Navy Closure Task Force–Red Hill
Joint Base Pearl Harbor Hickam

Appendix C. Responses to NASEM Request for Supporting Information

The purpose of this table is to provide specific responses and the supporting information as requested by NASEM.

No.	NASEM Request for Supporting Information	NCTF Response and Supporting Information	Available Resources/References
1.	<u>Chemical Composition.</u> Could you please provide the confirmed chemical composition of the spilled jet fuel, as well as any other substances relevant to the contamination? We are particularly interested in full compositional analysis results, including GC-MS, GC-FID, or other chemical characterization methods. If available, images of the fuel in the well, at faucets, or in collected water samples would also be helpful. Additionally, we would appreciate receiving the MSDSs (Material Safety Data Sheets) for all identified contaminants.	In July 2023, the Navy collected 16 samples of JP-5 fuel from seven storage tanks (i.e., Tank 07, 08, 09, 10, 11, 12, and 20) at the Red Hill Bulk Storage Facility. These samples were analyzed using the following methods: ○ PIANO (paraffins, isoparaffins, aromatics, naphthenes, and olefins) parameters by Method EPA8260D, ○ Phenol and alkylated PAHs by Method EPA8270E, and ○ Saturated Hydrocarbons by Method EPA8015M. The purpose of these samples was to develop a chemical composition for the JP-5 fuel that impacted the Joint Base Pearl Harbor-Hickam (JPBHH) Drinking Water Distribution System (System). These results were used to establish target analyte lists in the sampling and analysis plan and served as a comparison tool for determining if detections in the JBPHH System were potentially associated with JP-5 or other potential sources. Summary statistics for the chemicals that were detected in the JP-5 free product samples are provided in **Attachment 1.** The safety data sheet (SDS) for JP-5 fuel is provided as **Attachment 2.** The Navy has not observed fuel in the drinking water system, at faucets, or in drinking water samples collected. Different news media published photos at the time of the release; however, those photos were not corroborated and the location (or address) of those photos, time of the photo, or additional context that would be helpful in evaluating conditions at the time of the photo were not provided. The Navy has taken photos throughout Emergency Response, Long-Term Monitoring (LTM), and Extended Drinking Water Monitoring (EDWM). Photos of sampling activities, sampling locations, and other relevant photos are available for viewing at: https://www.dvidshub.net/search/?filter%5Btype%5D=image&filter%5Btags%5D%5B0%5D=safewaters&view=grid&sort=date.	Additional information regarding the free product samples is available in the: ▪ EDWM Supplement A Tier 2 Analysis of Total Petroleum Hydrocarbons (TPH) and Fuel Indicator Compounds at https://jbphh-safewaters.org/public/EDWM_Supplement_A_Oct_2024_Redacted.pdf; and ▪ Tier 2 Analysis of Total Petroleum Hydrocarbons (TPH) and Fuel Indicator Compounds memo will be posted on the JBPHH Safewaters drinking water webpage Document Library: https://jbphh-safewaters.org/public/framework/appcontainer.aspx?url=html.aspx&idhtml=10881&title=Document%20Library&idMenu=89535&ddlDSN=SYSTM&DSN=SYSTM

2.	<u>Water Sample Collection Procedures.</u>
	Can you provide details on the procedures used for collecting drinking water samples, including the types of containers used? We are especially interested in whether chlorine disinfectant was neutralized prior to sample storage, shipment, and chemical analysis. Any documentation of these processes would be helpful.
		Detailed sampling procedures are outlined in the Emergency Response Sampling Plan, the LTM Sampling Plan, and the EDWM Sampling Plan. In general, sampling procedures included:
		○ Selecting the sample location.
		○ Removing fixture filters.
		○ Isolating cold water.
		○ Clearing the sampling area of potential volatile sources (e.g., hand soap, dish soap, air fresheners, etc.).
		○ Removing aerators and detachable parts from the sample faucet.
		○ Performing a visual inspection and collecting water quality parameters before drinking water sampling. This included documenting headspace, recording sheen/odor observations, conducting a free chlorine test, and documenting temperature, pH, conductivity, and turbidity at the faucet.
		○ Set up sample containers and preservatives. Do not rinse any of the bottles. Do not reopen bottles after filling and capping.
		○ Fill sample containers in the following order using the following general procedures:
		  ▪ Remove the bottle cap and tilt the vial/bottle so the flow falls on the interior surface of the bottle; do not shake or agitate. Note: The sampling plans include specific procedures on how full the vial/bottle should be, based on the analyses (e.g., convex meniscus, flush with bottle top, etc.).
		  ▪ Add preservatives, if necessary.
		  ▪ Place the cap on the bottle and tighten.
		○ Complete the Chain-of-Custody.
		○ Wrap the sample bottles in bubble wrap and place them in a cooler for shipping.
		The analyses, type, and number of sample bottles, and preservatives are summarized in **Attachment 3.**
		Before April 2024, drinking water samples collected and analyzed for TPHs were not preserved using sodium thiosulfate. During LTM Period 6, the frequency of TPH detections increased, primarily in the diesel-range organics (TPH-d). None of these detections exceeded the DOH's incident-specific parameter (ISP) level of 266 micrograms per liter (µg/L).
		In response to the increase in low-level detections, the Navy proactively established a team of subject matter experts (SMEs; referred to as the Swarm Team). The Navy began working with the United States Environmental Protection Agency (EPA) and the Hawaii Department of Health (DOH) on actions to investigate these low-level TPH detections in drinking water samples collected from the System.
		During the week of 29 January 2024, an interagency team consisting of SMEs from the EPA, DOH, Navy, and Navy contractors met to discuss low-level TPH detections in the System. The team evaluated several lines of evidence, including:
		(a) The spatial and temporal distribution of TPH results reported during LTM,
		(b) Results of hydraulic modeling of the System following the November 2021 JP-5 fuel release,
		(c) A detailed review of the analytical methods used to identify and quantify TPH,
		(d) A side-by-side comparison of laboratory results using an alternative sample preparation method (i.e., comparison of TPH results when quenching with sodium thiosulfate versus no quenching),
			Additional information regarding sampling and analysis procedures is available in the:
			▪ Drinking Water Sampling Plan dated December 2021, which identifies sampling procedures for samples collected during the Emergency Response Phase (November 2021 – March 2022). Available at: https://jbphh-safewaters.org/public/JBPHH_SamplingPlan_Addendum3_Final.pdf.
			▪ Drinking Water Long-Term Monitoring Plan dated June 2022, which identifies sampling procedures for samples collected during LTM (March 2022 – March 2024). Available at: https://jbphh-safewaters.org/public/JBPHH_LTM_Plan_FINAL_20220629.pdf.
			▪ Extended Drinking Water Monitoring Plan dated October 23, 2024, which identifies sampling procedures for samples collected during EDWM (April 2024 – March 2025). Available at: https://jbphh-safewaters.org/public/JBPHH_EDWM_Plan_23Oct24.pdf.
			▪ SWARM Team Technical Memorandum summarizing Low-Level Hydrocarbons Detections Results of Test Method Interferences in Total Petroleum Hydrocarbon (TPH) Analysis of Chlorinated Drinking Water, dated 25 April 2024. Available at: https://jbphh-safewaters.org/public/Tech_Memo_JBPHH_LOE's_LTM_TPH_Detects_Redacted_Rev.pdf.

No.	NASEM Request for Supporting Information	NCTF Response and Supporting Information	Available Resources/References
		(e) Reviewing analytical results for other indicator compounds that are associated with JP-5, and (f) A statistical analysis of TPH results, chlorine residual measurements, and surrogate doses. Key findings, which are summarized in the Swarm Team Technical Memorandum (linked below), were: (a) TPH detections were randomly distributed throughout all Zones, and the temporal changes in TPH concentrations from one LTM period to the next were consistent across all Zones. (b) The frequency of TPH detections was similar in Zones H1, H2, H3, and I1, which have inline granular activated carbon (GAC) treatment units, which would remove TPHs in drinking water during the treatment process, if present. (c) TPH detections were similar among all Zones on the System. However, based on the results of the Hydraulic Model, there are Zones on the System that are hydraulically unlikely to receive drinking water from the Red Hill Shaft or receive significantly lower volumes of water compared to other Zones that are closer to the Red Hill Shaft. The Red Hill Shaft supplied approximately 20% of the water in the System at the time of the release. (d) The analytical method used to analyze for TPHs (EPA Method 8015) was not designed for analyzing drinking water. This method does not include a step to prevent interferences/reactions that may occur due to the presence of disinfectants, such as chlorine. The majority of low-level TPH detections were between the method detection limit (MDL) and the method reporting limit (MRL), demonstrating the laboratory's challenges in reporting detected concentrations to the MDL rather than the MRL. Low-level TPH detections were commonly found in laboratory method blanks, which contributed to “detections” of TPH concentrations in samples. Ghost peaks occur due to chemical reactions during the sample preparation and extraction process, caused by the presence of free chlorine (a common disinfectant in drinking water). These peaks were observed in both samples where TPH was detected and those where it was not. Empirical data have demonstrated that the ghost peaks do not appear if the sample was dechlorinated before analysis. (e) Results of the side-by-side comparison, which included collecting 658 drinking water samples and analyzing them using two analytical methods, demonstrate how the presence of free chlorine impacted TPH results. The first method (referred to as the Separatory Funnel [SF] Method) used separatory funnel extraction using EPA Method 3510 and analysis by gas chromatography and flame ionization detection (GC/FID) using EPA Method 8015 with no dechlorination. The SF Method is used to analyze drinking water samples during LTM Periods 1 through 7. The second method (referred to as the Micro-Extraction Quench [MEQ] Method) includes the addition of sodium thiosulfate to remove residual chlorine (in a process called “quenching”), micro-extraction using EPA Method 3511, and analysis by GC/FID using EPA Method 8015. The Navy collected 30 matrix spike samples, which are sample that has a known amount of a target chemical (JP-5 fuel in this case) added to them before analyzing the samples, to confirm that the “quenching” did not prevent accurate and precise measurements of TPH in drinking water samples. (f) Other fuel-related chemicals, such as 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, benzene, ethylbenzene, toluene, and xylenes, were detected infrequently (less than 0.2%) in samples collected during LTM. (g) Statistical analyses of over 8,000 drinking water samples indicated a higher chance of TPH detections as chlorine levels increase or when a high surrogate dose was utilized in the lab. All of these lines of evidence support the conclusion that low-level TPH detections observed during LTM were not associated with JP-5 fuel in the System (or any other release from Red Hill) and were likely associated with laboratory (e.g., method blank contamination/laboratory cross-contamination) and method challenges (e.g., interaction of residual chlorine in the drinking water samples with reagents required by the method to analyze the samples). The Navy considered the findings of the Swarm Team Tech Memo. In accordance with the recommendations of the Swarm Team Tech Memo, the Navy voluntarily decided to develop the EDWM program, which extended sampling by an additional year to incorporate the lessons learned from LTM. During EDWM, TPH samples were analyzed by quenching samples with sodium thiosulfate prior to extraction to prevent residual chlorine in the samples from reacting with other substances present in the sample and substances introduced by the laboratory to analyze the samples in accordance with the method (e.g., solvents, surrogates, internal standards). During LTM, TPHs were detected in 2,325 out of 8,668 (31%) drinking water samples collected. All results were below the ISP of 266 ppb. In samples where TPH was detected, over 77% of the results were between the MDL of 50 ppb and the MRL of 70 ppb. Based on the results of the Swarm Team Tech Memo, the analytical method for TPHs was modified to remove byproducts resulting from interactions between free chlorine and surrogates. Results during EDWM confirmed the findings of the Swarm Team Tech Memo. During EDWM, TPHs were detected in 13 out of 6,794 (0.19%) drinking water samples collected. TPH detection frequencies and additional context is shown in **Attachment 4**. Additional information regarding the comparison of LTM and EDWM results will be available in the EDWM Q4 and Annual Summary Report, posted on the JBPHH Safewaters Drinking Water webpage Document Library: https://jbphh-safewaters.org/public/framework/bannerhtml.aspx?idhtml=10737&banner=jbphh_home.png&title=JBPHH%20Drinking%20Water%20Monitoring&idMenu=88797&ddlDSN=SYSTM&DSN=SYSTM.	
3.	Water Systems Connection to JBPHH. Could you share the layout of the JBPHH water distribution system and indicate where it connects to other public water systems, including those owned or operated by the Navy, other military services, or outside entities? It would also be helpful to see designations of pressure zones, hydrants, and service lines.	A general overview of System piping is shown in **Attachment 5**. Detailed information about the Navy’s drinking water utility system, including distribution pipeline network and configuration, is designated as controlled information and is not releasable to the public. Hydrants that were sampled on the System during enhanced monitoring are listed in **Attachment 6**. There are 20 Zones on the System that receive drinking water via the JBPHH Drinking Water Distribution System. The System has an average daily demand of approximately 20.8 million gallons per day (MGD), and as of 03 December 2021, 100% of that demand is provided by the Waiawa Shaft. The Waiawa Shaft operates nearly 24/7 and provides on-demand drinking water. There is limited storage throughout the System. Additional information is available in the Navy and Marine Corps Force Health Protection Command’s (NMCFHPC’s) Pre-IDWST Exposure Memo. In 2022, Naval Facilities Engineering Systems Command (NAVFAC) contractor AH Engineering Consultants (AH) developed a hydraulic model of the JBPHH System, capable of simulating flows, pressures, and contaminant transport over time. To track the distribution of water from the Red Hill Shaft, the model simulated the addition of a conservative chemical (or tracer) to the source starting at noon on 27 November 2021. Neither the actual time the fuel entered the JBPHH System, nor the actual concentration of the contaminant is known. The time was selected so that the first occurrence of the model-simulated tracer in the System coincided roughly with the earliest reports of fuel-like odors by	Additional information regarding the piping network is available in the: ▪ Swarm Team Technical Memorandum summarizing Low-Level Hydrocarbons Detections Results of Test Method Interferences in Total Petroleum Hydrocarbon (TPH) Analysis of Chlorinated Drinking Water, dated 25 April 2024. Available at: https://jbphh-safewaters.org/public/Tech_Memo_JBPHH_LOE's_LTM_TPH_Detects_Redacted_Rev.pdf. ▪ NMCFHPC’s Technical Memorandum: Determination if Pre-IDWST Flushing Drinking Water Data Should be Used to Evaluate Exposure

