BOARD OF WATER SUPPLY
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April 20, 2026

Grace M. Lee, Chair
Committee on the Clinical Follow-Up and Care for Those
Impacted by the JP-5 Releases at Red Hill
National Academies of Sciences, Engineering, and Medicine
500 Fifth Street, NW
Washington, DC 20001

Dear Ms. Lee:

Subject: Honolulu Board of Water Supply Review of National Academies of Sciences, Engineering, and Medicine Document "Clinical Follow-up and Care for Those Impacted by the JP-5 Release at Red Hill (2026)"

The Honolulu Board of Water Supply (BWS) appreciates the Committee's work preparing the subject National Academies of Sciences, Engineering, and Medicine (NASEM) report. The report is consistent with long standing concerns BWS has with the Navy and regulatory agencies' approach to address the releases at Red Hill and appears to acknowledge that the Navy's approach was to minimize the appearance of potential and actual hazards and respond to regulatory requirements, but not necessarily to act proactively in the interests of preventing or accurately characterizing risks to public health. According to the report,

> *Environmental sampling after the releases was limited by inconsistent methodology, reliance on TPH* [Total Petroleum Hydrocarbons] *measurements, and lack of tentatively identified compound analysis, which obscured the range of dissolved and chlorinated by-products. Without validated biomarkers or consistent environmental data, it is currently impossible to quantify individual - or even neighborhood - level exposures with any precision. Measured concentrations of petroleum-related indicators can be influenced by groundwater sampling methods and analytical approaches, which may contribute to underestimation or variability in reported results.* [p. S-13]

> *The committee found evidence of petroleum contamination in the Red Hill Shaft in 2016, 2017, 2018, and 2020…. In 2017, contamination was reported as TPH-d at a maximum level of 65 µg/L (NAVFAC, 2018). In 2018, petroleum constituents such as*

ethylbenzene, toluene, and xylenes were detected in the Red Hill Shaft (NAVFAC, 2019). In 2020, petroleum contamination was reported as "TPH-d, C8–C18" up to 490 µg/L (NAVFAC, 2021). With regard to groundwater sampling, in 2016, total petroleum hydrocarbon (TPH) concentrations in groundwater from Red Hill monitoring wells were on the order of several thousand ug/L. [p. 3-19].

Between June and September [2021], *four monitoring samples at the Red Hill well detected total petroleum hydrocarbons in the oil range (TPH-o) in the well and two samples exceeded the state of Hawai'i environmental action level (EAL) of 500 µg/L (HDOH, 2021a). In this same timeframe, samples were also analyzed for total petroleum hydrocarbons in the diesel range (TPH-d), but there were no detections (HDOH, 2021a). EALs are screening thresholds intended to identify potential hazards that can prompt further investigation and action to protect human health and the environment. The results were reported to the HDOH prior to November 1, 2021 (Vice Chief of Naval Operations, 2022).* [p. 1-7]

At a public committee meeting on September 8, 2025, Katherine McClanahan, a member of the study's community liaison panel, and Eva Davis, a retired EPA employee, described a review they have been conducting of Red Hill drinking-water laboratory reports and sample chain-of-custody forms starting in July 2021. The presenters found that TPH had been reported in the Red Hill Shaft through the end of September 2021 (HDOH, 2021a, 2021d), until the Navy switched water-testing laboratories, after which TPH levels were no longer reported to be detectable. [p. 3-19]

Early sampling efforts following the releases were limited by inconsistent methods, inappropriate laboratory procedures, and reliance on total petroleum hydrocarbon metrics that could underestimate the true level of contamination (Chapter 3). Chlorination of water samples and failure to perform tentatively identified compound analysis obscured the range of dissolved and chlorinated by-products (HDOH, 2023). Given that there are no biomarkers specific to JP-5 exposure or long-term biomarkers for any constituent of JP-5 that can be used to monitor the exposures at Red Hill, water sampling data is critical to document when the exposures may have begun and ended. The water sampling approach used at Red Hill hindered the committee's efforts to formulate recommendations on clinical surveillance, testing, and care for those exposed to the contaminated water because the level of exposure could determine the level of clinical intervention. [p. 6-9]

The NASEM report identified various issues with the detection limits used by the Navy for analysis of chemical constituents in water.

