Preliminary Data Analysis Report as presented by Navy Contractor ABS Group (ABS) on December 5 and 7, 2017. December 18.

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Comments on Red Hill Sec 8.2, RVA Phase 2 SOW

20 Jan 2021

Overall comment on the Red Hill Sec 8.2 RVA Phase 2 SOW dated 23 Dec 2020

The Scope of Work (SOW) is presented in conceptual terms with an emphasis on the structure and various activities of the proposed Phase 2 Risk and Vulnerability Assessment (RVA) work. This is helpful for a general understanding of how that portion of the RVA work will be approached. The SOW doesn't specify how assessments will be conducted.

The conceptual-level terminology leaves room for different interpretations of how some of the risk assessment work will be conducted. This ambiguity in how assessments will be conducted – that is, what type of modeling will be used – makes it difficult to know with much clarity what work is being proposed.

There are three main topics in the SOW that would benefit from some further clarification. These are expanded on in the rest of this document.

- What will the product of the RVA phase 2 work look like? Some specificity on this would be helpful in understanding the degree of detail and the breadth of content.
- How will the RVA product be integrated with the Contaminant Fate and Transport (CF&T) modeling results to create the Investigation and Remediation Releases (IRR) report? How will the RVA be conducted so that compatibility with the CF&T is assured?
- Finally, related to the two areas of clarification already listed, it would be helpful to have some added detail on (1) the specific methodology that will be employed for the risk assessment and (2) the roles of those participating in the assessment process.

Further detail is provided below for each of these areas where some additional detail would be beneficial.

1. What is the product of the RVA? What will it look like?

Although the SOW says in multiple places that it will be estimating risk and that risk includes consideration of impacts to the drinking water, in Section 3.8, "Phase 2 Activities", there is this statement:

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- “The following scope outline is applied to the Phase 2 RVA Scope of Work: Basis: Will not quantify or characterize the impact to the water table; assessment will be limited to consideration of likelihood of a loss of inventory control. The Phase 1 assessment will be the baseline for loss of inventory control ... that can be caused by the initiate events considered in Phase 2.” [Page 3-9]
 - It isn’t clear how “loss of inventory” is evaluated as “risk” if there is not even any “characterization” of impacts to the water table. Is it just volume, as Section 2 says?
 - This limitation excluding impacts to the water table makes the many activities involving drinking water described in the body of the SOW difficult to interpret.
 - Since scenarios will be ranked (“prioritized”) based on “overall facility risk” [Page 3-8], how is that risk ranking developed when there will be no characterization of impacts to the water table.
- “Overall facility risk” [Page 3-8]
 - This is the criterion (or criteria?) for ranking risks posed by the facility to public assets. It isn’t defined anywhere in this SOW. Is this a single metric? If not, how is “overall” defined?
 - Subject matter experts [SMEs] are “determined” based on the risk ranking (“list of prioritized risks”) [Page 2-5] based on this “overall” criterion. How can risks be ranked before subject matter experts are identified? Aren’t SMEs necessary to define, identify, and assess risks? If so, how can they be chosen after this key SME role is already completed?

2. How is compatibility of the RVA and the CF&T certain

The SOW shows in a flow diagram [Figure 3-3] that the RVA results will be integrated with the CF&T modeling results to produce the IRR report.

- What is the methodological structure of the RVA that assures compatibility with the structure and output of the CF&T? The SOW says nothing about the specific structure of the RVA; in addition, the CF&T is a completely separate work stream.

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- Clarification is needed on the actual modeling methodologies that assures these two streams of analyses can be integrated in a meaningful and useful way. It is rare that separate workstreams of analyses on different types of variables requiring different types of modeling (which is often why they are separated in the first place) can actually be combined in a methodological way unless this is taken into account in designing the two basic approaches at their start.

3. How will the RVA be conducted

The previous two paragraphs (1 and 2, above) highlight two aspects of the SOW that have some ambiguities: (1) it is unclear what “risk” means if it is only volume of loss of inventory, and (2) it is unclear how the risk analyses (RVA) it will be integrated with the flow and transport modeling CF&T results.

The methodologies to be used for each of these workstreams would typically resolve both of these sources of ambiguity.