No.	NASEM Request for Supporting Information	NCTF Response and Supporting Information	Available Resources/References
		System users. Based on the flow of the water through the System, there are large areas of the System that were not supplied with drinking water by the Red Hill Shaft around the time of the fuel release. The Navy Aiea Halawa and Waiawa Shafts were not affected by the 2021 fuel release. Therefore, the drinking water in these zones could not have been impacted by the November 2021 fuel release despite reported TPH-d detections. The Zones of the System supplied water partly or solely by the Red Hill Shaft coincide with Zones where fuel-like odors were reported shortly after the incident. TPH-d detections during the LTM have occurred throughout the JBPHH System, including Zones that would not have been impacted by the fuel release and Zones within the Army water distribution system downstream of GAC treatment based on the determinations of the hydraulic model. GAC treatment units are expected to remove organic compounds, including TPH. As a result, based on the hydraulics of the JBPHH System, the November 2021 JP-5 release has not caused the TPH-d detections observed during LTM. More information is available in the Swarm Team Tech Memo. The Army occupies Zones H1, H2, H3, and I1 and has additional in-line granular activated carbon (GAC) treatment units that treat the water before being distributed to these Zones. Zone J1 (Manana Housing) was not provided with drinking water via the System at the time of the release. After the health advisory was lifted, this area was taken off the Board of Water Supply distribution system and provided drinking water via the System. Manana Housing was then added as a new Zone during EDWM, and > 80% of the houses within the Zone were sampled.	to JP-5 Fuel, dated June 2023. Available at: https://cnrh.cnic.navy.mil/Portals/79/CNRH/Documents/red_hill/Medical%20Reports/Red%20Hill%20Pre%20IDWST%20Exposure%20Tech%20Memo_June_23.pdf?ver=thH6TShA0Jw2ciZ4f_PXgw%3D%3D.
4.	Public Health Advisory. Could you provide the data and models that informed the public health advisory, especially regarding safe levels for ingestion, dermal contact, and inhalation of contaminants? If no such data or models were used, were previous similar incidents used as a reference? Please clarify which water systems the advisory applied to, how areas were determined to be safe, and whether water use in food service settings was considered in the advisory.	This question should be directed to the Hawaii Department of Health (DOH) since they issued the health advisory and eventually lifted it for each Zone. The DOH Environmental Action Level (EAL) was used as the risk-based level below which no human health effects are expected. Later, DOH established an incident-specific parameter (ISP) of 266 ug/L. The Health Advisory is provided as **Attachment 7**. The letter documenting the basis of the 266 ug/L, prepared by DOH, is provided as **Attachment 8**. The Health Advisory applied to the entire System. The System provides drinking water to ~93,000 consumers. All water provided by the System, including water use in a food service setting, was considered in the Advisory. In February 2022, DOH developed guidance on the Approach to Amending the Public Health Advisories. This guidance provided the criteria that DOH used to determine whether drinking water in each zone was considered safe. In general, the criteria included: (a) Ensuring and documenting that contamination was isolated and contained. To meet this criterion, the Navy physically disconnected the Red Hill Shaft from the System and ensured the Red Hill Shaft has remained offline. Additionally, the Navy provided DOH with documentation supporting that the Waiawa Shaft was the sole source of drinking water in the System. (b) Ensuring drinking water in the System is in compliance. To meet this criterion, the Navy collected drinking water samples from the System (e.g., hydrants) and Waiawa Shaft for chemicals regulated under the Safe Drinking Water Act and additional fuel-related chemicals, such as TPHs. Results were compared to state and federal maximum contaminant levels (MCLs), Hawaii EALs, and ISPs. (c) Ensuring no contamination throughout the System is occurring. To meet this criterion, the Navy performed a cross-connection review and confirmation in each Zone on the System. This included verifying that building and service connections with petroleum activities are protected from backflow risks by doing a gap analysis to identify locations where corrective action is needed, developing a map to document where petroleum-related activities occur, and creating an inventory of where cross-connection control devices are located. (d) Ensuring water within the System has been flushed. To meet this criterion, the Navy developed a hydraulic model to support flushing activities, provided documentation showing the volumetric goals and recorded flushing volumes in each Zone, and Certification that all storage facilities and distribution infrastructure had been flushed, inspected, and cleaned (if applicable). (e) Ensuring drinking water in premise plumbing of homes/buildings is in compliance. To meet this criterion, the Navy collected drinking water samples from homes and other priority buildings (e.g., schools, child development centers, medical buildings, etc.) for chemicals regulated under the Safe Drinking Water Act and additional fuel-related chemicals, such as TPHs. Results were compared to state and federal MCLs, Hawaii EALs, and ISPs. These results and supporting information were presented in Removal Action Reports for each Zone, which are available on DOH's website.	Additional information regarding the Health Advisory and amendments to the Health Advisory are available at: ▪ DOH's Website for Navy Water System Health Advisory Amendments. Available at: https://health.hawaii.gov/about/navy-water-amendments/.

No.	NASEM Request for Supporting Information	NCTF Response and Supporting Information	Available Resources/References
5.	Maps of Drinking Water Sampling Locations. Could you provide a map showing both formal and informal drinking water sampling locations used during the response and recovery phases? We would also appreciate the corresponding chemical testing data and the dates each sample was collected.	Maps showing locations sampled during the Emergency Response (December 2021 – February 2022), LTM (March 2022 – March 2024), and EDWM (April 2024 – March 2025) are shown on **Attachments 9, 10, and 11**, respectively. The maps also identify the total number of samples, as well as what the samples were analyzed for. Drinking water samples were collected and analyzed in accordance with the Emergency Response Sampling Plan, the LTM Sampling Plan, and the EDWM Sampling Plan (see response to request no. 2). A total of 1,759 samples were collected during the Emergency Response, 8,971 samples were collected during LTM, and 6,840 samples were collected during EDWM. By the conclusion of EDWM-related sampling (Spring 2025), over 93% (9,171 of 9,884) of residences on the System had been sampled. The Navy has collected representative samples from every Zone on the System. This ensured the Navy achieved spatial and temporal coverage and could assess the entire System throughout all sampling efforts. All analytical results, including a map where the sample was collected, what the sample was analyzed for, the date the sample was collected, and the results reported by the lab, are available on Safewaters using the Joint Base Pearl Harbor-Hickam (JBPHH) Drinking Water Monitoring Dashboard.	Additional information regarding the results of drinking water samples during the Emergency Response, LTM, and EDWM are available at Safewaters.org. At Safewaters.org, the following reports are available: ▪ Analytical results by Zone for LTM and EDWM, as well as the LTM Report for each Zone during each period of LTM. Available here. ▪ EDWM Q1 Report. https://jbphh-safewaters.org/public/EDWM_Q1_Data_Summary.pdf. ▪ EDWM Q2 Report: https://jbphh-safewaters.org/public/EDWM_Q2_Data_Summary.pdf. ▪ EDWM Q3 Report: https://jbphh-safewaters.org/public/EDWM_Q3_Data_Summary.pdf. ▪ EDWM Q4 Report will be posted on the JBPHH Safewaters Drinking Water webpage Document Library, here: https://jbphh-safewaters.org/public/framework/appcontainer.aspx?url=html.aspx&idhtml=10881&title=Document%20Library&idMenu=89535&ddlDSN=SYSTM&DSN=SYSTM ▪ LTM Reports (developed by Zone): https://jbphh-safewaters.org/public/framework/appcontainer.aspx?url=html.aspx&idhtml=10738&title=Water%20System%20Zone%20Map&idMenu=88798&ddlDSN=SYSTM&DSN=SYSTM. ▪ Emergency Response Reports (Stage 2 and Stage 4; developed by Zone): https://jbphh-safewaters.org/public/framework/appcontainer.aspx?url=html.aspx&idhtml=10738&title=Water%20System%20Zone%20Map&idMenu=88798&ddlDSN=SYSTM&DSN=SYSTM.
6.	Decontamination and Cleaning Guidance. What specific guidance was provided to individuals whose drinking water was contaminated? Were there any recommendations for decontaminating water or cleaning household items? Please share any data or assessments that supported the effectiveness of these cleaning methods.	Residents of JBPHH were provided a Residence Resource Guide immediately following the amendment of the Health Advisory. The Residents Resource Guide is a "living document," meaning it has been updated as needed to reflect current sampling activities, questions, and the needs of the JBPHH community, and to provide the most up-to-date information. An early version of the Resident Resource Guide, published in March 2022, included details on cleaning household items such as food service items (e.g., dishes, bottles, utensils, cups/glasses), appliances, ice makers, coffee makers, infant/child essentials, and special care items. The Residents Resource Guide, which was publicly available online and distributed to residents during sampling, included frequently asked questions on cleaning, petroleum hydrocarbons, health-related concerns, and where to get more information. A copy of the original Resident Resource Guide from March 2022 and the most up to date version, dated June 2025, is provided as **Attachment 12**. Additionally, consumers are provided a copy of the Resource Guide as their house is sampled after contacting the Navy's Water Quality Action Team, and the guides are available from the Navy housing partners. The purpose of this guide is to provide information on where water in the System comes from, how the water is tested, and where to get additional resources regarding general water quality, ongoing activities at JBPHH, or medical. The Residence Resource Guide is updated as new information becomes available or conditions at JBPHH change, for example, the guide was updated when LTM ended and EDWM began.	The Residence Resource Guide is available at: https://www.navyclosuretaskforce.navy.mil/Portals/101/JBPHH%20Water%20Response%20Resident%20Resources%20Guide_1.pdf.
7.	System Flushing. Please provide details on how system flushing was conducted following the contamination on November 20, 2021. Where did the flushing begin (e.g., at specific hydrants), how long did it last, and was it unidirectional or another method? What criteria were used to determine that the flushing was effective, and where was the flushed water discharged?	The System was flushed on a zone-by-zone basis in accordance with the Drinking Water Distribution System Recovery Plan (dated December 2021), and houses on the System were flushed in accordance with the Single Family Home Flushing Plan Checklist and Standard Operating Procedures (dated December 2021). The System was flushed using unidirectional flushing (UDF). These plans outline the general sequence of flushing, broken into four phases. Volumetric goals were established in the recovery plan to determine how much water needed to be flushed in each Zone of the System. Initial goals were between 2 and 5 volumetric turnovers to be protective. Flushing began in December 2021 and continued until March 2022. Flushing locations were strategically located to optimize flow through all mainline pipes within the flushing zone. The feasible discharge methods at each flush site were located and evaluated with the following prioritization: (a) Discharge to sanitary sewers, where applicable. Discharges complied with permits issued by the respective wastewater treatment authority (i.e., the City and County of Honolulu, Department of Environmental Services) and were not initiated without express authorization from the applicable wastewater treatment system owner or operator. (b) Direct land application after granular activated carbon (GAC) treatment. (c) Storm drains in accordance with a National Pollutant Discharge Elimination System (NPDES) Permit. Compliance sampling was performed after flushing and compared to action levels established in the flushing plans. All results were reported to DOH and EPA and considered as part of the health advisory amendments. See response no. 7 for more detailed information and background on flushing activities performed as part of the Emergency Response.	Additional information about flushing is available in the: ▪ Drinking Water Distribution System Recovery Plan. Available at: https://health.hawaii.gov/about/files/2021/12/Drinking-Water-Distribution-System-Recovery-Plan.pdf. ▪ Single Family Home Flushing Plan Checklist and Standard Operating Procedures. Available at: https://www.cpf.navy.mil/Portals/52/Downloads/JBPHH-Water-Updates/Final%20Home%20Flushing%20Plan%20122321%20signed%20bcastell_seng_dbrixius%20ho.pdf. ▪ JBPHH Flushing and Sampling Plan. Available at: https://www.cpf.navy.mil/JBPHH-Water-Updates/Flushing-and-Sampling-Plan/ ▪ DOH Directive One, Flushing Requirements. Available at: https://health.hawaii.gov/about/files/2021/12/DOH-Directive-Flushing.pdf.

No.	NASEM Request for Supporting Information	NCTF Response and Supporting Information	Available Resources/References
			▪ DOH Navy Water System Health Advisory Amendments. Available at: https://health.hawaii.gov/about/navy-water-amendments/.
8.	PPE and Worker Health During Flushing. Who was involved in flushing the contaminated water systems? Were there any reported health symptoms (e.g., headaches, eye/nose/throat irritation) among these workers, and if so, where and when did those occur?	Flushing was performed by active-duty personnel stationed at JBPHH and Navy environmental contractors. The NMCFHPC began working this issue immediately following the November 2021 release (prior to the establishment of the IDWST) and was one of the members of the IDWST established in December 2021. Between November 2021 and March 2022 (when the Health Advisory was amended and the IDWST-led sampling efforts), there were no reports of health symptoms reported to or received by the NMCFHPC.	
9.	Worker Guidance and PPE. What specific instructions were given to workers performing flushing activities? If PPE guidance was provided, who issued it? Were there recommendations on location-specific protocols (e.g., flushing in unventilated bathrooms)? Were workers instructed to flush hot water? Please detail any PPE that was provided to military personnel or others involved in the flushing process.	Workers performing flushing activities were trained to complete flushing activities in accordance with flushing plans and Standard Operating Procedures (SOPs; see response no. 7) by active-duty personnel. In addition, sampling teams comprised of members of the interagency teams, subject matter experts (SMEs), and Navy contractors. Flushing activities included cold water service line flushing, water heater draining, hot water flushing, spigot flushing, and flushing appliances. All personnel performing flushing and sampling activities were required to wear modified Level D Personal Protective Equipment (PPE), which includes (at a minimum): safety glasses, high-visibility vest or shirt, steel-toed boots, and nitrile gloves.	
10.	Post-Advisory Water Safety Data. After the public health advisory was lifted, were any petroleum compounds detected in subsequent water samples? If so, where and at what concentrations? Were SVOCs, VOCs, or PFAS tested in the well water, water system, or at the tap? Please provide sampling dates, methodologies, laboratory details, and chlorine residual concentrations for those samples. We would also appreciate access to the data in a machine-readable format (e.g., Excel, .csv).	After the DOH Health Advisory was lifted in March 2022, the Navy collected drinking water samples in accordance with the LTM Plan (between March 2022 and March 2024) and the EDWM Plan (between April 2024 and March 2025). The Navy collected over 15,000 samples between LTM and EDWM. Analytical results are available on Safewaters.org. The Navy has developed an interactive Drinking Water Monitoring Dashboard that allows individuals or organizations to review all available results, including the sample ID, sample date, what was analyzed, the result, and the appropriate screening level. This allows residences or other interested parties to see where samples have been collected and to determine where, if any, exceedances have occurred. Since the beginning of LTM, exceedances have been reported in 35 out of 18,510 (0.19%) samples collected. In accordance with the LTM and EDWM Plans, the Navy investigated every exceedance to determine the root cause. A detailed summary of all exceedances and the results of each follow-on investigation is provided in **Attachment 13**. Additionally, results during LTM and EDWM are summarized in LTM Reports (by Zone) and EDWM Reports (by Quarter), which are available on Safewaters.org. TPHs, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and other fuel indicator compounds were detected infrequently during LTM and EDWM. A summary of chemicals that have been detected during LTM and EDWM is provided in **Attachment 14**.	The Joint Base Pearl Harbor-Hickam (JBPHH) Drinking Water Monitoring Dashboard is available on Safewaters.org. Additional information regarding the results of drinking water samples during the Emergency Response, LTM, and EDWM are available at Safewaters.org. At Safewaters.org, the following reports are available: ▪ Analytical results by Zone for LTM and EDWM, as well as the LTM Report for each Zone during each period of LTM. Available here. ▪ EDWM Q1 Report. https://jbphh-safewaters.org/public/EDWM_Q1_Data_Summary.pdf. ▪ EDWM Q2 Report: https://jbphh-safewaters.org/public/EDWM_Q2_Data_Summary.pdf. ▪ EDWM Q3 Report: https://jbphh-safewaters.org/public/EDWM_Q3_Data_Summary.pdf. ▪ EDWM Q4 Report will be posted on the JBPHH Safewaters Drinking Water webpage Document Library: https://jbphh-safewaters.org/public/framework/bannerhtml.aspx?idhtml=10737&banner=jbphh_home.png&title=JBPHH%20Drinking%20Water%20Monitoring&idMenu=88797&ddlDSN=SYSTM&DSN=SYSTM ▪ LTM Reports (developed by Zone): https://jbphh-safewaters.org/public/framework/appcontainer.aspx?url=html.aspx&idhtml=10738&title=Water%20System%20Zone%20Map&idMenu=88798&ddlDSN=SYSTM&DSN=SYSTM.