- The Navy set their detection limits for sampling TPH based on the Hawai'i State Department of Health (DOH) Environmental Action Levels (EALs), which were not sufficiently protective. Instead, detection limits should be as low as technically possible to provide an early warning of fuel contamination and movement within the aquifer. However, DOH and the Environmental Protection Agency (EPA) (regulatory agencies) did not require this before the release.

- o BWS has long supported lowering the DOH TPH-diesel range (TPH-d) EALs (Lau 2018 a,b; 2019; 2022a,b; 2023; 2024) so that these levels can serve their intended purpose to screen for health risk or adverse aesthetic properties of the drinking water resource. DOH raised their EAL for TPH-d from 100 parts per billion (ppb) to 400 ppb in 2017, assuming incorrectly that all volatile components would have degraded resulting in no dermal or inhalation exposure. The Navy thus set their detection limit for TPH-d at 400 ppb. The EALs were only recently lowered after the Red Hill November 2021 release, and they are still not sufficiently protective.
- o Previously we commented that the DOH EALs for TPH were too high (not sufficiently protective) because the EALs did not include the dermal and inhalation routes of exposure for the volatile and soluble aromatic hydrocarbon fraction in jet fuel. BWS also informed DOH of more stringent EPA toxicity factor updates for TPH-d constituents, which DOH eventually incorporated after the 2021 releases.
- o Even currently, DOH's calculations for the health-based EALs for TPH-gasoline, TPH-middle distillate, and TPH-residual fuel are less protective than the EALs for other volatile chemicals. DOH assumes only 4 hours of exposure time in the home for TPH but 24 hours for other volatile chemicals. DOH has not provided a scientifically supportable rationale for this discrepancy. If the current DOH EALs for TPH-gasoline (74 ppb), TPH-middle distillate (91 ppb), and TPH-residual fuels (91 ppb) were instead calculated as DOH did for other volatile chemicals, the EALs would be reduced to 61 ppb, 57 ppb, and 57 ppb,[1] respectively.

The NASEM committee report's assessment of exposure immediately following the November 20, 2021 release (Table 3-2, p. 3-28, pdf p. 95) is based on DOH (2023) and thus underestimates exposure from this event.

- o As we previously noted (Lau 2023), the DOH (2023) assessment of exposure to fuel components was based on a TPH concentration of 0.015% (150,000 ppb) from water collected from the Red Hill Shaft three weeks after the JP-5 release. No attempt was made by DOH to estimate

[1] Note the TPH-gasoline EAL is less affected by the reduced exposure time because the inhalation toxicity criteria is less conservative than that for the other TPH fractions.

higher exposures closer to the release date and peak exposures during water use. For example, mixing of water in the plumbing and use of warmer water in showering, washing, cooking/boiling increase the release of dissolved and emulsified chemicals into the air. The static tests and assumptions of DOH thus do not reflect actual exposure potential.

The NASEM committee report's comparison of estimated exposure to EPA reference doses underestimates potential health risk.

Underestimation of drinking water intake

- The NASEM report (Table 3-3, p. 3-30, pdf p. 97) calculates doses of chemical constituents of JP-5 during the release based on estimated water concentrations from HDOH (2023) and drinking water intake rates from EPA's 2011 Exposure Factors Handbook. However, the drinking water intake rates in Table 3-3 (0.32 L/day for ages 6-11 years, 0.9 L/day for older adults, 0.73 L/day for pregnant women) apparently only include direct water consumption and therefore do not include other sources of tap water such as foods and beverages made with water. While these rates are slightly lower than the EPA recommended mean per capita rates, they are much lower than 95th percentile per capita rates and even lower than the recommended drinking water rates for those who consume water. EPA's per capita rates include all surveyed individuals, including those who responded that they drank no water (see differences between drinking water rates in NASEM Table 3-3 footnote and EPA 2011 table attached at the end of this letter).

No consideration of inhalation and dermal exposure

- Only the oral route of exposure is considered in Table 3-3, thereby underestimating the dose for volatile chemicals. Although the NASEM report acknowledges these other routes, the risks shown in this table would be much higher if inhalation and dermal routes were included. Instead, NASEM should have included inhalation and dermal exposure or compared the estimated water concentrations to the EPA Regional Screening Levels (RSL) for Tap Water, which include oral, inhalation, and dermal routes of exposure if relevant (U.S. EPA 2026).