The body of the SOW presents the methodology to be used to define and characterize “risk.” “Section 2: Methods, Process, and Criteria for Data Quality” [Page 2-1], presents some possible examples of how analyses might be conducted. The appropriateness of these approaches for a modeling effort of this size and significance if not presented. That would be an important inclusion in this section. In addition, it isn’t even clear from the current presentation if the approaches discussed are certain to be used.

a. *Objectives* [Section 2-3, page 2-2] that would benefit from clarification:

- Objective 2 is to “develop estimates of potential release rates, volumes...and consequences,” but the consequences are ultimately just total volume released – no link to impacts, just volume. Is volume the criterion for “risk?”
- Objective 3 is to “evaluate the likelihood of release events” that could impact “drinking water,” but since characterization of impacts to ground water are included in this SOW, how are the likelihoods “evaluated?”
- Objective 4 is to “identify potential mitigation measures” for scenarios that can impact “water quality or availability.” If only inventory loss is estimated and no characterization of water impacts is conducted, how can mitigations be effectively discussed other than keeping the inventory from escaping containment?

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- b. Methodology [Section 3.1, page 3-1]: The description of risk assessment (RVA) activities would benefit from clarification

This section presents a series of conceptual steps but there is no “methodology”, so it isn’t clear how these concepts will be implemented. Some examples are listed below to highlight some areas where the SOW could be more precise.

- *Severity*: This section of the SOW [Starting page 3-2, third paragraph, “Step one involves estimating the severity...”] only provides a possible approach by way of an example as a means for characterizing severity of impact.
 - On page 3-2, the SOW suggests “*One example of a method used to qualitatively evaluate the severity of the risk is shown...*” [emphasis added]. This is the well-known PEAR checklist, which is useful for real-time management tool for an incident but is not used (nor recommended for use) for a large-scale quantitative assessment of this scope. In addition, the categories aren’t clear; whose “reputation” is at stake, for example? The Navy, speaking generally? The Naval administration of Red Hill?
 - Also on page 3-2, the SOW says “the primary undesired consequence is the loss of fuel inventory control.” If loss of inventory is a *consequence*, are the PEAR attributes (environment, etc.) *additional* consequences? If water table impacts are not characterized, this statement seems to mix events (loss of containment) with qualitative concerns (reputation) and no mention of impacts to drinking water. How is “overall facility risk” defined?
- *Frequency*: On page 3-4, top paragraph, one or two examples are shown for defining frequency (or likelihood), but there is no statement about what will be used. The first example is a nominal scale; perhaps it is meant to be ordinal? The definition is too vague to be certain. Clarification is needed on what is planned to be done, rather than examples of what *could* be done.
- *Risk*: On page 3-4, example ordinal scales linked back to the PEAR paradigm are shown as examples with nominal labels (minor, major, etc.). Is this just an example or is this the structure proposed for use? Is this structure compatible with the CF&T methodology? Note that risk matrices are not a “methodology” for making assessments of either impact or likelihood; they are graphical means of displaying those estimates. PEAR is not a methodology for assessing risk, either, just categorizing it.

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- *Methodology:* On page 3-4, an example of a risk matrix (RAM) is shown in Table 3-4. This is a geometric way of displaying frequency and consequence of different scenarios. Is this the “methodology” that is proposed for the RVA? There are many ways to set up and to use risk matrices, and there are multiple ways to extract “overall risk” of a scenario. Clarification is needed about what is planned for the RVA.

This section on methodology is conceptual and uses flow diagrams associated with risk assessment processes. There is ambiguity for the reader when trying to understand specifics of the proposed approach to defining, identifying, and quantifying “overall risk” and vulnerabilities of the facility, as promised at the start off the proposed SOW. The PEAR paradigm would typically be considered inadequate for an assessment that would be useful to Red Hill at this point, so some justification of appropriateness is needed if this is basis for the RVA.

4. Roles in the RVA process would benefit from clarification

There are a number of places in the SOW where the roles of “stakeholders” and the roles of “SMEs” are unclear and sometimes seem reversed.