<table>
<tr><th>No.</th><th>NASEM Request for Supporting Information</th><th>NCTF Response and Supporting Information</th><th>Available Resources/References</th></tr>
<tr><td>11.</td><td><u>Drinking Water Complaints.</u>
Could you provide logs or summaries of consumer complaints related to drinking water—such as those concerning taste, odor, color, clarity, or health effects—filed between May 2021 and March 7, 2022? We are interested in records from public works, commanders, or utility departments.</td><td>The IDWST established the Rapid Response Team, which was an on-call team trained to respond to JBPHH System consumers with water quality concerns after the DOH amended the Health Advisory. The Navy later, under EDWM, updated and expanded the capabilities of the Rapid Response Team – which is now known as the Water Quality Action Team. All calls to the Rapid Response Team and Water Quality Action Team were/are logged in the Consumers Call Log for tracking purposes. This ensures the Navy follows through and documents every step of the water quality investigations from the initial call, to documenting consumers' concerns, to conducting a home inspection, and finally closing out the ticket – when the water quality concern has been addressed. A log of calls received by the Rapid Response Team between 17 February 2022 through 04 March 2022 (no calls were received between 05 and 07 March 2022) is provided as Attachment 15. The call log includes information regarding the location ID, the location type, when the call was received, and the reason for the call. Additional information is available on Safewaters.org, where the Water Quality Action Team's call log is uploaded to the Drinking Water webpage on a monthly basis.</td><td></td></tr>
<tr><td>12.</td><td><u>Monitoring and Replacement Activities.</u>
What routine monitoring was conducted to confirm the water no longer posed a health hazard, particularly in building plumbing systems? Were any materials or infrastructure (e.g., piping, fixtures, appliances) removed or replaced as part of remediation? If so, what prompted their replacement, and were any items found to be leaching chemicals linked to the contamination?</td><td>The Navy implemented two significant routine monitoring programs to confirm that water in the System no longer posed a health hazard. The first was Long Term Monitoring (LTM). LTM was a two-year monitoring program that began in March 2022 and ended in March 2024. Drinking water samples were collected and reported for 7 Periods (i.e., 1 Month, 2 Months, 3 Months, 9 Months, 15 Months, 21 Months, and 24 Months after the Health Advisory was amended). During LTM, the Navy collected 8,971 drinking water samples from residences, schools, child development centers, other facilities (e.g., medical clinics, workplaces), hydrants, and Waiawa Shaft. During LTM, approximately 65% of all residences on the System were sampled. EDWM was a voluntary program implemented by the Navy immediately following LTM. EDWM was a one-year monitoring program that began in April 2024 and ended in March 2025. Drinking water samples were collected monthly and reported quarterly. During EDWM, the Navy collected 6,840 drinking water samples from residences, schools, child development centers, other facilities (e.g., medical clinics, workplaces), hydrants, and Waiawa Shaft. By the end of EDWM, > 93% of all residences on the System had been sampled. A breakdown of samples collected during LTM and EDWM is summarized below.
<table>
<tr><th>Location Type</th><th>No. of Samples during LTM</th><th>No. of Samples during EDWM</th><th>Total No. of Samples</th></tr>
<tr><td>Residences</td><td>6,631</td><td>3,909</td><td>10,540</td></tr>
<tr><td>Schools</td><td>412</td><td>706</td><td>1,118</td></tr>
<tr><td>Child Development Centers</td><td>311</td><td>518</td><td>829</td></tr>
<tr><td>Other Facilities</td><td>698</td><td>167</td><td>865</td></tr>
<tr><td>Hydrants</td><td>907</td><td>1,510</td><td>2,417</td></tr>
<tr><td>Waiawa Shaft</td><td>12</td><td>30</td><td>42</td></tr>
<tr><td>Total</td><td>8,971</td><td>6,840</td><td>15,811</td></tr>
</table>
The Navy has collected over 15,000 samples from residences, schools, child development centers, hydrants, non-residences (e.g., workplaces, clinics, dental offices, etc.), and water shafts (Waiawa, Navy Aiea-Hawala, and Red Hill shafts) between December 2021 and April 2025. Samples were collected on a routine basis throughout all Zones of the System to ensure representative data were collected and could be used to confirm that the water in the System did not pose a hazard to human health. Results were compared to the EPA MCLs established under the Safe Drinking Water Act (SDWA). An MCL is the maximum permissible level of a contaminant in water that is delivered to any user of a public water system. The MCL is set to protect the public from acute and chronic health risks associated with consuming water containing these contaminants.

No materials or infrastructure (e.g., piping, fixtures, plumbing) were replaced because of fuel contamination or TPH detections; however, the Navy did replace faucets based on detections of lead, which is not related to JP-5 fuel (the fuel released from Red Hill Bulk Fuel Storage Facility).

The LTM and EDWM Sampling Plans included Courses of Action, or COAs, if exceedances of MCLs, Action Levels, or Incident-Specific Parameters occurred. In the event of an exceedance, the Navy would immediately notify the residence (or occupants), notify EPA and DOH, and begin conducting additional investigation. If the exceedance occurred at a residence, child development center, school, or non-residence, then the Navy would perform a site visit and an inspection to determine the root cause of the exceedance. The Navy would then resample the faucet and additional faucets in the building. Based on the site visit results and additional sampling, the Navy would work with EPA and DOH to determine whether remedial action, such as flushing or faucet replacement, was warranted. If the exceedance occurred at a hydrant, the Navy would perform bracket sampling, which includes sampling one hydrant upgradient of the original hydrant and one hydrant downgradient of the original hydrant. This helped the Navy determine whether the exceedance was a localized issue (e.g., associated with lubricants used to maintain the hydrants) or a System-wide issue. The original hydrant was also resampled. The Navy replaced faucets based on sampling results. No replacement faucets were triggered by the presence of fuel contamination or TPH detections. The replacement of faucets was triggered by detections of lead, which is not associated with JP-5, and by elevated lead concentrations at these locations, which were likely due to a plumbing issue on the premises.

In addition to LTM and EDWM, since November 2021, the Navy has continued to conduct routine compliance monitoring in accordance with state and federal regulations. These results are reported yearly in the annual Consumer Confidence Report.</td><td>Additional information is available in the:
▪ EPA's National Primary Drinking Water Regulations website. Available at: https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations.
▪ Removal Action Reports. Available at: https://health.hawaii.gov/about/navy-water-amendments/.
▪ JBPHH consumer confidence reports available at: https://pacific.navfac.navy.mil/Facilities-Engineering-Commands/NAVFAC-Hawaii/About-Us/Our-Services/Environmental/Water-Quality-Reports/</td></tr>
<tr><td>13.</td><td><u>Relocation and Reopening Information.</u>
How many individuals were advised to relocate, and how many reported a change of mailing address? When did affected schools and housing reopen? Was any tracer or marker used to confirm the absence of remaining contamination?</td><td>Following the Health Advisory, the Navy offered all personnel living on the JBPHH System Temporary Lodging Allowance (TLA). This TLA program through the Navy was optional; however, all service members, civilians, and their families were encouraged to use these resources and report health effects, observations of petroleum impacts, or other water quality concerns to the Navy. The Navy established the Rapid Response Team to address reported concerns quickly. U.S. Army Pacific (USARPAC) issued an emergency evacuation order for all Department of War personnel, civilian employees, and their families living in Army housing areas on the JBPHH drinking water distribution system, authorizing TLA to reimburse those families for certain expenses related to that temporary relocation. Schools were not closed as a result of the Health Advisory; however, alternative water sources were provided to residences, buildings, schools, and child development centers on the System. This included providing bottled water, providing water buffalos, mobilizing potable water trucks, and etc., which provided water that could be used for consumptive purposes (e.g., cooking, drinking, oral hygiene) while the Health Advisory was in effect.</td><td>• Information regarding family assistance including TLA and lodging available at: https://www.cpf.navy.mil/JBPHH-Water-Updates/</td></tr>
</table>

No.	NASEM Request for Supporting Information	NCTF Response and Supporting Information	Available Resources/References
		Confirmation samples were collected on a zone-by-zone basis to confirm the drinking water was safe and to support DOH in determining when to lift the Health Advisory (see response to no. 4 and 7).	
14.	Health Effects Research. What research has been conducted on the potential health impacts of the spill, particularly among military personnel and local residents? Can you provide aggregate data on individuals seen at the Red Hill-specific and base clinics? Useful data would include ICD codes, tests ordered and results, follow-up actions, demographics, and visit dates (e.g., weekly or biweekly). Tricare claims data related to the spill would also be helpful.	DHA responded to this NASEM question in April 2025. The information is also provided below. (1) CDC / ATSDR: (a) Community health impacts after a jet fuel leak contaminated a drinking water system: Oahu, Hawaii, November 2021, Shanna Miko, Alex R. Poniatowski, Alyssa N. Troeschel, Diana J. Felton, Shireen Banerji, Michele L. F. Bolduc, Alvin C. Bronstein, Alyson M. Cavanaugh, Charles Edge, Abigail L. Gates, Madeline Jarvis, Nicole A. Mintz, Vidisha Parasram, Jamie Rayman, Amanda R. Smith, Jared C. Wagner, Benjamin G. Gerhardstein, Maureen F. Orr; Community health impacts after a jet fuel leak contaminated a drinking water system: Oahu, Hawaii, November 2021. J Water Health 1 July 2023; 21 (7): 956–971. DOI: https://doi.org/10.2166/wh.2023.109 (b) Notes from the Field: Self-Reported Health Symptoms Following Petroleum Contamination of a Drinking Water System — Oahu, Hawaii, November 2021–February 2022, Troeschel AN, Gerhardstein B, Poniatowski A, et al. Notes from the Field: Self-Reported Health Symptoms Following Petroleum Contamination of a Drinking Water System — Oahu, Hawaii, November 2021–February 2022. MMWR Morb Mortal Wkly Rep 2022;71:718–719. DOI: http://dx.doi.org/10.15585/mmwr.mm7121a4 (c) In February and March 2023, at the DHA's request, CDC/ATSDR conducted an ACE investigation to assess the incident's health effects on military personnel. In this ACE investigation, they examined military health records. According to the ATSDR website, the third ACE investigation results "are still being analyzed and prepared for publication." (2) Defense Health Agency (DHA) Public Health (a) Incidence of Selected Health Conditions Among TRICARE Beneficiaries Exposed to the Red Hill Fuel Release November 2019–December 2023 (https://ph.health.mil/PHC%20Resource%20Library/edc-redhill-comparison-study-2019-2023.pdf) (b) Description of Joint Base Pearl Harbor-Hickam DoD-affiliated Housing Residents' Behavioral and Neurodevelopmental Health Medical Encounters Related to the JP-5 Release, 20 November 2020 – 30 November 2022 (https://cnrh.cnic.navy.mil/Portals/79/CNRH/Documents/red_hill/Medical%20Reports/Red%20Hill%202023%20BNH_August%202023.pdf?ver=1HVJDamFWnIeDsp2SeUnJA%3d%3d) (c) Description of Joint Base Pearl Harbor-Hickam DoD-affiliated Housing Residents' Medical Encounters Related to the JP-5 Release, 01 January 2021 – 30 November 2022 (https://cnrh.cnic.navy.mil/Portals/79/CNRH/Documents/red_hill/Medical%20Reports/Red%20Hill%20Medical%20Review_August%202023.pdf?ver=Ac95LrvA0m_Hes6pCgy7uw%3d%3d) (3) Navy and Marine Corps Public Health Center: (a) Technical Memorandum: Determination if Pre-IDWST Flushing Drinking Water Data Should be Used to Evaluate Human Exposure to JP-5 Fuel in Drinking Water at the Joint Base Pearl Harbor-Hickam Water Distribution System (https://cnrh.cnic.navy.mil/Portals/79/CNRH/Documents/red_hill/Medical%20Reports/Red%20Hill%20Pre%20IDWST%20Exposure%20Tech%20Memo_June_23.pdf?ver=thH6TShA0Jw2ciZ4f_PXgw%3d%3d)	
15.	Risk Assessments. Could you provide copies of any health risk assessments conducted for drinking water exposure scenarios related to the contamination?	DHA responded to this question in April 2025. The information is also provided below. Exposure Assessment: November 2021 Release of JP5 Jet Fuel into the Joint Base Pearl Harbor Hickam Drinking Water System, Hawaii Department of Health, Prepared by: Roger Brewer, PhD, June 2023 (https://health.hawaii.gov/about/files/2023/06/JBPHH-JP-5-Exposure-Assessment-HIDOH-June-2023.pdf). POC is Diana Felton, M.D. Between March 2022 and March 2025, the Navy collected over 15,000 drinking water samples (see additional information in response no. 10). Results from these samples have been compared with MCLs and risk-based action levels, including the ISP for TPH. These values are health-protective and were established by the EPA and the DOH. Concentrations in the System have complied with these health-protective screening levels, action levels, and ISPs, continuing to demonstrate that water in the System is not impacted by JP-5 and is safe. The NMCFHPC evaluated pre-IDWST flushing drinking water data to determine whether they were suitable for assessing human exposure to JP-5 fuel associated with the November 2021 release at JBPHH. The report is not intended to make any inferences or conclusions about health and/or mental health effects experienced during the release. Pre-IDWST flushing drinking water data were obtained by sampling drinking water shafts, drinking water storage tanks, and locations throughout the System between 24 November 2021 and 02 January 2022. Results of drinking water samples collected by NAVFAC HI between 29 November and 13 December 2021 were compared with those collected by DOH between 24 November 2021 and 02 January 2022 to determine whether the results and findings were similar. This report documents the lines-of-evidence approach used to determine whether or not the drinking water samples collected prior to IDWST flushing the System are appropriate for evaluating potential exposure to JP-5 fuel in drinking water after the release. The Memo provides: (a) Background information on the Red Hill Bulk Fuel Storage Facility and a timeline of events related to the November 2021 JP-5 release, (b) A summary of the contamination of potential concern (COPCs) and the estimated timeframe for human exposure, (c) An evaluation of Pre-IDWST data sources, (d) An evaluation of Pre-IDWST analytical results, (e) A determination on whether Pre-IDWST data is usable for evaluating potential exposure to JP-5 fuel in the JBPHH System and the lines of evidence evaluated to support this determination, and (f) An uncertainty analysis to identify potential questions or sources of uncertainty associated with their assumptions in the exposure assessment or the data sources provided.	Additional information is available in the: ▪ NMCFHPC's Technical Memorandum: Determination if Pre-IDWST Flushing Drinking Water Data Should be Used to Evaluate Exposure to JP-5 Fuel dated June 2023. Available at: https://cnrh.cnic.navy.mil/Portals/79/CNRH/Documents/red_hill/Medical%20Reports/Red%20Hill%20Pre%20IDWST%20Exposure%20Tech%20Memo_June_23.pdf?ver=thH6TShA0Jw2ciZ4f_PXgw%3D%3D.