The de-icing compound (diethylene glycol monomethyl ether DiEGME) in JP-5 potentially posed a high risk to pregnant women

- NASEM Table 3-3 indicates a high risk for DiEGME based on an estimated oral dose from the fuel contamination that is much higher than the EPA chronic reference dose. The NASEM report, however, states that toxicity thresholds for short-term exposure such as for the release are slightly higher than for chronic exposure (pdf p. 94). NASEM should have specifically noted that the EPA reference dose[2] and RSL for DiEGME is based on short-term exposure during pregnancy (and resulting developmental effects in laboratory animals) and not years of exposure, and the reference dose for subchronic and chronic exposure for DiEGME are the same. Thus, the estimated high exceedance of the EPA oral reference dose indicates a serious potential concern for the fetus of pregnant women. NASEM notes in Annex 3-1 (pdf p. 102) that the metabolite of DiEGME is a known reproductive toxicant.
- Chapter 4 of the NASEM report reviews the toxicological evidence for developmental effects of diesel fuel, jet fuel, and heating oil, but not for additives such as DiEGME (p. 4-37-38; pdf p. 150-151).

The NASEM report notes the lack of preparedness of the Navy for addressing a fuel release.

- Despite the historical threat to the drinking water supply from the Red Hill Bulk Fuel Storage Facility (RHBFSF), the Navy was unprepared to react to an actual exposure event in accurately quantifying the amount of exposure and in having a well-researched medical and public health action plan to address such exposures and health effects for military families as well as non-military families served by the Navy's water supply.

The regulatory authorities could have also been better prepared to respond to potential exposures.

- NASEM found deficiencies in the sampling in response to the spill:

  For the 2021 Red Hill fuel releases, the committee found no data showing that responding organizations screened the fuel or the contaminated drinking water itself for unregulated contaminants to inform decision making. Such work has been done previously by government agencies responding to spills, especially in

[2] https://cfpub.epa.gov/ncea/pprtv/documents/DiethyleneGlycolMonomethylEther.pdf

the case of unregulated contaminants; water testing is then designed accordingly (Whelton et al. 2017).

- The NASEM report states that no biomarkers would be useful at this time to assess exposure to the release, and comments on the HDOH clinical guidance:

On December 9, 2021 [2-1/2 weeks after the fuel release was noted in tap water], *in response to the Red Hill fuel releases, the Hawai'i State Department of Health (HDOH) issued interim clinical guidance for health care providers caring for individuals with potential exposure to petroleum-contaminated drinking water. This guidance reflected the limited availability of exposure-specific biomarkers and emphasized symptom based clinical evaluation and supportive care under conditions of substantial uncertainty (HDOH, 2021). Subsequently, on March 11, 2022, HDOH issued a medical advisory advising against urine or blood testing for petroleum hydrocarbon exposures because reliable, specific biomarkers for jet propellant 5 (JP-5) do not exist, and many hydrocarbon constituents are rapidly metabolized and excreted (HDOH, 2022).* [p. 5-1, pdf p. 165]

- The Navy and DOH should have been better prepared to advise physicians immediately after people were exposed. In addition, the NASEM report should also more clearly note that the DOH medical advisory missed key biomarkers of jet fuel that have been reported to be better indicators of exposure than benzene and its metabolites listed in the medical advisory.

- Contrary to DOH communications, biomarkers are available for exposure to jet fuel, although sampling must occur soon after exposure. Studies in exposed Air Force personnel found naphthols (metabolites of naphthalene) in urine to be a more useful biomarker for jet fuel exposure than benzene and its metabolites because of the greater urinary concentrations of naphthols and longer elimination time (Serdar et al. 2003, 2004; Chao et al. 2006; Rodriguez et al. 2014).[3] A study that measured the metabolite of diethylene glycol monomethyl ether (DiEGME) (2-methoxyethoxyacetic acid, MEAA) in urine reported this biomarker to be superior to benzene and toluene metabolites because of its specificity to jet fuel (unlike benzene or toluene which are present in gasoline and other fuels as well as cigarette smoke), and because it was easily detectable and distinguished high, medium, and low exposure categories of Air Force personnel exposed to jet

[3] Sendar et al. 2003 is cited by NASEM on pdf p. 102, but not these other references.

fuel (B'Hymer et al. 2012).[4] The metabolic conversion of DiEGME to MEAA is fairly rapid (1/2 life of 8 hours in animals), however, resulting in a likely shorter elimination time and window for biomonitoring than naphthols.

- The NASEM report states that biomonitoring would only be informative if collected within about 24 hours of exposure; however, in a situation of ongoing exposure over several days to weeks, opportunities were available to biomonitor residents if the health authorities were prepared.