- Table 2-1, the risk scenario paragraph on page 2-7, and Table 4-1, the summary of milestones, say that stakeholders will develop, then consolidate, then rank a list of risk scenario scenarios that will be submitted to the Navy.
 - This is unusual and the rationale for this step would be helpful. Typically, stakeholders provide a list of the assets they value and that they fear will be adversely impacted by the hazard. Drinking water is one of those assets that has been identified. Stakeholders may identify some key initiating events they care about (an earthquake, for example). Then SMEs provide the technical expertise needed to figure out how the hazard might adversely impact the asset.
 - Scenarios are a technical contribution to the overall risk assessment; they can be reviewed and commented on by stakeholders and stakeholders can contribute causes they want investigated (e.g., earthquakes), but they don’t have the expertise to provide solid scenario analysis of the pathway of impact. That seems to fall more in the CF&T analyses. This may be a semantic point but clarification is needed as to what is meant by this reference to stakeholders developing and then ranking risk scenarios in the proposed SOW. More on this in the next point.

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- The RVA workshops are used to prioritize the scenarios according to Section 3-1, page 3-1: [under paragraph 2. RVA Workshops] “stakeholders will meet to rank the list [of scenarios] from highest risk to lowest risk.” According to Section 1, SMEs prioritize risks.
 - “Prioritizing” here means ranking scenarios in terms of overall risk of the facility. But that overall risk isn’t available until later, according to the steps outlined in section 2. And prioritizing takes place in the first step in Section 2, it is done by SMEs absent input from stakeholders.
 - A stakeholder meeting is not equipped to rank qualitative scenarios that are not yet fully developed.
 - Typically, as said before, stakeholders specify what assets they care about, SMEs construct potential scenarios, evaluate their estimated impacts on those assets, report those estimates to the stakeholders, and the estimated impacts are the basis for the initial ranking of scenarios. Stakeholders review this ranking and have input. Stakeholders may propose use of specific SMEs, but the stakeholder role is distinct from the SME role and provides very different inputs to the decision process.
 - Summary: Different sequences seem to be presented in different parts of the SOW.
- In Section 3, SMEs “screen” scenarios and develop risk “thresholds” that determine which risks are “credible” and what risks are “acceptable.” In Step 4 at the bottom of page 3-7, “...risk and vulnerability assessment will be conducted by personnel with the appropriate range of experience and historical knowledge.” Step 2: “...scenarios must be credible.” This refers to SMEs making these judgments?
 - Section 3-4, page 3-8: “...screening analyses...will be based on criteria for acceptable threshold [sic] of risk. These risk thresholds will be developed by the Red Hill Bulk Fuel Storage Facility RHBFSF subject matter experts.”
 - This needs to be explained. SMEs are present because they have needed technical and analytical capabilities. They don’t tell stakeholders what risks they will tolerate, much less accept, and which they will not.
 - Stakeholders are the ones bearing the risks so stakeholders are the ones who specify what risk levels they find tolerable; this is always a mix of tradeoffs. For example, some aesthetic risk may be tolerated because the risk of high cost or further damage out-

weigh the risk of aesthetic issues. SMEs don't tell stakeholders a risk the stakeholders bear is "acceptable."

- To aid in the assessment of tolerable risks, public agencies (for example, EPA) have conducted extensive investigations in the past to identify the characteristics of "safe" drinking water. Risks in the public interest often use these as guidelines to define tolerable risk levels for the public.

Roles are important; Stakeholders specify their "stake" in relationship to the hazard – the assets they value that could be adversely impacted by the hazard. SMEs provide the technical expertise to estimate how the hazard might impact those assets, how severely, and how likely that is to happen. The stakeholders consider those estimates and decision makers then make decisions about what mitigations, if any, need to be conducted.

5. Section 3 quality assurance clarifications would be useful

Large-scale analyses with multiple streams of work using large datasets and large-scale and/or proprietary software have the potential for loss of both data quality and analytical quality – datasets are corrupted and software accuracies aren't tested due to problem size. Data quality, especially in risk assessments of the size and significance of Red Hill, is an important contributor to confidence in the overall results. The SOW provides no structural comments on this aspect of the RVA other than to say that "Phase 2 RVA project will ... strive for continual improvement ... for establishing ... quality." A methodologically-sound processes for assuring the quality of the data, the results, and their usefulness to the decision process should be part of SOWs going forward.

Summary comment

Making adjustments through clarifications in the SOW is relatively straightforward at this point in the process. Making certain that everyone's expectations of the result are accurate saves a lot of time in the process as well as in the evaluation and use of the results.