No.	NASEM Request for Supporting Information	NCTF Response and Supporting Information	Available Resources/References
		Overall, the NMCFHPC concluded that the pre-IDWST flushing drinking water data, collected by NAVFAC HI (between 29 November and 13 December 2021) and DOH (between 24 November 2021 and 02 January 2022), would not be appropriate for use in conducting an exposure assessment of individuals who consumed drinking water that was impacted by the JP-5 fuel release. This determination was supported by: (a) The timeline of events. Pre-IDWST flushing drinking water samples were collected after the Red Hill Shaft had been taken offline and were not collected within the most likely highest estimated exposure timeframe (i.e., 20 November and 29 November 2021). After 29 November 2021, the JP-5 fuel remaining in the JBPHH system was diluted and/or flushed daily by clean drinking water from the Waiawa Shaft and the Navy Aiea Halawa Shaft (until taken offline on 3 December 2021). By 29 November 2021, there was likely limited JP-5 fuel contamination remaining in the JBPHH system. (b) Location and Spatial Distribution of Drinking Water Samples. The neighborhoods/zones most likely impacted by JP-5 fuel are the neighborhoods/zones closest to the Red Hill Shaft. However, during the emergency response, drinking water samples were collected throughout the JBPHH system to rapidly characterize drinking water quality and the potential extent of TPH contamination. There are approximately 9,694 households, schools, child development centers, and workplaces within the JBPHH system. Due to limited lab capacities, not every location could be sampled. Consequently, drinking water samples were collected from less than 1% (NAVFAC HI) and 2% (DOH) of all households, schools, child development centers, and workplaces in the JBPHH system. (c) Insufficient Data Quality. Pre-IDWST flushing drinking water data was collected prior to the IDWST developing the Sampling Plan, which identified the appropriate analytical methods, QA/QC requirements and procedures, sample collection and handling procedures, and the project screening levels. There is currently no available information documenting how samples were collected to ensure there were no data quality concerns at the time of collection (e.g., were all samples collected using the same method, were field crews trained on how to collect drinking water samples).	
16.	Clinical Follow-Up. Could you provide any specific guidance that was given to Red Hill clinical providers for supporting individuals exposed to the contaminated drinking water? Additionally, do you have any clinical follow-up protocols for individuals exposed to jet fuels or similar petroleum products (e.g., kerosene, gasoline), whether through occupational or other types of exposure?	DHA responded to this question in April 2025. The information is also provided below. (1) Red Hill Health Resources for Military Health System Healthcare Providers (https://info.health.mil/hco/phealth/OEH/SitePages/Red%20Hill%20PH.aspx) (2) Chronic Multisymptom Illness (CMI) for Clinicians: A Limited Video Series (https://info.health.mil/hco/phealth/OEH/SitePages/Red%20Hill%20PH.aspx) (3) A DHA Continuing Education webinar "Patient- and Family-Centered Care for Environmental Exposures: Red Hill Case Study" took place on July 13, 2023. It was available for on-demand viewing as a home study course with 3.0 hours of CME credit through August 28, 2024. (a) Description (https://www.dhaj7-cepo.com/content/special-feature-webinar-patient-and-family-centered-care-environmental-exposures-red-hill) (b) Slides (https://www.dhaj7-cepo.com/sites/default/files/course/2023-07/DHA_J7_CEPO_SFW%20Red%20Hill%20PPT_v1-0_2023-7-12_0.pdf) (c) Videos: (i) Part 1 (https://www.dvidshub.net/video/893414/special-feature-webinar-july-2023-red-hill-part-1) (ii) Part 2 (https://www.dvidshub.net/video/893418/special-feature-webinar-july-2023-red-hill-part-2) (iii) Part 3 (https://www.dvidshub.net/video/893422/special-feature-webinar-july-2023-red-hill-part-3) (4) Defense Health Network -Indo-Pacific provided training to primary care providers before they assumed duties as the Red Hill Clinic (RHC) provider. Clinical follow-up protocols: (1) Healthcare Provider Recommendations to Support Patients Exposed to the November 2021 Fuel Release at Red Hill (https://ph.health.mil/PHC%20Resource%20Library/redhill-doctor-guidance.pdf) (2) Hawaii Department of Health: Drinking Water Petroleum Exposure Health Care Provider Evaluation and Treatment Guidance (https://health.hawaii.gov/about/files/2021/12/Medical-Advisory-Drinking-Water-Petroleum-Exposure.pdf) The Joint Medical Services Working Group on Red Hill was established on 01 December 2021. Daily encounter numbers and brief descriptions started being collected by a working group that became the MED COP (Medical Comprehensive Operating Picture) on 01 December 2021. Two phone centers for reporting of medical symptoms or other medical inquiries were established: (1) the Military Health System H2O Hotline (808-433-8102) which was open 0730 to 1600 daily and (2) the 24/7 TRICARE Nurse Advice Line (800-874-2273) in addition to the individual medical facilities' phone lines. With increasing numbers of medical encounters (34 by 01 DEC 21, and 40 on 02 DEC 21, and 85 on 03 DEC 21) and a desire to be accessible to all individuals in the affected areas, the Army deployed a mobile military treatment facility to the Army Military Reservation (AMR) at Red Hill and the Navy opened both an Emergency Family Assistance Center (EFAC) at the Personnel Support Detachment building and a military medical treatment and screening center at Halsey Terrace (inside the Community Center). Each of these community MTFs (AMR, EFAC, and Halsey Terrace) had medical providers and actively provided medical care or triaged the individuals to appropriate medical care. The EFAC also provided mental health resources, financial and housing guidance, and religious services in addition to the medical care, screening, and reporting that were provided at the other centers. Through this period TAMC was the only facility open 24 hours a day, 7 days a week. The temporary community clinics typically operated with extended hours from 0700 to 2000, seven days a week while the permanent, fixed clinics typically operated from 0700 to 1630 Monday through Friday. With the opening of the community-based centers around the 4th of December, a large divergent group of individuals who only wanted to report and have recorded their possible exposure to potentially contaminated water arose. Additionally, physicians were provided with a Patient Encounter Flow Chart in February 2022 to establish a protocol for ensuring patient encounters were properly documented and treated (see **Attachment 16**).	

ATTACHMENTS

Attachment 1	Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)
Attachment 2	Jet Propellant, Grade 5 Safety Data Sheet
Attachment 3	Analyses, Sample Containers, and Preservatives
Attachment 4	TPH Detection Frequency During LTM and EDWM Sampling Periods
Attachment 5	Map: Joint Base Pearl Harbor Hickam Drinking Water Distribution System Piping Network
Attachment 6	Map: Joint Base Pearl Harbor Hickam Drinking Water Distribution System Hydrant Locations
Attachment 7	DOH Health Advisory
Attachment 8	DOH Letter Recommending Risk-Based Drinking Water Action Levels for TPH
Attachment 9	Map: Emergency Response Sample Locations
Attachment 10	Map: LTM Sample Locations
Attachment 11	Map: EDWM Sample Locations
Attachment 12	Residence Resource Guide
Attachment 13	Table: Identification of Exceedances Reported in Drinking Water Samples
Attachment 14	Table: Summary of Detections of TPHs, VOCs, and SVOCs during LTM and EDWM (March 2022 – March 2025)
Attachment 15	Consumer Call Log (17 February 2022 – 04 March 2022)
Attachment 16	Patient Encounter Flow Chart for Water Exposure Health Concerns

Attachment 1

Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

The summary statistics presented in the following table are based on the results from 16 free product samples collected from Red Hill tanks in July 2023. The sample IDs are as follows:

- RHTK07-10TAP-POLN01
- RHTK07-135TAP-POLN01
- RHTK08-10TAP-POLN01
- RHTK08-75TAP-POLN01
- RHTK09-135TAP-POLN01
- RHTK09-75TAP-POLN01
- RHTK10-10TAP-POLN01
- RHTK10-75TAP-POLD01
- RHTK10-75TAP-POLN01
- RHTK11-10TAP-POLN01
- RHTK12-120TAP-POLN01
- RHTK12-60TAP-POLN01
- RHTK12-8TAP-POLN01
- RHTK20-120TAP-POLN01
- RHTK20-200TAP-POLN01
- RHTK20-60TAP-POLN01

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
7094-27-1	1,1,4-Trimethylcyclohexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
1638-26-2	1,1-Dimethylcyclopentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
877-44-1	1,2,4-Triethylbenzene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
106-93-4	1,2-Dibromoethane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
107-06-2	1,2-Dichloroethane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
102-25-0	1,3,5-Triethylbenzene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
98-19-1	1,3-Dimethyl-5-tert-Butylbenzene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
872-05-9	1-Decene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
592-41-6	1-Hexene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
124-11-8	1-Nonene	16	0	0.0	468	1,210	0.0	0.0	441	538	242	154
111-66-0	1-Octene	16	0	0.0	468	1,210	0.0	0.0	441	538	242	154
109-67-1	1-Pentene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
464-06-2	2,2,3-Trimethylbutane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
564-02-3	2,2,3-Trimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
75-83-2	2,2-Dimethylbutane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
590-73-8	2,2-Dimethylhexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
590-35-2	2,2-Dimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
560-21-4	2,3,3-Trimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
565-75-3	2,3,4-Trimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
79-29-8	2,3-Dimethylbutane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
584-94-1	2,3-Dimethylhexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
565-59-3	2,3-Dimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
108-08-7	2,4-Dimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
592-13-2	2,5-Dimethylhexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
872-55-9	2-Ethylthiophene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
563-46-2	2-Methyl-1-Butene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
625-27-4	2-Methyl-2-pentene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
107-83-5	2-Methylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
554-14-3	2-Methylthiophene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
2216-38-8	2-Nonene	16	0	0.0	468	1,210	0.0	0.0	441	538	242	154
1067-20-5	3,3-Diethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
562-49-2	3,3-Dimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
619-99-8	3-Ethylhexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
617-78-7	3-Ethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
563-45-1	3-Methyl-1-butene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
96-14-0	3-Methylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
616-44-4	3-Methylthiophene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
691-37-2	4-Methyl-1-pentene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
56-55-3	Benz(a)anthracene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
71-43-2	Benzene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
50-32-8	Benzo(a)pyrene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
205-99-2	Benzo(b)fluoranthene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
192-97-2	Benzo(e)pyrene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
191-24-2	Benzo(g,h,i)perylene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
205-82-3, 207-08-9	Benzo(j)+(k)fluoranthene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
95-15-8	Benzothiophene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
218-01-9-C1	C1-Chrysenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
218-01-9-C2	C2-Chrysenes BS	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
206-44-0,129-00-0-C2	C2-Fluoranthenes/Pyrenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
218-01-9-C3	C3-Chrysenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
206-44-0,129-00-0-C3	C3-Fluoranthenes/Pyrenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
85-01-8,120-12-7-C3	C3-Phenanthrenes/Anthracenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
218-01-9-C4	C4-Chrysenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
132-65-0-C4	C4-Dibenzothiophenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
206-44-0,129-00-0-C4	C4-Fluoranthenes/Pyrenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
85-01-8,120-12-7-C4	C4-Phenanthrenes/Anthracenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
218-01-9,Triph	Chrysene/Triphenylene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
6443-92-1	cis-2-Heptene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
7688-21-3	cis-2-Hexene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
7642-04-8	cis-2-Octene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
627-20-3	cis-2-Pentene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
20237-46-1	cis-3-Nonene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
287-92-3	Cyclopentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
53-70-3 , 218-58-7	Dibenz(a,h)+(a,c)anthracene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
637-92-3	Ethyl-Tert-Butyl-Ether	16	0	0.0	187	484	0.0	0.0	176	216	97	62
206-44-0	Fluoranthene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
193-39-5	Indeno(1,2,3-cd)pyrene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
1678-98-4	Isobutylcyclohexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
540-84-1	Isooctane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
78-78-4	Isopentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
78-79-5	Isoprene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
108-20-3	Isopropyl Ether	16	0	0.0	187	484	0.0	0.0	176	216	97	62
696-29-7	Isopropylcyclohexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
1634-04-4	Methyl tert butyl ether	16	0	0.0	187	484	0.0	0.0	176	216	97	62
12108-13-3	MMT	16	0	0.0	468	1,210	0.0	0.0	441	538	242	154
629-97-0	n-Docosane (C22)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
544-85-4	n-Dotriacontane (C32)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
112-95-8	n-Eicosane (C20)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
629-94-7	n-Heneicosane (C21)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
630-04-6	n-Hentriacontane (C31)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
593-49-7	n-Heptacosane (C27)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
7194-84-5	n-Heptatriacontane (C37)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
630-01-3	n-Hexacosane (C26)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
630-06-8	n-Hexatriacontane (C36)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
630-03-5	n-Nonacosane (C29)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
629-92-5	n-Nonadecane (C19)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
7194-86-7	n-Nonatriacontane (C39)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
7194-85-6	n-Octatriacontane (C38)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
630-07-9	n-Pentatriacontane (C35)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
4181-95-7	n-Tetracontane (C40)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
646-31-1	n-Tetracosane (C24)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
14167-59-0	n-Tetratriacontane (C34)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
638-68-6	n-Triacontane (C30)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
638-67-5	n-Tricosane (C23)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
630-05-7	n-Tritriacontane (C33)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
109-66-0	Pentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
198-55-0	Perylene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
108-95-2	Phenol	16	0	0.0	427	496	0.0	0.0	233	232	244	9.6
638-36-8	Phytane	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
129-00-0	Pyrene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
483-65-8	Retene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
100-42-5	Styrene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
75-65-0	Tertiary Butanol	16	0	0.0	2,340	6,050	0.0	0.0	2,203	2,695	1,210	771
994-05-8	Tertiary-Amyl Methyl Ether	16	0	0.0	187	484	0.0	0.0	176	216	97	62
110-02-1	Thiophene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
14686-13-6	trans-2-Heptene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
4050-45-7	trans-2-Hexene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
646-04-8	trans-2-Pentene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
14686-14-7	trans-3-Heptene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
20063-92-7	trans-3-Nonene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
2532-58-3	1,3-Dimethylcyclopentane (cis)	16	1	6.3	193	484	39	39	173	216	97	68
120-12-7	Anthracene	16	1	6.3	2.6	11	1.3	1.3	3.2	2.9	N/A	1.5
132-65-0-C3	C3-Dibenzothiophenes	16	1	6.3	2.7	11	1.5	1.5	3.3	3.0	N/A	1.4
86-73-7-C3	C3-Fluorenes	16	1	6.3	2.7	11	3.3	3.3	3.5	3.0	N/A	1.3
630-02-4	n-Octacosane (C28)	16	1	6.3	675	798	47	47	355	374	N/A	85
1-Heptene/1,2-DMCP(trans)	1-Heptene/1,2-DMCP (trans)	16	2	13	387	968	55	59	336	431	454	152
591-76-4	2-Methylhexane	16	2	13	187	484	50	55	167	216	97	74

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
589-53-7	4-Methylheptane	16	2	13	187	484	60	117	173	216	227	66
3875-51-2	Isopropylcyclopentane	16	2	13	193	484	42	43	170	216	227	72
110-54-3	n-Hexane	16	2	13	187	484	44	45	166	216	97	75
98-06-6	tert-Butylbenzene	16	2	13	187	484	27	32	166	216	227	77
85-01-8,120-12-7-C2	C2-Phenanthrenes/Anthr BS	16	3	19	5.1	11	0.90	2.5	3.3	2.9	N/A	1.5
589-43-5	2,4-Dimethylhexane	16	4	25	193	484	25	39	157	216	227	87
4032-86-4	3,3-Dimethylheptane	16	4	25	193	484	24	37	157	216	227	88
589-34-4	3-Methylhexane	16	4	25	193	484	51	81	165	216	227	76
1640-89-7	Ethylcyclopentane	16	4	25	193	484	39	48	160	216	227	84
96-37-7	Methylcyclopentane	16	4	25	193	484	29	43	158	216	227	86
629-99-2	n-Pentacosane (C25)	16	4	25	186	798	390	429	365	390	390	77
110-82-7	Cyclohexane	16	5	31	222	484	25	64	156	216	227	88
3892-00-0	Norpristane (1650)	16	5	31	700	798	224	321	351	364	N/A	51
593-45-3	n-Octadecane (C18)	16	6	38	700	795	74	205	294	359	N/A	108
206-44-0,129-00-0-C1	C1-Fluoranthenes/Pyrenes	16	7	44	2.6	11	1.6	3.8	3.1	2.7	N/A	1.6
2207-01-4	1,2-Dimethylcyclohexane (cis)	16	10	63	430	473	113	224	193	215	160	40
926-82-9	3,5-Dimethylheptane	16	11	69	243	473	35	100	117	86	N/A	69
629-78-7	n-Heptadecane (C17)	16	13	81	700	728	229	494	366	360	404	87
1921-70-6	Pristane	16	14	88	773	795	151	254	228	208	206	70
85-01-8,120-12-7-C1	C1-Phenanthrenes/Anthracenes	16	15	94	11	11	1.7	5.9	3.7	3.6	N/A	1.2
488-23-3	1,2,3,4-Tetramethylbenzene	16	16	100	0.0	0.0	1,880	3,500	2,715	2,795	3,060	460
527-53-7	1,2,3,5-Tetramethylbenzene	16	16	100	0.0	0.0	2,060	3,820	2,918	2,850	N/A	510
526-73-8	1,2,3-Trimethylbenzene	16	16	100	0.0	0.0	1,790	3,230	2,702	2,785	2,950	366
95-93-2	1,2,4,5-Tetramethylbenzene	16	16	100	0.0	0.0	1,090	2,000	1,555	1,575	1,430	236
95-63-6	1,2,4-Trimethylbenzene	16	16	100	0.0	0.0	3,510	6,370	5,210	5,420	5,690	711
135-01-3	1,2-Diethylbenzene	16	16	100	0.0	0.0	410	735	557	516	N/A	108
933-98-2	1,2-Dimethyl-3-Ethylbenzene	16	16	100	0.0	0.0	1,000	1,830	1,439	1,380	1,240	264
934-80-5	1,2-Dimethyl-4-Ethylbenzene	16	16	100	0.0	0.0	1,450	2,610	2,074	2,110	N/A	337
6876-23-9	1,2-Dimethylcyclohexane (trans)	16	16	100	0.0	0.0	173	348	266	268	268	53
108-67-8	1,3,5-Trimethylbenzene	16	16	100	0.0	0.0	1,020	1,860	1,502	1,570	1,580	205
141-93-5	1,3-Diethylbenzene	16	16	100	0.0	0.0	564	1,050	841	839	N/A	132
2870-04-4	1,3-Dimethyl-2-Ethylbenzene	16	16	100	0.0	0.0	306	687	481	477	584	90