The NASEM report stops short of describing additional lessons learned from the fuel release event that could be implemented to prevent exposure or in the event of future exposures. Although the tanks have been drained, contamination remains in the vadose zone beneath the tanks, as well as the underlying sole-source aquifer.

- More detailed and specific sampling and analysis along with emergency response procedures should be considered to better characterize the fate and transport of the fuel in the aquifer and for immediate and effective response in the event of exposure.
- DOH should conduct a more thorough review of the available scientific and clinical literature on biomarkers for jet fuel even beyond the review in the NASEM report, so that their medical advisory information is up to date in case of future exposures.

Joint Base Pearl Harbor Hickam (JBPHH) Water System

BWS contracted two subject-matter experts to conduct an independent peer review of the Navy reports and drinking water sample analytical data from the JBPHH drinking water system. The BWS experts (Analytical Quality Associates [AQA] and Dr. Paul Winkler were also provided a copy of the NASEM study to review. The NASEM committee findings relative to the JBPHH water system TPH sampling were very similar to what our experts found, most notably that the increase in TPH detections within the Navy's water distribution system were caused by chlorine in the water samples and/or laboratory contamination–were generally not supported by the information available or proper technical analyses. Complete copies of both AQA and Dr. Winkler NASEM study review documents are attached.

BWS appreciates that the NASEM committee conducted this study and provided recommendations to try and make the situation better on O'ahu for all drinking water users. BWS encourages the NASEM committee to remain involved and to continue to assist those impacted by the Navy's historical releases of petroleum hydrocarbons, both

[4] B'Hymer et al. 2012 is cited by NASEM for benzene and ethylbenzene (pdf p. 101) but not for DiEGME.

historically at Red Hill as well as from the releases of 2021. If you have any questions, please contact Erwin Kawata, Deputy Manager, at (808) 748-5066.

Very truly yours,

Ernest Y.W. Lau, P.E.
Manager and Chief Engineer

Attachments

1 – AQA Review of NASEM Study

2 – Dr. Paul Winkler Review of NASEM Study

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TABLE 3-3 Estimated Exposure Dose for JP-5 Constituents

JP-5 constituent	Dissolved contaminants + JP-5 sheen + FSII emulsion (µg/L)[a]	Adult exposure dose (µg)[b]	Adult exposure dose (µg/kg-day)[c]	Child exposure dose (µg)[d]	Child exposure dose (µg/kg-day)[e]	Pregnant adult exposure dose (µg)[f]	Pregnant adult exposure dose (µg/kg-day)[g]	EPA RfD (µg/kg-day)
Benzene	16	14	0.18	5.12	0.16	11.7	0.16	4
Toluene	182	164	2.05	58.2	1.82	133	1.77	80
Ethylbenzene	123	111	1.38	39.4	1.23	89.8	1.20	50
Xylenes	943	849	10.6	302	9.43	688	9.18	200
Naphthalene	1,083	975	12.2	347	10.83	791	10.5	20
1-Methylnaphthalene	1,155	1,040	13.0	370	11.55	843	11.2	70
2-Methylnaphthalene	789	710	8.88	252	7.89	576	7.68	4
BTEXNM total	4291	3,862	48.3	1,373	42.91	3,132	41.8	N/A
C5–C8 Aliphatics	250	225	2.81	80.0	2.5	183	2.43	5
C8–C18 Aliphatics	120,962	108,866	1,361	38,708	1,210	8,8302	1,177	10
>C8 Aromatics	29,702	26,732	334	9,505	297	21,682	289	10
Total petroleum hydrocarbon	155,204	139,684	1,746	49,665	1,552	113,299	1,511	N/A
DiEGME	400,000	360,000	4,500	128,000	4,000	292,000	3,893	40
2,6-Di-T*ert*-butyl-4-methylphenol	25	23	0.28	8.00	0.25	18.3	0.24	300
Linoleic acid dimers	54	49	0.61	17.3	0.54	39.4	0.53	N/A

[a] Includes dissolved-phase contaminants plus sheens and an assumed 0.1 percent concentration of 40 percent DiEGME emulsion. Other additives assumed to remain dissolved in water and/or in product sheen.

[b] A drinking-water ingestion rate of 0.90 L/day was used for adults aged 50+ years; only direct water consumption was considered.

[c] Average adult (50+ years) body weight was assumed to be 80 kg.