For these reasons, it is especially important that both the Navy and the Red Hill team are clear about what the RVA activities are, what the final product will look like, and how it will be used.

The Section 8.2 RVA SOW is primarily conceptual in its descriptions of proposed activities. There are examples presented of approaches that could be taken, but it isn't clear if these are what is planned

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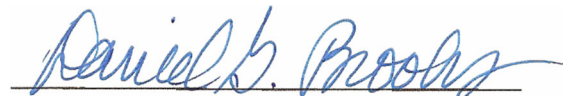
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and, if so, why they are appropriate for a decision process as large, complicated, and significant as Red Hill.

Readers' expectations would benefit from clarifications of the ambiguities listed in this document regarding descriptions of the (1) product the RVA will produce, (2) the methodology employed to produce that product, (3) how that product is assured to be compatible with the CF&T, (4) and the rationale for the roles of the various participants in conducting the RVA.

A key aspect of risk assessment and management conducted in the public interest is that the decision process employed is sound, appropriate, helpful, and auditable if questions arise. The comments above are an attempt to make the Red Hill decision process more auditable but the various parties that will be impacted by its results.

Daniel G. Brooks



20 January 2021

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April 6, 2021

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Dear Mr. Linder and Ms. Kwan:

Subject: Honolulu Board of Water Supply (BWS) Comments on Navy document "Section 8.2 - Risk/Vulnerability Assessment Phase 2 Scope of Work" dated December 23, 2020 and associated Navy's Cover Letter "Risk and Vulnerability Assessment Phase 2 for the Red Hill Administrative Order On Consent Statement of Work Section 8, Notice of Deficiency and Opportunity to Cure" dated December 23, 2020

The BWS offers our comments on the subject two documents submitted by the Navy under Red Hill Bulk Fuel Storage Facility (RHBFSF) Administrative Order on Consent (AOC) Section 8. The first document is the "Section 8.2 - Risk/Vulnerability Assessment Phase 2 Scope of Work" dated December 23, 2020 (NAVFAC 2020). The second document is the Navy's associated cover letter to the Scope of Work document entitled "Risk and Vulnerability Assessment Phase 2 for the Red Hill Administrative Order on Consent Statement of Work Section 8, Notice of Deficiency and Opportunity to Cure" dated December 23, 2020 (Navy 2020).

Please note that the BWS has submitted letters in the past that commented on various Quantitative Risk and Vulnerability Assessment (QRVA) documents submitted previously by the Navy under RHBFSF AOC Section 8 (Lau, 2016; Lau, 2017a; Lau, 2017b; Lau, 2017c; Lau, 2017e; Lau, 2018c; Lau, 2019c; and Lau, 2020). We are

referencing these past letters as they provide context and historical perspective to our comments contained herein.

Prior to discussing the Navy's Proposed RVA Phases 2, 3 and 4 Scope of Work, a brief summary of AOC Section 8 and related documents is provided as follows:

- Section 8 of the AOC SOW requires the Navy to perform a risk/vulnerability assessment of the RHBFSF to determine the level of risk to the drinking water aquifer and to inform other AOC decisions (EPA/DOH, 2015).
- The original scope of AOC Section 8 included a full QRVA using rigorous engineering methods commonly used for nuclear power plants and other critical infrastructure (NAVFAC, 2017). This type of risk assessment employs a comprehensive quantitative engineering evaluation performed by specialty consultants. The first of four phases of that work were completed by ABS Consulting in November 2018 and took approximately 17 months to complete (ABS 2018).
- After reviewing the unacceptably high probabilities of large fuel releases from ABS' QRVA Phase 1 results, the Navy appears to be disputing its own engineering consultant's findings and has proposed that the AOC Section 8.3 SOW be "modified" to eliminate the rigorous quantitative risk assessment for the remaining QRVA phases in favor of a "qualitative approach" (Navy, 2019c).
- As recognized in the AOC, a qualitative risk assessment has limited value to inform decision-making. Therefore, the BWS continues to object to any attempt by the Navy to abandon the agreed-upon quantitative risk assessment approach for a qualitative assessment of the risks posed by the RHBFSF, consistent with the comments provided on September 5th (Lau, 2019c).
- On September 23, 2019, the U.S. Environmental Protection Agency (EPA) and Hawaii Department of Health (DOH) (collectively, "Regulatory Agencies") conditionally approved the Phase 1 RVA Report and expressed an "openness" to consider the Navy's proposal to conduct a qualitative screening approach to potential risks prior to conducting a quantitative risk posed by specific vulnerability or initiating events of concern. The Regulatory Agencies required that the Navy submit a revised work plan detailing how certain minimum requirements would be met, including that certain risks be quantified (EPA/DOH, 2019).
- The Navy's RVA Phase 2 scope of work (Navy, 2019a), as described in its cover letter (Navy 2019b), did not set forth an approach that meets these minimum quantitative evaluation requirements placed on the Navy by the Regulatory