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
874-41-9	1,3-Dimethyl-4-Ethylbenzene	16	16	100	0.0	0.0	1,820	3,330	2,608	2,510	N/A	476
934-74-7	1,3-Dimethyl-5-Ethylbenzene	16	16	100	0.0	0.0	1,900	3,510	2,762	2,710	N/A	500
1758-88-9	1,4-Dimethyl-2-Ethylbenzene	16	16	100	0.0	0.0	1,510	2,820	2,133	1,990	1,990	439
2207-04-7	1,4-Dimethylcyclohexane (trans)	16	16	100	0.0	0.0	68	165	133	138	126	24
611-14-3	1-Methyl-2-Ethylbenzene	16	16	100	0.0	0.0	961	1,730	1,405	1,375	1,320	228
527-84-4	1-Methyl-2-Isopropylbenzene	16	16	100	0.0	0.0	123	225	188	194	153	27
1074-17-5	1-Methyl-2-N-Propylbenzene	16	16	100	0.0	0.0	1,630	2,990	2,333	2,260	N/A	444
620-14-4	1-Methyl-3-Ethylbenzene	16	16	100	0.0	0.0	1,290	2,360	1,950	1,985	N/A	287
535-77-3	1-Methyl-3-Isopropylbenzene	16	16	100	0.0	0.0	556	982	826	861	N/A	110
1074-43-7	1-Methyl-3-N-Propylbenzene	16	16	100	0.0	0.0	1,660	2,980	2,511	2,650	2,790	369
622-96-8	1-Methyl-4-Ethylbenzene	16	16	100	0.0	0.0	732	1,280	1,053	1,050	1,060	163
99-87-6	1-Methyl-4-Isopropylbenzene	16	16	100	0.0	0.0	447	809	685	722	N/A	93
1074-55-1	1-Methyl-4-N-Propylbenzene	16	16	100	0.0	0.0	884	1,580	1,292	1,315	1,470	197
90-12-0	1-Methylnaphthalene	16	16	100	0.0	0.0	2,140	4,480	3,646	3,735	3,660	709
2245-38-7	2,3,5-Trimethylnaphthalene	16	16	100	0.0	0.0	83	163	105	95	N/A	24
3074-71-3	2,3-Dimethylheptane	16	16	100	0.0	0.0	281	530	424	424	N/A	75
2216-30-0	2,5-Dimethylheptane	16	16	100	0.0	0.0	164	320	244	241	296	49
3891-98-3	2,6,10-Trimethyldodecane (1380)	16	16	100	0.0	0.0	4,340	6,240	5,111	4,845	N/A	651
3891-99-4	2,6,10-Trimethyltridecane (1470)	16	16	100	0.0	0.0	3,260	6,580	4,171	3,825	N/A	960
581-42-0	2,6-Dimethylnaphthalene	16	16	100	0.0	0.0	1,350	2,920	1,860	1,655	1,350	485
592-27-8	2-Methylheptane	16	16	100	0.0	0.0	140	395	255	242	213	76
91-57-6	2-Methylnaphthalene	16	16	100	0.0	0.0	3,150	6,500	5,223	5,400	N/A	1,042
871-83-0	2-Methylnonane	16	16	100	0.0	0.0	2,060	3,670	2,826	2,745	3,340	556
3221-61-2	2-Methyloctane	16	16	100	0.0	0.0	465	982	736	713	N/A	160
4110-44-5	3,3-Dimethyloctane	16	16	100	0.0	0.0	148	238	189	195	209	30
922-28-1	3,4-Dimethylheptane	16	16	100	0.0	0.0	128	244	195	196	N/A	35
589-81-1	3-Methylheptane	16	16	100	0.0	0.0	184	387	299	316	316	66
5911-04-6	3-Methylnonane	16	16	100	0.0	0.0	1,930	3,450	2,656	2,560	N/A	525
2216-33-3	3-Methyloctane	16	16	100	0.0	0.0	627	1,220	937	893	862	189
2216-34-4	4-Methyloctane	16	16	100	0.0	0.0	380	692	544	527	N/A	107
83-32-9	Acenaphthene	16	16	100	0.0	0.0	27	66	40	37	39	13
208-96-8	Acenaphthylene	16	16	100	0.0	0.0	10	29	16	14	N/A	4.9
92-52-4	Biphenyl	16	16	100	0.0	0.0	322	704	460	437	N/A	124

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
132-65-0-C1	C1-Dibenzothiophenes BS	16	16	100	0.0	0.0	2.5	7.0	4.9	5.3	N/A	1.4
86-73-7-C1	C1-Fluorenes	16	16	100	0.0	0.0	9.9	19	14	14	14	2.7
91-20-3-C1	C1-Naphthalenes	16	16	100	0.0	0.0	3,920	8,270	5,196	5,130	4,050	1,264
132-65-0-C2	C2-Dibenzothiophenes	16	16	100	0.0	0.0	1.8	6.0	4.3	4.6	3.0	1.2
86-73-7-C2	C2-Fluorenes	16	16	100	0.0	0.0	4.8	11	7.7	7.8	N/A	1.6
91-20-3-C2	C2-Naphthalenes	16	16	100	0.0	0.0	2,880	6,640	4,081	3,885	N/A	1,208
91-20-3-C3	C3-Naphthalenes	16	16	100	0.0	0.0	897	1,890	1,156	1,040	N/A	304
91-20-3-C4	C4-Naphthalenes	16	16	100	0.0	0.0	139	264	173	166	N/A	34
124-18-5	Decane (C10)	16	16	100	0.0	0.0	15,100	26,800	21,106	22,200	N/A	3,961
132-64-9	Dibenzofuran	16	16	100	0.0	0.0	44	125	68	62	N/A	24
132-65-0	Dibenzothiophene	16	16	100	0.0	0.0	4.7	9.4	7.0	7.3	N/A	1.7
112-40-3	Dodecane (C12)	16	16	100	0.0	0.0	24,400	53,100	38,081	38,500	38,600	7,912
100-41-4	Ethylbenzene	16	16	100	0.0	0.0	281	552	426	426	N/A	78
86-73-7	Fluorene	16	16	100	0.0	0.0	31	81	43	36	N/A	15
142-82-5	Heptane	16	16	100	0.0	0.0	69	261	141	128	N/A	57
1077-16-3	Hexylbenzene	16	16	100	0.0	0.0	581	1,330	928	916	906	189
496-11-7	Indane	16	16	100	0.0	0.0	332	605	476	481	N/A	67
95-13-6	Indene	16	16	100	0.0	0.0	89	150	123	125	114	18
538-93-2	Isobutylbenzene	16	16	100	0.0	0.0	171	334	271	282	N/A	43
98-82-8	Isopropylbenzene	16	16	100	0.0	0.0	183	346	282	289	N/A	44
108-87-2	Methylcyclohexane	16	16	100	0.0	0.0	153	398	270	264	N/A	70
91-20-3	Naphthalene	16	16	100	0.0	0.0	1,830	3,470	2,965	3,075	N/A	482
104-51-8	n-Butylbenzene	16	16	100	0.0	0.0	873	1,580	1,300	1,310	N/A	213
124-18-5	n-Decane (C10)	16	16	100	0.0	0.0	15,600	25,500	21,869	22,500	N/A	3,071
112-40-3	n-Dodecane (C12)	16	16	100	0.0	0.0	36,500	55,700	48,188	48,900	47,000	5,629
544-76-3	n-Hexadecane (C16)	16	16	100	0.0	0.0	1,220	1,980	1,641	1,645	N/A	245
111-84-2	n-Nonane (C9)	16	16	100	0.0	0.0	4,900	7,180	6,100	6,025	N/A	672
111-84-2	Nonane (C9)	16	16	100	0.0	0.0	3,640	6,820	5,472	5,335	6,680	1,029
629-62-9	n-Pentadecane (C15)	16	16	100	0.0	0.0	5,960	10,000	7,591	7,545	N/A	1,091
538-68-1	N-Pentylbenzene	16	16	100	0.0	0.0	579	1,140	854	787	N/A	189
103-65-1	n-Propylbenzene	16	16	100	0.0	0.0	513	927	779	792	N/A	116
629-59-4	n-Tetradecane (C14)	16	16	100	0.0	0.0	16,200	22,500	18,556	18,450	16,200	1,988
629-50-5	n-Tridecane (C13)	16	16	100	0.0	0.0	29,700	44,300	35,275	33,650	32,000	4,312

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
1120-21-4	n-Undecane (C11)	16	16	100	0.0	0.0	34,100	65,200	52,350	54,350	46,000	8,973
111-65-9	Octane	16	16	100	0.0	0.0	610	1,490	1,003	915	N/A	270
629-62-9	Pentadecane	16	16	100	0.0	0.0	5,140	8,180	6,559	6,355	N/A	903
85-01-8	Phenanthrene	16	16	100	0.0	0.0	4.3	9.0	6.7	6.6	6.6	1.1
135-98-8	sec-Butylbenzene	16	16	100	0.0	0.0	397	736	613	623	610	98
629-59-4	Tetradecane (C14)	16	16	100	0.0	0.0	10,100	19,100	15,338	15,300	14,600	2,556
108-88-3	Toluene	16	16	100	0.0	0.0	164	375	255	247	227	60
629-50-5	Tridecane	16	16	100	0.0	0.0	17,000	35,100	24,794	26,600	27,500	4,802
1120-21-4	Undecane	16	16	100	0.0	0.0	6,300	61,400	41,794	43,000	43,000	13,899
1330-20-7	Xylene (Total)	16	16	100	0.0	0.0	1,850	3,420	2,863	2,915	N/A	456

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 2 – Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

The summary statistics presented in the following table are based on the results from 16 free product samples collected from Red Hill tanks in July 2023. The sample IDs are as follows:

- RHTK07-10TAP-POLN01
- RHTK07-135TAP-POLN01
- RHTK08-10TAP-POLN01
- RHTK08-75TAP-POLN01
- RHTK09-135TAP-POLN01
- RHTK09-75TAP-POLN01
- RHTK10-10TAP-POLN01
- RHTK10-75TAP-POLD01
- RHTK10-75TAP-POLN01
- RHTK11-10TAP-POLN01
- RHTK12-120TAP-POLN01
- RHTK12-60TAP-POLN01
- RHTK12-8TAP-POLN01
- RHTK20-120TAP-POLN01
- RHTK20-200TAP-POLN01
- RHTK20-60TAP-POLN01

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
7094-27-1	1,1,4-Trimethylcyclohexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
1638-26-2	1,1-Dimethylcyclopentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
877-44-1	1,2,4-Triethylbenzene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
106-93-4	1,2-Dibromoethane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
107-06-2	1,2-Dichloroethane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
102-25-0	1,3,5-Triethylbenzene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
98-19-1	1,3-Dimethyl-5-tert-Butylbenzene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
872-05-9	1-Decene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
592-41-6	1-Hexene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
124-11-8	1-Nonene	16	0	0.0	468	1,210	0.0	0.0	441	538	242	154
111-66-0	1-Octene	16	0	0.0	468	1,210	0.0	0.0	441	538	242	154
109-67-1	1-Pentene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
464-06-2	2,2,3-Trimethylbutane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
564-02-3	2,2,3-Trimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
75-83-2	2,2-Dimethylbutane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
590-73-8	2,2-Dimethylhexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
590-35-2	2,2-Dimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
560-21-4	2,3,3-Trimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
565-75-3	2,3,4-Trimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
79-29-8	2,3-Dimethylbutane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
584-94-1	2,3-Dimethylhexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
565-59-3	2,3-Dimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
108-08-7	2,4-Dimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
592-13-2	2,5-Dimethylhexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
872-55-9	2-Ethylthiophene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
563-46-2	2-Methyl-1-Butene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
625-27-4	2-Methyl-2-pentene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
107-83-5	2-Methylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
554-14-3	2-Methylthiophene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
2216-38-8	2-Nonene	16	0	0.0	468	1,210	0.0	0.0	441	538	242	154
1067-20-5	3,3-Diethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
562-49-2	3,3-Dimethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
619-99-8	3-Ethylhexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
617-78-7	3-Ethylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
563-45-1	3-Methyl-1-butene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
96-14-0	3-Methylpentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
616-44-4	3-Methylthiophene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
691-37-2	4-Methyl-1-pentene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
56-55-3	Benz(a)anthracene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
71-43-2	Benzene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
50-32-8	Benzo(a)pyrene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
205-99-2	Benzo(b)fluoranthene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
192-97-2	Benzo(e)pyrene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
191-24-2	Benzo(g,h,i)perylene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
205-82-3, 207-08-9	Benzo(j)+(k)fluoranthene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
95-15-8	Benzothiophene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
218-01-9-C1	C1-Chrysenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
218-01-9-C2	C2-Chrysenes BS	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
206-44-0,129-00-0-C2	C2-Fluoranthenes/Pyrenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
218-01-9-C3	C3-Chrysenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
206-44-0,129-00-0-C3	C3-Fluoranthenes/Pyrenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
85-01-8,120-12-7-C3	C3-Phenanthrenes/Anthracenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
218-01-9-C4	C4-Chrysenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
132-65-0-C4	C4-Dibenzothiophenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
206-44-0,129-00-0-C4	C4-Fluoranthenes/Pyrenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
85-01-8,120-12-7-C4	C4-Phenanthrenes/Anthracenes	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
218-01-9,Triph	Chrysene/Triphenylene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
6443-92-1	cis-2-Heptene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
7688-21-3	cis-2-Hexene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
7642-04-8	cis-2-Octene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
627-20-3	cis-2-Pentene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
20237-46-1	cis-3-Nonene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
287-92-3	Cyclopentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
53-70-3 , 218-58-7	Dibenz(a,h)+(a,c)anthracene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
637-92-3	Ethyl-Tert-Butyl-Ether	16	0	0.0	187	484	0.0	0.0	176	216	97	62
206-44-0	Fluoranthene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
193-39-5	Indeno(1,2,3-cd)pyrene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
1678-98-4	Isobutylcyclohexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
540-84-1	Isooctane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
78-78-4	Isopentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
78-79-5	Isoprene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
108-20-3	Isopropyl Ether	16	0	0.0	187	484	0.0	0.0	176	216	97	62
696-29-7	Isopropylcyclohexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
1634-04-4	Methyl tert butyl ether	16	0	0.0	187	484	0.0	0.0	176	216	97	62
12108-13-3	MMT	16	0	0.0	468	1,210	0.0	0.0	441	538	242	154
629-97-0	n-Docosane (C22)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
544-85-4	n-Dotriacontane (C32)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
112-95-8	n-Eicosane (C20)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
629-94-7	n-Heneicosane (C21)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
630-04-6	n-Hentriacontane (C31)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
593-49-7	n-Heptacosane (C27)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
7194-84-5	n-Heptatriacontane (C37)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
630-01-3	n-Hexacosane (C26)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
630-06-8	n-Hexatriacontane (C36)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
630-03-5	n-Nonacosane (C29)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
629-92-5	n-Nonadecane (C19)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
7194-86-7	n-Nonatriacontane (C39)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
7194-85-6	n-Octatriacontane (C38)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
630-07-9	n-Pentatriacontane (C35)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
4181-95-7	n-Tetracontane (C40)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
646-31-1	n-Tetracosane (C24)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
14167-59-0	n-Tetratriacontane (C34)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
638-68-6	n-Triacontane (C30)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
638-67-5	n-Tricosane (C23)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
630-05-7	n-Tritriacontane (C33)	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
109-66-0	Pentane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
198-55-0	Perylene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
108-95-2	Phenol	16	0	0.0	427	496	0.0	0.0	233	232	244	9.6
638-36-8	Phytane	16	0	0.0	186	798	0.0	0.0	358	374	N/A	73
129-00-0	Pyrene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
483-65-8	Retene	16	0	0.0	2.6	11	0.0	0.0	3.3	3.0	N/A	1.4
100-42-5	Styrene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
75-65-0	Tertiary Butanol	16	0	0.0	2,340	6,050	0.0	0.0	2,203	2,695	1,210	771
994-05-8	Tertiary-Amyl Methyl Ether	16	0	0.0	187	484	0.0	0.0	176	216	97	62
110-02-1	Thiophene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
14686-13-6	trans-2-Heptene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
4050-45-7	trans-2-Hexene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
646-04-8	trans-2-Pentene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
14686-14-7	trans-3-Heptene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
20063-92-7	trans-3-Nonene	16	0	0.0	187	484	0.0	0.0	176	216	97	62
2532-58-3	1,3-Dimethylcyclopentane (cis)	16	1	6.3	193	484	39	39	173	216	97	68
120-12-7	Anthracene	16	1	6.3	2.6	11	1.3	1.3	3.2	2.9	N/A	1.5
132-65-0-C3	C3-Dibenzothiophenes	16	1	6.3	2.7	11	1.5	1.5	3.3	3.0	N/A	1.4
86-73-7-C3	C3-Fluorenes	16	1	6.3	2.7	11	3.3	3.3	3.5	3.0	N/A	1.3
630-02-4	n-Octacosane (C28)	16	1	6.3	675	798	47	47	355	374	N/A	85
1-Heptene/1,2-DMCP(trans)	1-Heptene/1,2-DMCP (trans)	16	2	13	387	968	55	59	336	431	454	152
591-76-4	2-Methylhexane	16	2	13	187	484	50	55	167	216	97	74