[d] A direct drinking-water ingestion rate of 0.32 L/day was used for children aged 6–11 years; only direct water consumption was considered.

[e] An average body weight of 32 kg was used for children aged 6–11 years.

[f] A direct drinking-water ingestion rate of 0.73 L/day was used for pregnant adults; only direct water consumption was considered.

[g] An average body weight of 75 kg was used for pregnant adults.

NOTE: Orange rows indicate constituents that exceed the EPA RfD. Body weight and drinking-water ingestion rates from each population group come from EPA. BTEXNM = benzene, toluene, ethyl benzene, xylenes, naphthalene, and 1-and-2 methylnaphthalenes; DiEGME = diethylene glycol monomethyl ether; EPA = U.S. Environmental Protection Agency; FSII = fuel system icing inhibitor; JP-5 = jet propellant 5; N/A = not available; RfD = reference doses.
SOURCE: Adapted from HDOH, 2023.

Exposure Factors Handbook

Chapter 3—Ingestion of Water and Other Select Liquids

Table 3-1. Recommended Values for Drinking Water Ingestion Rates[a]

Age Group	Mean		95th Percentile		Multiple Percentiles
	mL/day	mL/kg-day	mL/day	mL/kg-day	
Per Capita[b]					
Birth to <1 month[c]	184	52	839[d]	232[d]	See Table 3-7 and Table 3-11 for children <3 years old and Table 3-23 and Table 3-28 for individuals >3 years old.
1 to <3 months[c]	227	48	896[d]	205[d]	
3 to <6 months[c]	362	52	1,056	159	
6 to <12 months[c]	360	41	1,055	126	
1 to <2 years[c]	271	23	837	71	
2 to <3 years[c]	317	23	877	60	
3 to <6 years	327	18	959	51	
6 to <11 years	414	14	1,316	43	
11 to <16 years	520	10	1,821	32	
16 to <18 years	573	9	1,783	28	
18 to <21 years	681	9	2,368	35	
≥21 years	1,043	13	2,958	40	
>65 years	1,046	14	2,730	40	
All ages[e]	869	14	2,717	42	
Consumers Only[f]					
Birth to <1 month[c]	470[d]	137[d]	858[d]	238[d]	See Table 3-15 and Table 3-19 for children <3 years old and Table 3-33 and Table 3-38 for individuals >3 years old.
1 to <3 months[c]	552	119	1,053[d]	285[d]	
3 to <6 months[c]	556	80	1,171[d]	173[d]	
6 to <12 months[c]	467	53	1,147	129	
1 to <2 years[c]	308	27	893	75	
2 to <3 years[c]	356	26	912	62	
3 to <6 years	382	21	999	52	
6 to <11 years	511	17	1,404	47	
11 to <16 years	637	12	1,976	35	
16 to <18 years	702	10	1,883	30	
18 to <21 years	816	11	2,818	36	
≥21 years	1,227	16	3,092	42	
>65 years	1,288	18	2,960	43	
All ages[e]	1,033	16	2,881	44	

[a] Ingestion rates for combined direct and indirect water from community water supply.
[b] Per capita intake rates are generated by averaging consumer-only intakes over the entire population (including those individuals that reported no intake).
[c] Based on Kahn and Stralka (2009) and Kahn (2008).
[d] Estimates are less statistically reliable based on guidance published in the *Joint Policy on Variance Estimation and Statistical Reporting Standards on NHANES III and CSFII Reports: NHIS/NCHS Analytical Working Group Recommendations* (NCHS, 1993).
[e] Based on U.S. EPA analysis of NHANES 2003–2006 data.
[f] Consumer-only intake represents the quantity of water consumed only by individuals that reported consuming water during the survey period.

Source: Kahn and Stralka (2009); Kahn (2008); U.S. EPA analysis of NHANES 2003–2006 data.

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Review of
Clinical Follow-up and Care for Those Impacted by the JP-5 Releases at Red Hill (2026)
National Academies of Sciences, Engineering, and Medicine

Prepared For:
The Honolulu Board of Water Supply (BWS)

Prepared By:

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April 14, 2026

AQA reviewed the National Academies of Sciences, Engineering, and Medicine's (NASEM's) document "Clinical Follow-up and Care for Those Impacted by the JP-5 Releases at Red Hill (2026)," which was written, reviewed, and edited by multiple persons (collectively referred to as the Committee from here on), many of whom were experts in the field and/or had access to the type of sources needed to determine the outcome of their investigation.