Agencies as conditions of their approval of the Phase 1 RVA Report (EPA/DOH, 2019).

- On October 23, 2020, the Regulatory Agencies issued a Notice of Deficiency and Opportunity to Cure (EPA/DOH, 2020) reasserting their position that the Phase 2 RVA should include quantitative analyses and enumerating their expectations of the Phase 2 RVA deliverables.
- As described in its cover letter (Navy, 2020), the Navy intended the revised RVA Phase 2 scope of work (NAVFAC, 2020) to meet the requirements placed on the Navy by the Regulatory Agencies as conditions of their approval of the Phase 1 RVA Report (EPA/DOH, 2019) and reiterated in the notice of deficiency (EPA/DOH, 2020). However, the RVA approach outlined by the Navy fails to meet the requirements or the stated objective of the Risk Assessment.
- Specifically, the BWS finds insufficient basis to conclude that implementing the current Navy approach, as described in the revised RVA Phase 2 scope of work, will yield results that can be combined with or otherwise inform the quantitative results of the Phase 1 QRVA. Further, it does not appear that the Navy's proposal, if implemented, could inform the assessment of the risks of product releases or aquifer contamination in any meaningful (quantitative) way.

In view of the apparent gap between the Navy's proposed RVA approach and its stated objectives, the BWS urges the Regulatory Agencies to reject the Navy's proposal and require the execution of a scope of work that will produce risk estimates compatible with the Phase 1 QRVA and that can be integrated with the Phase 1 results to provide a more accurate and complete assessment of risk. The BWS' detailed comments on the Navy's cover letter and the revised RVA Phase 2 scope of work are presented below.

Comments on the Navy's Cover Letter

The Navy's cover letter, dated December 23, 2020 (Navy 2020), to the Scope of Work document entitled "Section 8.2 - Risk/Vulnerability Assessment Phase 2 Scope of Work," also dated December 23, 2020 (NAVFAC 2020), purports to address the four expectations enumerated in the Regulatory Agencies' notice of deficiency (EPA/DOH 2020). However, the Navy's characterization of the proposed work scope does not fulfill the letter or spirit of the Regulatory Agencies' guidance in at least three critical respects:

1. *Deferral of the estimation of environmental consequences of fuel releases.* The Regulatory Agencies clearly stated that the RVA analysis and deliverables needed to include an estimate of the environmental consequences of all fuel releases. Rather than providing this in the SOW as expressly required, the Navy proposes to defer this work until submission and regulatory approval of other AOC deliverables—including reports on the modeling of groundwater flow and

contaminant fate and transport, as well as the investigation and remediation of releases.

2. *Omission of potential mitigation measures for identified scenarios.* The Regulatory Agencies required the Navy to include in the remaining RVA analysis and deliverable “identification of potential mitigation measures for identified scenarios with potential to impact drinking water quality and availability.” In its cover letter, the Navy does not even mention this expressed requirement or explain how it will be satisfied. Although the RVA Scope of Work discusses the development of mitigation measures, it does not indicate when this work will be completed.
3. *Persistent refusal to solicit input from external stakeholders.* In their notice of deficiency, the Regulatory Agencies reiterated that the RVA process should allow for stakeholder review at various stages. In response the Navy repeats a statement from its previous cover letter: “At this time, Navy/DLA do not intend to seek input from external stakeholders.” Although this statement is followed by a pledge to consider input submitted to the Regulatory Agencies on behalf of external stakeholders, the Navy’s cover letter is inconsistent with the spirit of the Regulatory Agencies’ notice of deficiency and effectively precludes timely review and input from all stakeholder subject matter experts. The Navy’s decision to maintain such a posture after the Regulatory Agencies’ rejection of the previously submitted Phase 2 QRVA scope of work also does not foster transparency or confidence among interested third parties as the Navy conducts its follow-on risk assessment work associated with AOC Section 8.