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
589-53-7	4-Methylheptane	16	2	13	187	484	60	117	173	216	227	66
3875-51-2	Isopropylcyclopentane	16	2	13	193	484	42	43	170	216	227	72
110-54-3	n-Hexane	16	2	13	187	484	44	45	166	216	97	75
98-06-6	tert-Butylbenzene	16	2	13	187	484	27	32	166	216	227	77
85-01-8,120-12-7-C2	C2-Phenanthrenes/Anthr BS	16	3	19	5.1	11	0.90	2.5	3.3	2.9	N/A	1.5
589-43-5	2,4-Dimethylhexane	16	4	25	193	484	25	39	157	216	227	87
4032-86-4	3,3-Dimethylheptane	16	4	25	193	484	24	37	157	216	227	88
589-34-4	3-Methylhexane	16	4	25	193	484	51	81	165	216	227	76
1640-89-7	Ethylcyclopentane	16	4	25	193	484	39	48	160	216	227	84
96-37-7	Methylcyclopentane	16	4	25	193	484	29	43	158	216	227	86
629-99-2	n-Pentacosane (C25)	16	4	25	186	798	390	429	365	390	390	77
110-82-7	Cyclohexane	16	5	31	222	484	25	64	156	216	227	88
3892-00-0	Norpristane (1650)	16	5	31	700	798	224	321	351	364	N/A	51
593-45-3	n-Octadecane (C18)	16	6	38	700	795	74	205	294	359	N/A	108
206-44-0,129-00-0-C1	C1-Fluoranthenes/Pyrenes	16	7	44	2.6	11	1.6	3.8	3.1	2.7	N/A	1.6
2207-01-4	1,2-Dimethylcyclohexane (cis)	16	10	63	430	473	113	224	193	215	160	40
926-82-9	3,5-Dimethylheptane	16	11	69	243	473	35	100	117	86	N/A	69
629-78-7	n-Heptadecane (C17)	16	13	81	700	728	229	494	366	360	404	87
1921-70-6	Pristane	16	14	88	773	795	151	254	228	208	206	70
85-01-8,120-12-7-C1	C1-Phenanthrenes/Anthracenes	16	15	94	11	11	1.7	5.9	3.7	3.6	N/A	1.2
488-23-3	1,2,3,4-Tetramethylbenzene	16	16	100	0.0	0.0	1,880	3,500	2,715	2,795	3,060	460
527-53-7	1,2,3,5-Tetramethylbenzene	16	16	100	0.0	0.0	2,060	3,820	2,918	2,850	N/A	510
526-73-8	1,2,3-Trimethylbenzene	16	16	100	0.0	0.0	1,790	3,230	2,702	2,785	2,950	366
95-93-2	1,2,4,5-Tetramethylbenzene	16	16	100	0.0	0.0	1,090	2,000	1,555	1,575	1,430	236
95-63-6	1,2,4-Trimethylbenzene	16	16	100	0.0	0.0	3,510	6,370	5,210	5,420	5,690	711
135-01-3	1,2-Diethylbenzene	16	16	100	0.0	0.0	410	735	557	516	N/A	108
933-98-2	1,2-Dimethyl-3-Ethylbenzene	16	16	100	0.0	0.0	1,000	1,830	1,439	1,380	1,240	264
934-80-5	1,2-Dimethyl-4-Ethylbenzene	16	16	100	0.0	0.0	1,450	2,610	2,074	2,110	N/A	337
6876-23-9	1,2-Dimethylcyclohexane (trans)	16	16	100	0.0	0.0	173	348	266	268	268	53
108-67-8	1,3,5-Trimethylbenzene	16	16	100	0.0	0.0	1,020	1,860	1,502	1,570	1,580	205
141-93-5	1,3-Diethylbenzene	16	16	100	0.0	0.0	564	1,050	841	839	N/A	132
2870-04-4	1,3-Dimethyl-2-Ethylbenzene	16	16	100	0.0	0.0	306	687	481	477	584	90

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
874-41-9	1,3-Dimethyl-4-Ethylbenzene	16	16	100	0.0	0.0	1,820	3,330	2,608	2,510	N/A	476
934-74-7	1,3-Dimethyl-5-Ethylbenzene	16	16	100	0.0	0.0	1,900	3,510	2,762	2,710	N/A	500
1758-88-9	1,4-Dimethyl-2-Ethylbenzene	16	16	100	0.0	0.0	1,510	2,820	2,133	1,990	1,990	439
2207-04-7	1,4-Dimethylcyclohexane (trans)	16	16	100	0.0	0.0	68	165	133	138	126	24
611-14-3	1-Methyl-2-Ethylbenzene	16	16	100	0.0	0.0	961	1,730	1,405	1,375	1,320	228
527-84-4	1-Methyl-2-Isopropylbenzene	16	16	100	0.0	0.0	123	225	188	194	153	27
1074-17-5	1-Methyl-2-N-Propylbenzene	16	16	100	0.0	0.0	1,630	2,990	2,333	2,260	N/A	444
620-14-4	1-Methyl-3-Ethylbenzene	16	16	100	0.0	0.0	1,290	2,360	1,950	1,985	N/A	287
535-77-3	1-Methyl-3-Isopropylbenzene	16	16	100	0.0	0.0	556	982	826	861	N/A	110
1074-43-7	1-Methyl-3-N-Propylbenzene	16	16	100	0.0	0.0	1,660	2,980	2,511	2,650	2,790	369
622-96-8	1-Methyl-4-Ethylbenzene	16	16	100	0.0	0.0	732	1,280	1,053	1,050	1,060	163
99-87-6	1-Methyl-4-Isopropylbenzene	16	16	100	0.0	0.0	447	809	685	722	N/A	93
1074-55-1	1-Methyl-4-N-Propylbenzene	16	16	100	0.0	0.0	884	1,580	1,292	1,315	1,470	197
90-12-0	1-Methylnaphthalene	16	16	100	0.0	0.0	2,140	4,480	3,646	3,735	3,660	709
2245-38-7	2,3,5-Trimethylnaphthalene	16	16	100	0.0	0.0	83	163	105	95	N/A	24
3074-71-3	2,3-Dimethylheptane	16	16	100	0.0	0.0	281	530	424	424	N/A	75
2216-30-0	2,5-Dimethylheptane	16	16	100	0.0	0.0	164	320	244	241	296	49
3891-98-3	2,6,10-Trimethyldodecane (1380)	16	16	100	0.0	0.0	4,340	6,240	5,111	4,845	N/A	651
3891-99-4	2,6,10-Trimethyltridecane (1470)	16	16	100	0.0	0.0	3,260	6,580	4,171	3,825	N/A	960
581-42-0	2,6-Dimethylnaphthalene	16	16	100	0.0	0.0	1,350	2,920	1,860	1,655	1,350	485
592-27-8	2-Methylheptane	16	16	100	0.0	0.0	140	395	255	242	213	76
91-57-6	2-Methylnaphthalene	16	16	100	0.0	0.0	3,150	6,500	5,223	5,400	N/A	1,042
871-83-0	2-Methylnonane	16	16	100	0.0	0.0	2,060	3,670	2,826	2,745	3,340	556
3221-61-2	2-Methyloctane	16	16	100	0.0	0.0	465	982	736	713	N/A	160
4110-44-5	3,3-Dimethyloctane	16	16	100	0.0	0.0	148	238	189	195	209	30
922-28-1	3,4-Dimethylheptane	16	16	100	0.0	0.0	128	244	195	196	N/A	35
589-81-1	3-Methylheptane	16	16	100	0.0	0.0	184	387	299	316	316	66
5911-04-6	3-Methylnonane	16	16	100	0.0	0.0	1,930	3,450	2,656	2,560	N/A	525
2216-33-3	3-Methyloctane	16	16	100	0.0	0.0	627	1,220	937	893	862	189
2216-34-4	4-Methyloctane	16	16	100	0.0	0.0	380	692	544	527	N/A	107
83-32-9	Acenaphthene	16	16	100	0.0	0.0	27	66	40	37	39	13
208-96-8	Acenaphthylene	16	16	100	0.0	0.0	10	29	16	14	N/A	4.9
92-52-4	Biphenyl	16	16	100	0.0	0.0	322	704	460	437	N/A	124

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
132-65-0-C1	C1-Dibenzothiophenes BS	16	16	100	0.0	0.0	2.5	7.0	4.9	5.3	N/A	1.4
86-73-7-C1	C1-Fluorenes	16	16	100	0.0	0.0	9.9	19	14	14	14	2.7
91-20-3-C1	C1-Naphthalenes	16	16	100	0.0	0.0	3,920	8,270	5,196	5,130	4,050	1,264
132-65-0-C2	C2-Dibenzothiophenes	16	16	100	0.0	0.0	1.8	6.0	4.3	4.6	3.0	1.2
86-73-7-C2	C2-Fluorenes	16	16	100	0.0	0.0	4.8	11	7.7	7.8	N/A	1.6
91-20-3-C2	C2-Naphthalenes	16	16	100	0.0	0.0	2,880	6,640	4,081	3,885	N/A	1,208
91-20-3-C3	C3-Naphthalenes	16	16	100	0.0	0.0	897	1,890	1,156	1,040	N/A	304
91-20-3-C4	C4-Naphthalenes	16	16	100	0.0	0.0	139	264	173	166	N/A	34
124-18-5	Decane (C10)	16	16	100	0.0	0.0	15,100	26,800	21,106	22,200	N/A	3,961
132-64-9	Dibenzofuran	16	16	100	0.0	0.0	44	125	68	62	N/A	24
132-65-0	Dibenzothiophene	16	16	100	0.0	0.0	4.7	9.4	7.0	7.3	N/A	1.7
112-40-3	Dodecane (C12)	16	16	100	0.0	0.0	24,400	53,100	38,081	38,500	38,600	7,912
100-41-4	Ethylbenzene	16	16	100	0.0	0.0	281	552	426	426	N/A	78
86-73-7	Fluorene	16	16	100	0.0	0.0	31	81	43	36	N/A	15
142-82-5	Heptane	16	16	100	0.0	0.0	69	261	141	128	N/A	57
1077-16-3	Hexylbenzene	16	16	100	0.0	0.0	581	1,330	928	916	906	189
496-11-7	Indane	16	16	100	0.0	0.0	332	605	476	481	N/A	67
95-13-6	Indene	16	16	100	0.0	0.0	89	150	123	125	114	18
538-93-2	Isobutylbenzene	16	16	100	0.0	0.0	171	334	271	282	N/A	43
98-82-8	Isopropylbenzene	16	16	100	0.0	0.0	183	346	282	289	N/A	44
108-87-2	Methylcyclohexane	16	16	100	0.0	0.0	153	398	270	264	N/A	70
91-20-3	Naphthalene	16	16	100	0.0	0.0	1,830	3,470	2,965	3,075	N/A	482
104-51-8	n-Butylbenzene	16	16	100	0.0	0.0	873	1,580	1,300	1,310	N/A	213
124-18-5	n-Decane (C10)	16	16	100	0.0	0.0	15,600	25,500	21,869	22,500	N/A	3,071
112-40-3	n-Dodecane (C12)	16	16	100	0.0	0.0	36,500	55,700	48,188	48,900	47,000	5,629
544-76-3	n-Hexadecane (C16)	16	16	100	0.0	0.0	1,220	1,980	1,641	1,645	N/A	245
111-84-2	n-Nonane (C9)	16	16	100	0.0	0.0	4,900	7,180	6,100	6,025	N/A	672
111-84-2	Nonane (C9)	16	16	100	0.0	0.0	3,640	6,820	5,472	5,335	6,680	1,029
629-62-9	n-Pentadecane (C15)	16	16	100	0.0	0.0	5,960	10,000	7,591	7,545	N/A	1,091
538-68-1	N-Pentylbenzene	16	16	100	0.0	0.0	579	1,140	854	787	N/A	189
103-65-1	n-Propylbenzene	16	16	100	0.0	0.0	513	927	779	792	N/A	116
629-59-4	n-Tetradecane (C14)	16	16	100	0.0	0.0	16,200	22,500	18,556	18,450	16,200	1,988
629-50-5	n-Tridecane (C13)	16	16	100	0.0	0.0	29,700	44,300	35,275	33,650	32,000	4,312

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

CASRN	Analyte	# Samples	# of Detections	Frequency of Detection (%)	Minimum Nondetect (mg/kg)	Maximum Nondetect (mg/kg	Minimum Detection (mg/kg)	Maximum Detection (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Mode (mg/kg)	Standard Deviation (mg/kg)
1120-21-4	n-Undecane (C11)	16	16	100	0.0	0.0	34,100	65,200	52,350	54,350	46,000	8,973
111-65-9	Octane	16	16	100	0.0	0.0	610	1,490	1,003	915	N/A	270
629-62-9	Pentadecane	16	16	100	0.0	0.0	5,140	8,180	6,559	6,355	N/A	903
85-01-8	Phenanthrene	16	16	100	0.0	0.0	4.3	9.0	6.7	6.6	6.6	1.1
135-98-8	sec-Butylbenzene	16	16	100	0.0	0.0	397	736	613	623	610	98
629-59-4	Tetradecane (C14)	16	16	100	0.0	0.0	10,100	19,100	15,338	15,300	14,600	2,556
108-88-3	Toluene	16	16	100	0.0	0.0	164	375	255	247	227	60
629-50-5	Tridecane	16	16	100	0.0	0.0	17,000	35,100	24,794	26,600	27,500	4,802
1120-21-4	Undecane	16	16	100	0.0	0.0	6,300	61,400	41,794	43,000	43,000	13,899
1330-20-7	Xylene (Total)	16	16	100	0.0	0.0	1,850	3,420	2,863	2,915	N/A	456

Attachment 1 - Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Attachment 2

Jet Propellant, Grade 5 Safety Data Sheet

Safety Data Sheet

Material Name: Jet Fuel JP5

SDS No. 9942
US GHS

Synonyms: JP – 5; Military Aviation Jet Fuel JP –5

* * * Section 1 - Product and Company Identification * * *

Manufacturer Information

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS
Emergency # 800-424-9300 CHEMTREC
www.hess.com (Environment, Health, Safety Internet Website)

* * * Section 2 - Hazards Identification * * *

GHS Classification:

Flammable Liquids - Category 3
Skin Corrosion/Irritation - Category 2
Eye Damage/Irritation - Category 2A
Carcinogenicity - Category 2
Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 3
Aspiration Hazard - Category 1
Hazardous to the Aquatic Environment Chronic - Category 2

GHS LABEL ELEMENTS

Symbol(s)

Signal Word

Danger

Hazard Statements

Flammable liquid and vapor.
Causes skin irritation.
Causes serious eye irritation.
Suspected of causing cancer.
May cause respiratory irritation.
May cause drowsiness or dizziness.
May be fatal if swallowed and enters airways.
Toxic to aquatic life with long lasting effects.