Upon reading the Preface to the document, it was obvious that the Committee did more than just look at data. The Committee investigated all aspects of the jet fuel (JP-5) spill, including the first spill in May 2021 that led to jet fuel being diverted to the fire suppression system pipeline and even going so far as to visit the spill area. The Committee then took the approach of fixing the system instead of placing blame, which included combining Hawai'ian beliefs and cultural values about how people and land should be treated with English medical principles.

The Committee heard the same issues that AQA heard from those residents who were affected by the spill. Instead of passing complaints of ill health off as psychosomatic symptoms, the Committee listened to the residents and delved into a discussion about the possible mental and physical health effects. They did a good job of validating the residents' experiences in Section 2.

In Section 3, the Committee spent a large amount of time explaining all of the Navy's missteps and mistakes and noted that those essentially rendered the hydraulic model the Navy produced useless. The Committee specifically stated, "it treats the fuel as a single conservative contaminant, which is defined as nonreactive and nonsorbing" and goes on to describe the many ways that JP-5 could react with and sorb into the water distribution system.

In Section 3, the Committee also speculated, just as AQA did, that there are "reservoirs" of JP-5 still in the system that are episodically releasing: "...it is reasonable to conclude that slugs of jet fuel became entrained[3] in the water distribution system, sorbed onto and penetrated into materials, and were released over time."

In Section 3, the Committee also cited Katherine McClanahan and Eva Davis's presentation on the review of laboratory reports and noted the change in laboratories, but the Committee was careful not to draw any conclusions. However, the Committee did recommend split sampling.

Throughout the document, the Committee's conclusions matched those of AQA and Dr. Winkler–there was insufficient evidence to determine the absence of JP-5 in the drinking water system–and gave in-depth explanations reinforcing many of the points that AQA and Dr. Winkler made during their presentations. The Committee noted that photoionization detectors (PIDs) are not good for detecting volatile organic compounds (VOCs) in air and that JP-5 can react with free chlorine to produce new chemicals such as chlorinated paraffins.

In addition, the Committee also determined that there was insufficient evidence (both from the spill and existing scientific studies) to determine the effects on those who were exposed to the fuel and concludes that the exposure assessment was negatively impacted by the sampling and analysis issues. Examples the Committee gave were that the free chlorine disinfectant commonly used in drinking water systems can mask petroleum-related odors and that the fuel can react with free product to produce disinfectant byproducts that were not included in the compounds that were screened, which could lead to underestimating true exposure to the jet fuel.

The Committee questioned why the Navy analyzed for mercury and metals during the initial response and long-term monitoring (LTM) when they were not chemicals of concern but recommended that tentatively identified compound (TIC) analysis be performed going forward to characterize contamination from fuel spills.

Sections 4, 5, and 6 are beyond AQA's technical knowledge; however, using the Integrated Risk Information System (IRIS) tool, the Committee found that all studies conducted on the health effects of exposure to JP-5 in the Red Hill population to be of *low confidence* and that "understanding the degree and duration of exposure for individuals was not possible based on the sampling and analytic approaches used."

In conclusion, AQA agrees with the recommendations provided by the Committee, especially those on standardized sampling and analysis methods and understanding potential exposure pathways.

Review

Of

NASEM Document

Clinical Follow-up and Care for Those Impacted by the JP-5 Releases at Red Hill (2026)

ISBN 978-0-309-60498-7

Prepared for:

The Honolulu Board of Water Supply (BWS)

Prepared By:

Paul C. Winkler, Ph.D.

4/14/2026

Introduction

A request was made by the Honolulu Board of Water Supply (BWS) to provide comments to the National Academies of Science Engineering and Medicine document *"Clinical Follow-up and Care for Those Impacted by the JP-5 Releases at Red Hill (2026)"*. This document is part of the National Academies Press and has been issued the ISBN number of 978-0-309-60498-7 and a DOI number of 10.17226/29404.

This document was a review of the impact of the JP-5 release in May and November 2021. Topics that were researched, reviewed and discussed were the historical context of Red Hill, a review and evaluation of the exposure assessment, health effects of exposure to JP-5, an evaluation of clinical guidance and enhancing care and public health post Red Hill.

The comments presented below refer to those comments where the sampling procedures or the analytical methodologies were discussed and evaluated. Chapter 3. "Exposure Assessments and Models" is the chapter most applicable to the comments below. The comments are listed in order that they occur in the document and are identified by the page for reference.