Comments on the Navy’s Proposed RVA Phase 2 Scope of Work

Compared to the previously submitted scope of work (Navy 2019a), the revised RVA Phase 2 scope of work (NAVFAC 2020) does include a more thorough description of the qualitative risk assessment methodology the Navy proposes be used in evaluating and screening what it considers plausible risk scenarios. The scope of work indicates that scenarios with risk ratings in a red zone defined by their likelihood and consequences will then be evaluated quantitatively to estimate release rates, durations, and volumes, as well as the associated probabilities and frequencies.

Despite this new content in the proposal, the adoption of Regulatory Agency expectations as primary study objectives, and the representations made in the Navy’s cover letter, the revised RVA Phase 2 scope of work fails to describe a process for conducting a technically defensible quantitative RVA or one that unambiguously meets the Regulatory Agencies’ minimum additional work requirements. Instead, the revised RVA Phase 2 scope of work retains several key deficiencies on which we have commented previously, including that the proposed RVA Phase 2:

1. Will not adequately assess the risks of fuel releases or aquifer contamination,
2. Will not meaningfully inform a potential tank upgrade alternative decision, and
3. Will not provide a mechanism for direct external stakeholder review.

In addition, the revised Phase 2 scope of work raises new concerns regarding some aspects of the qualitative risk assessment methodology.

- Continued reliance on a “[s]implified bounding assessment in lieu of a comprehensive quantitative assessment, which is complex and time consuming.”

Although the revised RVA Phase 2 scope of work now proposes to include quantitative evaluation of selected event scenarios, the description of Phase 2 activities indicates the Navy still expects that the risk of most events can be assessed adequately using a qualitative white paper approach. As in the previous submission, only for selected seismic events and certain accident scenarios affecting the lower access tunnel, the revised RVA Phase 2 scope of work proposes to undertake a simplified bounding assessment and a targeted analysis to identify potential facility improvements.

The revised RVA Phase 2 scope of work does not justify the simplified assessments or explain how they will provide credible quantitative estimates of risk necessary to make critical decisions under the AOC such as the TUA. For example, retaining language from the original submission, the revised RVA Phase 2 scope of work describes the assessment of earthquake risk as a “probabilistic bounding analysis of seismic hazards under the assumption of an agreed analysis, seismic design basis..., and seismic analysis of the relevant structures and nonstructural components”. However, as before, the seismic analysis will not include “detailed soil-structure interaction analysis” or “detailed analysis of facility specific component fragility.” As the BWS noted in our latest comment letter (Lau, 2020), a fragility curve is a key component of any quantitative assessment of seismic risk, and explicitly precluding it is a clear indication that such assessment is not intended.

The Navy proposes to use the Phase 1 assessment as the baseline for loss of inventory control that can be caused by the Phase 2 initiating events, but the revised RVA Phase 2 scope of work does not explain how the Red Hill facility’s response to an earthquake, for example, will be expressed in terms of the location and size of holes in the tank liner, nozzle, and piping. In short, the analysis as described by the Navy proposal cannot lead to meaningful quantitative risk assessment or expand the efforts completed in the Phase 1 work.

- Continued reliance on “targeted quantitative analyses,” undefined further in the revised Phase 2 scope of work but previously described by the Navy as utilizing “standardized engineering calculations” (Navy, 2019b).

In the absence of further details in the proposed RVA Phase 2 scope of work concerning such “targeted quantitative analyses”, there is no basis to expect the Navy will provide new information to aid in assessing the level of risk posed by specific initiating events of concern. As the BWS noted in our latest comment letter (Lau, 2020), the unscreened hazards would apparently be evaluated using standard engineering equations such as those found in a building code. While assessments using standard engineering equations might indeed be quantitative in nature, their use is not applicable for performing quantitative risk assessment.