Precautionary Statements

Prevention

Keep away from heat/sparks/open flames/hot surfaces. No smoking
Keep container tightly closed.
Ground/bond container and receiving equipment.

Use explosion-proof electrical/ventilating/lighting/equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Wear protective gloves/protective clothing/eye protection/face protection.
Wash thoroughly after handling.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Avoid breathing fume/gas/mist/vapors/spray.
Use only outdoors or in a well-ventilated area.

Response
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell.
IF SWALLOWED: Immediately call a poison center or doctor/physician. Do NOT induce vomiting.
If exposed or concerned: Get medical advice/attention.
In case of fire: Use water spray, fog or fire fighting foam to extinguish.

Storage
Store locked up.
Store in a well-ventilated place. Keep cool.

Disposal
Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 3 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
8008-20-6	Kerosene	100
91-20-3	Naphthalene	0.04

A complex combination of hydrocarbons including naphthenes, paraffins, and aromatics.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

First Aid: Skin

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or with waterless hand cleanser. Obtain medical attention if irritation or redness develops. Thermal burns require immediate medical attention depending on the severity and the area of the body burned.

Safety Data Sheet

Material Name: Jet Fuel JP5

First Aid: Ingestion

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

See Section 9 for Flammability Properties.

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, and other gaseous agents.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Unsuitable Extinguishing Media

None

Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

* * * Section 6 - Accidental Release Measures * * *

Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Caution, flammable vapors may accumulate in closed containers.

Safety Data Sheet

Material Name: Jet Fuel JP5

Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Prevention of Secondary Hazards

None

* * * Section 7 - Handling and Storage * * *

Handling Procedures

Handle as a combustible liquid. Keep away from heat, sparks, excessive temperatures and open flame! No smoking or open flame in storage, use or handling areas. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

Storage Procedures

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks."

Incompatibilities

Keep away from strong oxidizers.

Safety Data Sheet

Material Name: Jet Fuel JP5

* * * Section 8 - Exposure Controls / Personal Protection * * *

Component Exposure Limits

Kerosene (8008-20-6)

ACGIH: 200 mg/m3 TWA (application restricted to conditions in which there are negligible aerosol exposures, total hydrocarbon vapor)
Skin - potential significant contribution to overall exposure by the cutaneous route
NIOSH: 100 mg/m3 TWA

Naphthalene (91-20-3)

ACGIH: 10 ppm TWA
15 ppm STEL
Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA: 10 ppm TWA; 50 mg/m3 TWA
NIOSH: 10 ppm TWA; 50 mg/m3 TWA
15 ppm STEL; 75 mg/m3 STEL

Engineering Measures

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

Personal Protective Equipment: Respiratory

A NIOSH approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Personal Protective Equipment: Hands

Gloves constructed of nitrile, neoprene, or PVC are recommended.

Personal Protective Equipment: Eyes

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

Personal Protective Equipment: Skin and Body

Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

* * * Section 9 - Physical & Chemical Properties * * *

Safety Data Sheet

Material Name: Jet Fuel JP5

Appearance:	Pale yellow to water-white.	**Odor:**	Characteristic petroleum distillate odor
Physical State:	Liquid	**pH:**	ND
Vapor Pressure:	0.029 psia @ 100 °F (38 °C)	**Vapor Density:**	AP 4.5
Boiling Point:	280 to 572 °F (140 to 300 °C)	**Melting Point:**	ND
Solubility (H2O):	Negligible	**Specific Gravity:**	AP 0.80
Evaporation Rate:	Slow; varies with conditions	**VOC:**	ND
Percent Volatile:	100%	**Octanol/H2O Coeff.:**	ND
Flash Point:	>140 °F (60 °C)	**Flash Point Method:**	TCC
Upper Flammability Limit (UFL):	5.0	**Lower Flammability Limit (LFL):**	0.7
Burning Rate:	ND	**Auto Ignition:**	475°F (246°C)

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Conditions to Avoid

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

Incompatible Products

Keep away from strong oxidizers such as nitric and sulfuric acids.

Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

* * * Section 11 - Toxicological Information * * *

Acute Toxicity

A: General Product Information

Harmful if swallowed.

B: Component Analysis - LD50/LC50

Kerosene (8008-20-6)

Inhalation LC50 Rat >5.28 mg/L 4 h; Oral LD50 Rat >5000 mg/kg; Dermal LD50 Rabbit >2000 mg/kg

Naphthalene (91-20-3)

Inhalation LC50 Rat >340 mg/m3 1 h; Oral LD50 Rat 490 mg/kg; Dermal LD50 Rat >2500 mg/kg; Dermal LD50 Rabbit >20 g/kg

Potential Health Effects: Skin Corrosion Property/Stimulativeness

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

Potential Health Effects: Eye Critical Damage/ Stimulativeness

Contact with eyes may cause mild to moderate irritation.

Safety Data Sheet

Material Name: Jet Fuel JP5

Potential Health Effects: Ingestion

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

Potential Health Effects: Inhalation

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity

This product is not reported to have any mutagenic effects.

Carcinogenicity

A: General Product Information

Dermal carcinogenicity: positive - mice

Studies have shown that similar products produce skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation.

B: Component Carcinogenicity

Kerosene (8008-20-6)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans

Naphthalene (91-20-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen
NTP: Reasonably Anticipated To Be A Human Carcinogen (Possible Select Carcinogen)
IARC: Monograph 82 [2002] (Group 2B (possibly carcinogenic to humans))

Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

Specified Target Organ General Toxicity: Single Exposure

May cause drowsiness or dizziness.

Specified Target Organ General Toxicity: Repeated Exposure

This product is not reported to have any specific target organ general toxicity repeat exposure effects.

Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Safety Data Sheet

Material Name: Jet Fuel JP5

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Naphthalene (91-20-3)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	5.74-6.44 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	1.6 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	0.91-2.82 mg/L [static]	
96 Hr LC50 Pimephales promelas	1.99 mg/L [static]	
96 Hr LC50 Lepomis macrochirus	31.0265 mg/L [static]	
72 Hr EC50 Skeletonema costatum	0.4 mg/L	
48 Hr LC50 Daphnia magna	2.16 mg/L	
48 Hr EC50 Daphnia magna	1.96 mg/L [Flow through]	
48 Hr EC50 Daphnia magna	1.09 - 3.4 mg/L [Static]	

Persistence/Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

* * * Section 13 - Disposal Considerations * * *

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 14 - Transportation Information * * *

DOT Information

Shipping Name: Fuel, Aviation, Turbine Engine
UN #: 1863 **Hazard Class:** 3 **Packing Group:** II

Safety Data Sheet

Material Name: Jet Fuel JP5

Placard:

*** Section 15 - Regulatory Information ***

Regulatory Information

Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Naphthalene (91-20-3)

CERCLA: 100 lb final RQ; 45.4 kg final RQ

SARA Section 311/312 – Hazard Classes

Acute Health	Chronic Health	Fire	Sudden Release of Pressure	Reactive
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product may contain listed chemicals below the de minimis levels which therefore are not subject to the supplier notification requirements of Section 313 of the Emergency Planning and Community Right- To-Know Act (EPCRA) of 1986 and of 40 CFR 372. If you may be required to report releases of chemicals listed in 40 CFR 372.28, you may contact Hess Corporate Safety if you require additional information regarding this product.

State Regulations

Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Kerosene	8008-20-6	No	Yes	No	Yes	Yes	No
Naphthalene	91-20-3	Yes	Yes	Yes	Yes	Yes	No

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

Component Analysis - WHMIS IDL

No components are listed in the WHMIS IDL.

Additional Regulatory Information

Safety Data Sheet

Material Name: Jet Fuel JP5

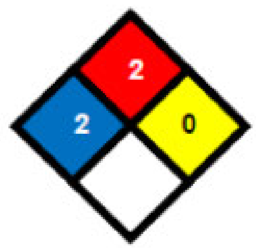
Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Kerosene	8008-20-6	Yes	DSL	EINECS
Naphthalene	91-20-3	Yes	DSL	EINECS

* * * Section 16 - Other Information * * *

NFPA® Hazard Rating

Health	2	
Fire	2	
Reactivity	0	



HMIS® Hazard Rating

Health	2	Moderate
Fire	2	Moderate
Physical	0	Minimal
		*Chronic

Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration., NJTSR = New Jersey Trade Secret Registry.

Literature References

None

Other Information

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

End of Sheet

Attachment 3

Analyses, Sample Containers, and Preservatives

3.0 Sample Control Procedures

Prior to sampling, the field team will inspect all supplies and consumables to ensure that they are acceptable for use. Table 1 lists, for each analyte group, the sample containers, preservatives, and applicable hold times as required by SW-846 and applicable state and federal drinking water methods. The analytical laboratories selected for the site characterization will provide the required sample containers. Chain-of-custody (COC) documentation will be maintained for samples during all phases of sample collection, transport, and receipt and internal transfer within the laboratory.

Table 1: Sample Containers, Preservatives, and Holding Times- Compliance Sampling

Parameter	Analytical Method	Container	Preservative	Holding Time
Volatile Organic Chemicals	524.2	3 x 40 mL Glass VOA	0.5 mL HCl (Unchlorinated); 25 mg Ascorbic / 3 drops HCl (Chlorinated)	14 days
Synthetic Organic Chemicals	525.2/ 525.3	2 x 1 L Amber Glass	2 mL HCl (unchlorinated); 45 mg Sodium Sulfite / 2 mL HCl (chlorinated)	14 days
Metals	200.8/245.1	250 mL Poly	1 mL HNO_3, pH<2	6 months /28 days
JP-5 (Total Petroleum Hydrocarbon [TPH], Diesel/Oil Ranges)	8015	2 x 1 L Amber Glass	0.5 mL HCl	14 days
JP-5 (TPH-Gasoline Range)	8260	3 x 40 mL Glass VOA	0.5 mL HCl	14 days
Total Organic Carbon (TOC)	EPA Approved	3 x 40 mL Glass VOA		14 days
Chlorine, Free (Field Test)	8021			

Note:
All samples will be chilled to < 6°C.
This list may be modified/adjusted based on the results of the Shaft Samples.

4.0 Laboratory Analytical Methods

Analytical activities will be separated into two phases 1) system flushing assessment phase and 2) drinking water compliance phase.

1) System flushing will be performed in a phased approach moving in accordance with the flushing plan. Analytical samples will be collected during the system flushing to assess progress towards clearing the system of incident specific parameters. These samples will be analyzed for a JP-5-focused analyte list via SW-846 analytical methods for rapid

TABLE 4 Sample Containers, Preservatives, and Holding Times

Parameter	Analytical Method	Container	Preservative	Holding Time
Volatile Organic Compounds	524.2	3 x 40 mL Glass VOA	0.5 mL HCl (Unchlorinated); 25 mg Ascorbic / 3 drops HCl (Chlorinated)	14 days
Synthetic Organic Compounds	525.2/ 525.3	2 x 1 L Amber Glass	525.2 2 mL HCl (unchlorinated); 45 mg Sodium Sulfite / 2 mL HCl (chlorinated) 525.3 Ascorbic Acid, EDTA, KH2Citrate	14 days
Metals	200.8/245.1	250 mL Poly	1 mL HNO_3, pH<2	6 months /28 days
JP-5 (Total Petroleum Hydrocarbon [TPH], Diesel/Oil Ranges)	8015	2 x 1 L Amber Glass	0.5 mL HCl	14 days
JP-5 (TPH-Gasoline Range)	8260	3 x 40 mL Glass VOA	0.5 mL HCl	14 days
Total Organic Carbon (TOC)	EPA Approved	3 x 40 mL Glass VOA	Acidify to pH < 2 with H2SO4 or H3PO4 immediately after collection and cool to ≤ 6°C, but not frozen.	28 days
Chlorine, Free (Field Test)	8021			
Haloacetic Acids (HAA5)	552.2/552.3	2 x Amber Glass	Ammonium Chloride	14 days
HPC	SM9215B Pour Plate/SM9215E SimPlate	125 ml or 150 ml Plastic Bottles		24 hours

Note: All samples will be chilled to < 6°C.

Table 5 of this Plan presents the analytical methods and associated analytes, action levels, and method detection limits (MDL) along with regulatory standards, including the Federal and State Maximum Contaminant Levels (MCL) for drinking water and SW-846 analytical methods, respectively. Any updates of these parameters will be provided in addendums to this document.

COC documentation will be maintained for samples during all phases of sample collection, transport, and receipt and internal transfer within the laboratory.

5.3.2 Data Quality

Field QC samples will be collected during each sampling event to include field duplicates, field reagent blanks, and trip blanks. Field duplicates will be collected at a frequency of 10% the number of the normal samples and field reagent blanks, and trip blanks will be collected daily for each sampling event in accordance to the procedures described in Naval Facilities Engineering Systems Command (NAVFAC)

Analytical Method	Analyte	CASRN	EPA / DOH Maximum Contaminant Level (MCL; µg/L)	Method Detection Limit (MDL; µg/L)	Method Reporting Limit (MRL; µg/L)	Residential Priority Buildings Sampling	Hydrant Sampling	Waiawa Shaft Sampling Source (Raw) Water / Post Chlorination	NAH Shaft Sampling Source (Raw) Water	Red Hill Shaft Sampling Source (Raw) Water
EPA 525.2	Pyrene[2]	129-00-0		0.25	0.5	All	M	M/M	n/a	n/a
EPA 8260 EPA 8015 EPA 8015	JP-5 as Combined Total Petroleum Hydrocarbons (TPH)-Gasoline, Diesel, and Oil Ranges	PCHG PCHD MOIL	—	GRO, DRO, ORO = 50	GRO, DRO, ORO = 80	All	M	M/M	n/a	n/a
EPA 200.8	Copper	7440-50-8	1300[(3)]	0.5	2	All	n/a	n/a	n/a	n/a
EPA 200.8	Lead	7439-92-1	15[(3)]	0.13	0.5	All	n/a	n/a	n/a	n/a
EPA 245.1	Mercury	7439-94-7	2	0.025	0.1	All	n/a	n/a	n/a	n/a
SM 5310 B, C or D, or EPA 415.3, Rev 1.2	Total Organic Carbon (TOC)	TOC	—	200	500	All	M	M/M	n/a	n/a
HACH 8021 (Based on SM 4500-Cl G)	Chlorine, Free (Field Test): • Sample Hot Water • Sample Cold Water	7782-50-5	4000	—	—	All	M	n/a/M	n/a	n/a
EPA 170.1	Temperature (Field Test): • Sample Hot Water • Sample Cold Water	TMP	—	—	—	All	M	M/M	Q	Q
EPA 150.3	pH (Field Test)	pH	—	—	—	All	M	M/M	Q	Q
SM 2510 B	Conductivity (Field Test)	CONDUCT	—	—	—	All	M	M/M	Q	Q
SM 2130 B	Turbidity (Field Test)	TURBID	< 5 NTUs	—	—	All	M	M/M	Q	Q
SM 2320 B	Total Alkalinity	TOTAL_ALK	—	—	—	All	M	M/M	Q	Q
EPA 200.7	Cations: • Sodium • Potassium • Calcium • Magnesium • Iron • Manganese	 7440-23-5 7440-09-7 7440-70-2 7439-95-4 7439-89-6 7439-96-5	—	 51 250 53 31 10 1.1	 400 1000 400 200 20 5	n/a	n/a	M/M	Q	Q
EPA 200.7	Silica	7631-86-9	—	320	430	n/a	n/a	M/M	Q	Q

Notes:

All: Indicates every location will be sampled, M: Indicates monthly sampling, Q: Indicates quarterly sampling, n/a: Indicates not applicable.

The analytical laboratory will report non-detected results to the MDL. Values between the MDL and MRL will be flagged as estimates ('J' flag).

[1] These analytes are primary components of JP-5 (i.e., these analytes comprise a significant amount [based on their molar fraction in JP-5 samples obtained from Red Hill on July 5, 2023, and their solubility in water] of the composition of JP-5 dissolved in water) and are key indicators of the presence/absence of JP-5 in drinking water samples and will be evaluated per Course of Action 3 (COA 3) for concentrations above the MRL– See section 5.2.3 .