Discussion

1. Preface, page 10 of the pdf. The authors stated that it was not possible to understand the degree or duration of exposure based on the sampling plan and analytical approach used.
    a. This is an accurate statement. As was previously observed, the training for samplers was poor and problems with sampling were not corrected in a timely manner. This brings uncertainty to confidence in the final analytical results.
    b. There were no intermediate sampling points in the system which may lead to an under reporting of exposure to JP-5 or other system contaminants.
    c. The samples were not collected in compliance with procedures specified for chlorinated drinking water samples, thus invalidating the results and making it difficult to assess exposure. While method compliance was not an issue for the committee, they did recognize that non-target compounds could be formed with reactions to free chorine and that this was a shortcoming of the data.
    d. The use of Method 8015 was useful in the early stages of monitoring because it was known that there would be large amounts of JP-5 in the system. As the levels of TPH and other chemicals present in the fuel decreased, the method did not have adequate specificity to provide accurate chemical exposure data, which ultimately led to the committee's conclusion that the data were not usable for exposure risk assessment.
    e. Throughout the project, there was not much attention given to identifying non-target compounds in the sample by the Navy or their contractor. Due to the fact that this was chlorinated drinking water, it should be expected that compounds

may be present in the sample that could impact public safety that were not on the target compound list of the methods used for the analysis of Red Hill samples. This was another reason for the existing data to be of no use for determining exposure risks.

2. Page S-11. Box S-2.
    a. The statement is made that there is no specific method for the detection of P-5 in blood or urine. There are NIOSH methods for the determination of hydrocarbons that fully cover the range found in JP-5 in blood and urine. There are ATSDR methods for measuring kerosene components in blood and urine. While these methods do not specify JP-5 directly, they are applicable for the determination of fuel and fuel oils in biological matrices. These methods have been fully validated and are GC/MS methods which would provide enough specificity for this application.
3. Recommendation 2, page S-11.
    a. It has been recommended that regulatory agencies continue efforts to reduce exposure. The current analytical methodology is not sufficient to meet this goal. As stated in observations given by the BWS during the SWARM team review, more specific methods and non-target methods need to be developed to meet the project requirements.
4. Page S-12, Box S-3 and Recommendation 4, page S-13.
    a. It is recommended to make improvements to the current chemical analysis approach. This is a correct statement. The methods for detection of hydrocarbons, additives and other contaminants such as PFAS, need to be more specific. Additionally, methods using GC/HRMS (High Resolution Mass Spectrometry) and LC/HRMS and ICP/MS need to be employed to fully understand the exposure risk.
5. Page 1-13.
    a. It was noted that TPH analysis was performed by a certified laboratory which is correct. It should be noted, however, that, while that laboratories were certified for the analyses requested, that does not serve as proof that the methods were capable of providing the data needed to assess the environmental hazards associated with these drinking waters. Going forward, methods more suitable to monitoring for the actual hazards will be critical.
    b. It was noted that in 2023, samples were taken that indicated TPH was below the EAL of 266µg/L, which was correct. This limit, however is not a health advisory limit, yet the Navy indicated that this was proof that the water was safe. The statement continues on to indicate that investigators concluded that these below EAL level TPH results that were observed were due to analytical artifacts. It was demonstrated in the BWS SWARM team review that these TPH detections were not due to laboratory artifacts and may have been an indication of actual low level TPH. This may explain why community members remain concerned (Gutierrez, 2025). Again, more sensitive and specific methods are needed to understand this environmental hazard.