For example, the process flow chart for the seismic RVA (Figure 3-8, NAVFAC, 2020) is unchanged from the original, rejected Phase 2 scope of work, as is the statement that “[t]he seismic RVA bounding analysis will apply a demand-to-capacity ratio approach for decision support.” Standard engineering equations compare simplified, nominal strengths to minimum demands contained in general standards (e.g., a building code), but they are not used to assess levels of risk. The proposed approach is therefore unsatisfactory, because the results of this proposed phase of AOC Section 8 work could not be combined with or otherwise inform the quantitative results of RVA Phase 1, nor could they inform the risks of product releases or aquifer contamination in any meaningful (quantitative) way.

The revised RVA Phase 2 proposal stands in stark contrast to common practice in the chemical industry, in which quantitative risk assessments are often performed—using fault trees, event trees, and data analysis methods similar to those used in the Red Hill Phase 1 QRVA—on select high-risk scenarios previously identified from qualitative screening assessments. The detailed scope of work and associated process flow diagrams provide no indication that quantitative evaluation of the high-risk scenarios will be performed in a manner compatible with the Phase 1 QRVA. The absence of clarity regarding which quantitative evaluation methods the Navy proposes to implement raises serious questions about whether the Navy’s methodology is adequate to meet the expectations established by the Regulatory Agencies.

- No allowance in the detailed scope of work to identify additional risk scenarios for quantitative evaluation during the RVA workshop.

Quantitative risk evaluations, described in the revised RVA Phase 2 scope of work as involving simplified bounding assessments and targeted quantitative analyses, are proposed only for selected seismic events and certain accident scenarios affecting the lower access tunnel. A qualitative, “white paper” approach to risk assessment is proposed for all other events. Although specification of an expected scope of work may be useful for budgeting purposes, the detailed scope of work is logically inconsistent with the proposed general RVA approach in its failure to acknowledge that the set of events designated for quantitative risk assessment is ultimately to be determined in the RVA workshop.

Furthermore, notwithstanding the revised objective to develop estimates of potential release volumes and frequencies, the contents of the RVA Phase 2 detailed scope of work is virtually unchanged from the Navy's original submission. The process flow charts for floods, fires, and other external events in the two submissions are identical and offer no indication that quantification of any risk scenarios might be performed. Even the process flow chart for seismic events, including those designated for targeted quantitative analyses, has a block that references seismic risk qualification—not quantification.

- Ambiguity and imbalance in the qualitative risk assessment methodology.

The revised RVA Phase 2 scope of work presents a methodology for qualitative risk assessment that differentiates the consequential harm to people, assets, environment, and reputation (PAER). However, although the expressed intent is to emphasize the impacts on people and environment, the risk matrix scoring appears to weigh direct impacts on people more heavily than environment impacts. For example, an event scenario that has occurred previously at Red Hill would be designated for quantitative evaluation (i.e., assigned to the “red zone”) if it involves permanent total disability or up to three fatalities, but not if it involves a moderate (not major) effect on the environment. For the Red Hill facility, it is essential that the RVA Phase 2 focus on environmental impacts, consistent with EPA and DOH previous comments and with the original Phase 1 QRVA. An environmental impact should be considered sufficiently severe to require quantification if it would result in the release of a measurable amount of fuel to the underlying sole source aquifer.

Also, the severity categories of environmental impact should be defined precisely in terms of potential fuel volume release ranges (i.e., number of gallons released), consistent with the QRVA Phase 1. The illustrated classification of environmental effects as minor, moderate, major, or massive is vague and subjective—in contrast to the classification of impacts on people, for which the distinction between “up to 3 fatalities” and “more than 3 fatalities” defines, respectively, the two categories of most severe consequence.

The likelihood categories should be precisely defined in terms their expected occurrence interval (such as once a year, once in 10 years, once in 100 years etc.). At present all of the top likelihood categories are associated with a “has happened or more than once a year” time frame (either at the location, or in the organization or in the industry). Moreover, the subsequent quantitative evaluation is proposed only for select “red zone” combinations of such “has happened or once a year time frame” likelihood categories. The RVA Phase 2 approach (as currently proposed) will NOT “quantify” potential moderate/major fuel releases with expected occurrence likelihoods of “once in 10 years” or “once in 100 years”.

It is also critical that the “original” QRVA Phase 1 scenario event categories be retained, especially for the “quantification” phase of select RVA Phase 2 high-risk “Red” zone scenarios. We recommend that the regulators require the Navy to include all of the high probability release initiating events identified by ABS (e.g., liner leaks) as definitively in the “red zone” and thus needing to be quantified. Although liner leaks (and other such high probability events) were already a part of Phase 1 QRVA, it is likely that the likelihood of such events could be “further” increased by contribution from these other Phase 2, 3, 4 pathways. In fact, if Navy’s consultant (ABS) had continued on the originally proposed QRVA path for Phases 2-4 they would have likely retained all of the high risk Phase 1 identified leak events and “added” additional probabilities to such events (from the subsequent QRVA Phase 2-4 evaluations).

- Continued restriction of assessment scope to the loss of inventory control without quantification or characterization of the impact to the underlying aquifer.

As in the Navy’s previous RVA Phase 2 submission, the proposed scope of work will not simulate consequences of potential uncontrolled fuel releases—specifically, acute large releases initiated at the tank nozzle and smaller acute releases initiated at the tank liner—to the underlying groundwater aquifer and nearby drinking water production wells. Such work is explicitly excluded from the scope, which is “limited to consideration of likelihood of a loss of inventory control” and “[w]ill not quantify or characterize the impact to the water table” (NAVFAC 2020). In its cover letter, the Navy does pledge to evaluate the impact of fuel releases on the quality or availability of drinking water when associated AOC deliverables have been completed and received regulatory approval. However, unless the AOC Section 8 work generates specific release volumes for individual risk scenarios, the Navy will have no factual basis on which to model contaminant release scenarios as required by AOC Section 7. The EPA and DOH requirement that “Environmental consequences should be described in terms of potential contaminant concentrations at existing groundwater extraction locations including, but not limited to Red Hill Shaft, Halawa Shaft, and Moanalua Wells” will not be achieved in scientifically-defensible terms using the approach currently outlined in the Navy RVA Phase 2 submission.

Summary of Comments

In summary, while the Navy states that the revised RVA Phase 2 scope of work is intended to address the Regulatory Agencies’ requirement that the deliverables shall include quantitative estimates of risk (e.g., release volumes and frequencies), the revisions do not provide a clear and convincing explanation of how that objective will be achieved. Additional details should be provided—at least for the risk scenarios that are expected to be evaluated quantitatively—of the RVA Phase 2 methodology by which the Phase 2 risk results will eventually be integrated with the Phase 1 QRVA risk results.

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The detailed scope of work and associated process flow charts should be revised to account explicitly for the possibility that the proposed RVA workshop will identify additional scenarios (beyond those expected) as high risk and designated for quantitative evaluation. Also, consistent with the Red Hill Phase 1 QRVA, the Phase 2 qualitative risk assessment should place primary emphasis on environmental impacts defined precisely in terms of potential fuel volume release ranges (i.e., number of gallons released).

The Risk Matrix, as currently proposed, is inadequate as a screening tool. The Risk Matrix category definitions need to be more precise. The emphasis of the severity categories should be on the environmental impact categories and these should be defined precisely in terms of potential fuel volume release ranges (i.e., number of gallons released), consistent with the QRVA Phase 1. Similarly, the likelihood categories should be precisely defined in terms their expected occurrence interval (such as once a year, once in 10 years, once in 100 years etc.). The "red zone" needs to be expanded to ensure that the RVA Phase 2 will "quantify" all significant fuel releases scenarios.

The BWS reiterates our insistence for continuing the rigorous **quantitative** risk approach of Phase 1 for Phases 2 through 4 of the RVA, and for this work to be initiated immediately. Given the Navy's failure to fulfill the clear directive provided by both the AOC and the Regulatory Agencies RVA comment letters and to make appropriate modifications in the detailed RVA scope of work, the BWS urges the Regulatory Agencies to reject the Navy's revised RVA Phase 2 submission and require the Navy to prepare a scope of work capable of quantitatively assessing the level of risk the RHBFSF poses to our critical drinking water resources and informing a subsequent TUA decision, as required by the AOC.

Thank you for the opportunity to comment. If you have any questions, please contact Mr. Erwin Kawata, Program Administrator of the Water Quality Division, at 808-748-5080.

Very truly yours,



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