6. Page 1-18.
   a. It is again noted that a strong exposure risk monitoring system is defined by data sources and analytic methods to ensure that the findings lead to protective measures. The current water monitoring plan does not meet that standard. This is primarily because the main potential hazards are hydrocarbons and method 8015 is not sufficient to meet the needs to accurately assess the health hazard that may be present in the Red Hill system.
7. Page 3-1.
   a. The statement is made that understanding the risks requires knowing the specific chemicals present and the duration and magnitude of the exposure. The current EDWM does not address these needs. The methods specified do not meet the requirements for identification of specific chemicals and does not have sufficient sensitivity to monitor for low level chronic exposure, which may occur in this drinking water system. An example of the need to monitor low levels of TPH was observed in July to December 2023. In this time period, an increase of low level TPH results were observed. This is evidence that it may be expected that there will be events where low levels of contaminants may leach out of the drinking water system and it is imperative to have analytical methods with the sensitivity and specificity to detect these events.
8. Page 3-11.
   a. The discussion related to fate and transport of JP-5 constituents and other potential system contaminants is entirely reliant of adequate analytical methods. It is noted on page 3-16 that chemical adsorption and permeation can lead to leaching from the system. Leaching will certainly result in low concentrations of contaminants. When performing accurate trace level analyses, method specificity is the most important metric a method will have. This behavior cannot be adequately addressed with the current analytical approach. ICP/MS, GC/MS and LC/MS would be needed to provide the required specificity and sensitivity.
9. Page 3-17
   a. The committee determined that the monitoring approach, post spill, would not generate data that would allow for the evaluation of the effectiveness of the flushing event. This is why an improved water monitoring plan is essential to understanding the on-going environmental impact of the spill.
10. Page 3-18
    a. The committee indicated that this spill cannot be considered as simple as a contamination event that can be quickly flushed and considered to be complete. When developing a comprehensive plan to monitor the long term exposure, better sampling plans and methods will be required.
11. Page 3-19.
    a. While our review of McClanahan and Davis's conclusions of laboratory data fraud found their conclusions to be without merit, it does not indicate that there were no issues with the entire monitoring process, just that we did not find fraud in the laboratory. Suspicion about the analytical data is understandable. As an

example, when low level detections began to be noticed in 2023, the Navy developed a new method and the low level detections stopped being observed. The Navy has never properly evaluated the changes to their analytical method or adequately explained why there was a sudden loss in low level detections.

12. Page 3-20.
    a. The committee concluded that the 8000 TPH results were of limited utility for exposure estimation. The BWS investigations during the SWARM team review arrived at a similar conclusion about the utility and defensibility of the data.
    b. The committee also noted that several reviews of the method concluded that TPH results were associated with free chlorine and laboratory cross contamination. The BWS investigation have shown this to be a dubious and convenient conclusion. And, as noted by the Winkler citation, the presence of other trace level fuels cannot be ruled out.
13. Page 3-21, Box 3-4.
    a. The TSDR concluded that the TPH results are not specific enough to have value in the assessment of potential health effects. This agrees with previous comments that were made during the BWS SWARM team review of the Navy's analytical approach.
14. Page 3-21
    a. Related to the concerns of the review committee, it was stated that there were analytical challenges and extraneous analyses that were called for such as alkalinity that had no value to assessing exposure risks. Further, it was noted that no samples were chemically characterized to identify any unexpected compounds that may be present. This was noted during the BWS review of the SWARM team report. It appears that the work and conclusions that the BWS engaged in during the evaluation of events of late 2023 are in agreement with the NASEM committee.
15. Page 3-23.
    a. It was concluded that 8015 is not adequate for assessing an exposure assessment. This is a correct statement and indicates the need to update the methodology in the current EDWM.
16. Page 3-24
    a. The committee recommends better characterization of the samples to identify unknown target compounds and that such analyses have been performed in previous spills. Agreed. Better characterization is very important to understanding the actual exposure that is present in this water system.
17. Page 3-26
    a. The statement was made that the effects of chlorination on JP-5 were not considered and may have resulted in underreporting of exposure. This is a correct statement. This is more cause to have methods available for the identification of unknown and unexpected contaminants.
18. Page 3-31

a. The committee concluded that detailed exposure data to inform clinical decisions were not available due to limitations with the sampling plan and the limitations of the water testing that was performed. Further, it was concluded that evidence indicates the exposure risks may still exist. Definitely agree with this statement. More indication that better sampling and analysis is required to evaluate exposure risks to users of the Red Hill system.

Conclusion

The NASEM committee concluded that the analytical data generated during the JP-5 spill of 2021 was not useable for estimating exposure risks. Agreed. In particular, 8015 is a method that is suitable for monitoring a cleanup effort when the contamination is well known and at a high concentration. The method is not suitable for accurate trace analyses, TPH or otherwise, or for identifying unknown contaminants. The shortcomings in the data was identified during the BWS review of Navy SWARM team report. The BWS review of the SWARM team report identified many of the same problems with the data that the NASEM committee identified.

More specific methods with increased sensitivity are needed if data that can be used to assess exposure risks are required. This would require also that a full chemical characterization of the unknown and unexpected chemicals present in the system be performed. This is in agreement with the conclusions of the NASEM committee.