[2] These analytes are potentially associated with other petroleum compounds (e.g., other fuels, oils, and lubricants) and will be evaluated per COA 3 for concentrations above the MRL– See section 5.2.3.

[3] Lead and copper concentrations in drinking water regulations do not have MCL's, only Action Levels. Lead and copper are regulated by a treatment technique that requires systems to control the corrosiveness of their water. For the purposes of EDWM sampling, lead and copper concentrations in drinking water will be screened at the regulatory Action Levels, though these are not samples collected for the purposes of compliance with federal and state lead and copper regulations.

Attachment 3 - Analyses, Sample Containers, and Preservatives

Analytical Method	Analyte	CASRN	EPA / DOH Maximum Contaminant Level (MCL; µg/L)	Method Detection Limit (MDL; µg/L)	Method Reporting Limit (MRL; µg/L)	Residential Priority Buildings Sampling	Hydrant Sampling	Waiawa Shaft Sampling Source (Raw) Water / Post Chlorination	NAH Shaft Sampling Source (Raw) Water	Red Hill Shaft Sampling Source (Raw) Water
EPA method 300.0 Rev. 2.1	Anions:					n/a	n/a	M/M	Q	Q
	• Chloride	16887-00-6	—	400	500					
	• Sulfate	14808-79-8	— 4000	400	500					
	• Fluoride	16984-48-8	—	50	100					
	• Ortho-Phosphate-P	14265-44-2	—	35	50					
	• Bromide	24959-67-9		25	50					
EPA method 300.1 Rev. 1.0	Anions:	14998-27-7	1000	5		n/a	n/a	M/M	Q	Q
	• Chlorite	15541-45-4	10	25	10					
	• Bromate	14866-68-3	—	5	10					
	• Chlorate				10					
EPA 504.1	Ethylene Dibromide[2]	106-93-4	0.05	0.005	0.022	n/a	Q	Q	n/a	n/a
EPA 8270SIM	2-(2-Methoxyethoxy)-Ethanol[2]	111-77-3	—	80	100	n/a	Q	Q	n/a	n/a

Notes:

All: Indicates every location will be sampled, M: Indicates monthly sampling, Q: Indicates quarterly sampling, n/a: Indicates not applicable.

The analytical laboratory will report non-detected results to the MDL. Values between the MDL and MRL will be flagged as estimates ('J' flag).

[1] These analytes are primary components of JP-5 (i.e., these analytes comprise a significant amount [based on their molar fraction in JP-5 samples obtained from Red Hill on July 5, 2023, and their solubility in water] of the composition of JP-5 dissolved in water) and are key indicators of the presence/absence of JP-5 in drinking water samples and will be evaluated per Course of Action 3 (COA 3) for concentrations above the MRL– See section 5.2.3 .

[2] These analytes are potentially associated with other petroleum compounds (e.g., other fuels, oils, and lubricants) and will be evaluated per COA 3 for concentrations above the MRL– See section 5.2.3.

[3] Lead and copper concentrations in drinking water regulations do not have MCL's, only Action Levels. Lead and copper are regulated by a treatment technique that requires systems to control the corrosiveness of their water. For the purposes of EDWM sampling, lead and copper concentrations in drinking water will be screened at the regulatory Action Levels, though these are not samples collected for the purposes of compliance with federal and state lead and copper regulations.

Attachment 4

TPH Detection Frequency During LTM and EDWM Sampling Periods

EDWM: Petroleum Hydrocarbons Results

SAFE. DELIBERATE. ENGAGED. COMMITTED.

	Location	Results	Assessment
1	Hydrant	48.4ppb ORO	Lubricant
2	Hydrant	37ppb GRO	Isopropyl alcohol
3	Hydrant	92.4ppb ORO, 1460ppb DRO	Lubricant
4	Residence	62.4ppb ORO	Lubricant
5	Residence	47.4ppb ORO, 62.3 DRO	Lubricant
6	Hydrant	63.5ppb GRO	Isopropyl alcohol
7	Residence	73ppb ORO	Lubricating oil
8	Residence	246ppb ORO, 145ppb DRO	Skin contact contamination (lab)
9	Residence	165ppb ORO	Lubricant
10	Hydrant	143ppb GRO, (Duplicate 64.5ppb GRO)	Isopropyl alcohol

- Each sample above ran through tiered assessment to evaluate source of detection

0.27% TPH detection rate across 4,300 samples; no fuel detected.

Independent Evaluations

SAFE. DELIBERATE. ENGAGED. COMMITTED.

- Concurrent EPA monitoring
  - Independent analysis of over 300 samples collected to date
  - Sep 2024 EDWM sampling audit:

    "Although there are specific findings, none of the findings are predicted to have a significant effect on sample integrity. Total Petroleum Hydrocarbons, diesel fraction and lead samples have no associate finding."

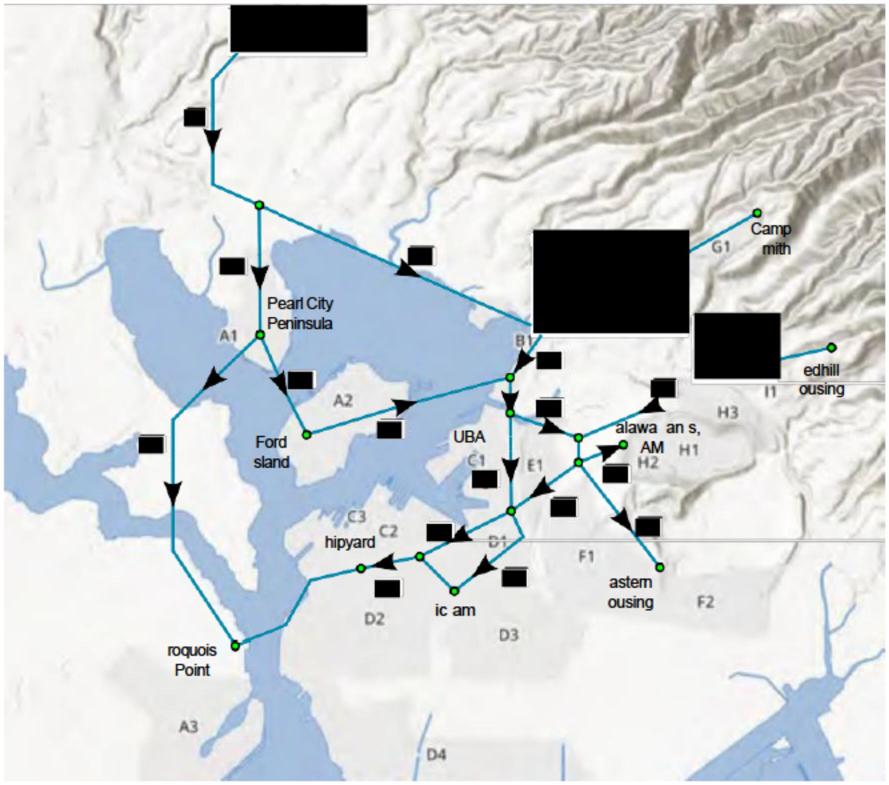
- Independent HDOH investigation, Feb-May 2024
  - Analyzed Waiawa source, residences and school/CDC
  - No evidence of petroleum or jet fuel compounds

No results or indication of the presence of fuel in drinking water system.

Attachment 5

Map: Joint Base Pearl Harbor Hickam Drinking Water Distribution System Piping Network

Attachment 5 - Map Joint Base Pearl Harbor Hickam Drinking Water Distribution System Piping Network



Attachment 6

Map: Joint Base Pearl Harbor Hickam Drinking Water Distribution System Hydrant Locations

Zone	Hydrant	Zone	Hydrant
A1	SA-DFH 57	D2	FH:056
A1	SA-AFH 35	D2	FH:079
A1	FH ID: SA-AFH 7	D2	FH:084
A1	SA-AFH 60	D3	FH 188
A1	Hydrant 55B	D3	FH 213
A1	Hydrant 72	D3	FH 219
A2	FH 214	D3	FH 222
A2	FH 39	D3	FH 411
A2	FH 5-25	D3	FH 520
A2	FH ID: 3-1	D3	FH 592
A2	FH 6-2	D3	FH ID: 473
A2	FH 7-13	D4	FH 1941
A2	FH 7-4	D4	FH 2390
A2	FH 812	E1	Hydrant 920
A2	FH 84	E1	FH 1216
A2	FH Z-16	E1	FH ID: 933
A3	FH ID: SA-LFH 2	E1	FH 2250
A3	A3-SA-JFH-44	F1	FH ID: FH:9A
A3	FH752	F1	FH ID: FH:14A
A3	SA-JFH-52	F1	FH ID: FH:17B
A3	SA-JFH-4	F1	FH ID: FH:28A
A3	SA-JFH-28	F1	FH ID: FH:29A
A3	SA-JFH-72	F1	FH ID: FH:37A
A3	SA-JFH-7	F1	FH ID: FH:609
B1	FH 6 (B1-HYD545)	F1	FH ID: FH-11A
B1	FH ID: 8	F2	FH 2
C1	FH ID: 512	F2	FH 3
C1	FH ID: FH 503	F2	FH 11
C1	FHID: 563	F2	FH 12 /HYD1338
C1	FHID: 479	F2	FH 14
C1	FHID: 413	F2	FH 26
C1	FHID: 530A	F2	FH 30
C2	C2-FH209B	F2	FH 31
C2	C2-FH204	F2	FH 39
C2	C2-FH246	F2	FH 3A
C2	FH ID: 315	F2	FH 47
C2	Hydrant 268	F2	FH 213
C2	Hydrant 301	F2	FH 520
C2	Hydrant 303	F2	FH 71A
C3	FH ID: 230	G1	FH ID: 3
C3	FH ID: 177	H1	Hydrant 1387
D1	FH ID: 436	H1	Hydrant 1396
D1	FH ID: 714	H1	Hydrant 1416
D1	FH ID: 731	H2	Hydrant 377
D1	FH ID: 748	H2	Hydrant 1331
D1	FH ID: 771	H2	Hydrant 1646
D1	FH ID: 768	H3	Hydrant 1641
D2	FH:519	H3	Hydrant 1651

D2	FH:509	H3	Hydrant 1676
D2	FH:429	I1	HYD-1324A
D2	FH:074	J1	SA-EFH2A / FH 123
D2	FH:236	J1	SA-EHF11 / FH 128
D2	FH:321	J1	SA-EFH13 / FH 135
D2	FH:365	J1	SA-EFH15 / FH 174
D2	FH:420	J1	SA-EFH17 / FH 132

Attachment 7
DOH Health Advisory

DEPARTMENT OF HEALTH

DAVID Y. IGE
GOVERNOR

ELIZABETH A. CHAR, MD
DIRECTOR

FOR IMMEDIATE RELEASE
November 29, 2021 21-165

Hawaiʻi Department of Health advises Navy water system consumers not to drink, consume tap water

HONOLULU – The Hawaiʻi Department of Health (DOH) received numerous complaints today of a fuel or gasoline-like odor from consumers of the Navy's Joint Base Pearl Harbor-Hickam (JBPHH) water system, including the Aliamanu Military Reservation, Red Hill and Nimitz Elementary Schools, and military housing. All complaints are from users of the Navy's water system.

The DOH recommends **all Navy water system users** avoid using the water for drinking, cooking, or oral hygiene. Navy water system users **who detect a fuel odor** from their water should avoid using the water for drinking, cooking, bathing, dishwashing, laundry or oral hygiene (brushing teeth, etc.).

As a regulated water system under the jurisdiction of the DOH's Safe Drinking Water Branch, the Navy is responsible for maintaining a safe and reliable source of drinking water to its customers and provide alternative sources of drinking water for *human consumptive uses* as deemed necessary.

The Navy and the DOH are working together to investigate the extent and source of the odor complaints, including performing sampling and analyses for potential petroleum components. DOH's initial screening results received this afternoon were inconclusive and did not detect a contaminant. Samples have also been sent to a drinking water testing laboratory in California, and more quantifiable, contaminant-specific results are expected by the end of the week. In the interim, the DOH recommends all users avoid using the water for drinking, cooking, or oral hygiene.

Affected residents are asked to contact the Navy at (808) 448-2570 and the DOH at SDWB@doh.hawaii.gov to report similar complaints. Please provide your name, phone number, affected address and any details relating to the smell/taste or color in the drinking water.

Attachment 8

DOH Letter Recommending Risk-Based Drinking Water Action Levels for TPH

DAVID Y. IGE
GOVERNOR OF HAWAII

ELIZABETH A. CHAR, MD
DIRECTOR OF HEALTH

In reply, please refer to:
File: 2022-005-RB

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

January 27, 2022, revised February 12, 2022
Revised April 20, 2022

TO: Kathleen S. Ho, Deputy Director
Environmental Health Administration

THROUGH: Joanna L. Seto, P.E., Chief
Environmental Management Division

Gaudencio C. Lopez, P.E., Chief
Safe Drinking Water Branch

Gabriele Fenix Grange, Supervisor
Site Discovery, Assessment and Remediation Section
Hazard Evaluation and Emergency Response Office

Diana Felton, M.D., State Toxicologist
Hazard Evaluation and Emergency Response Office

FROM: Roger Brewer, PhD, Senior Environmental Scientist
Hazard Evaluation and Emergency Response Office

SUBJECT: Recommended Risk-Based Drinking Water Action Levels for Total Petroleum Hydrocarbons (TPH) Associated with Releases of JP-5 Jet Fuel (revised 02/12/2022)

The February 12, 2022, update to this memorandum was revised April 20, 2022, based on submitted comments. A summary of the updates is included in the introduction to the attachment. The updates resulted in a marginal change of the example TPH tapwater action levels presented in Table 1. A more detailed study of the chemical makeup of JP-5 jet fuel and other petroleum fuels is currently underway. The results of that study and methods presented in this memorandum and will summarized in a separate document and used to formally update HIDOH TPH guidance.

Background

Total Petroleum Hydrocarbon (TPH) is defined as the sum total of all hydrocarbons and hydrocarbon-related degradation products not otherwise tested for and assessed as individual compounds (HIDOH 2017). Testing and assessment of individually targeted compounds, including benzene, toluene, ethylbenzene, xylenes, methylnaphthalenes and naphthalene (BTEXMN), is carried out concurrent with testing for TPH.

The Hawai'i Department of Health (HIDOH) has published a risk-based "action level" for "Total Petroleum Hydrocarbon (TPH)" associated with middle distillate, petroleum fuels of 400 ug/L (HIDOH 2017). As stated in the referenced guidance document, the action level is intended to reflect the toxicity of degraded, non-volatile, dissolved-phase diesel in water. The action level is not applicable to releases of fuel directly into a drinking water system where volatile contaminants might still be present.

In the case of such releases, an independent TPH action level must be developed that reflects the specific type of fuel released and takes into consideration exposure via inhalation of vapors during use of impacted water. This technical memorandum specifically presents toxicity-based, tapwater action levels for TPH in water that has been impacted by JP-5 jet fuel and serves as an addendum to the HIDOH Environmental Action Level guidance (HIDOH 2017).

Methods

Details of the calculation of the action level are provided in the attachment to this memorandum. In summary, a six-step approach was used:

Step 1: Estimation of the carbon range and BTEXMN makeup of fresh, JP-5 jet fuel;

Step 2: Estimation of the dissolved-phase makeup of carbon range and BTEXMN compounds in water that is in direct contact with fresh JP-5 jet fuel;

Step 3: Calculation of the weighted toxicity of the carbon range component of the dissolved-phase mixture, assumed to represent non-degraded compounds reported as "TPH;"

Step 4: Calculation of the weighted toxicity of the combined carbon range-plus-BTEXMN component of the dissolved-phase mixture, assumed to represent non-degraded compounds reported as "TPH;"

Step 5: Calculation of weighted toxicity factors for dissolved-phase JP-5 based on different mixtures of non-degraded and degraded compounds; and

Step 6: Calculation of associated TPH action levels for dissolved-phase JP-5 TPH in tapwater based on toxicity factors derived in Step 5.

The tapwater model presented in the USEPA Regional Screening Level guidance document was used to derive TPH action levels (USEPA 2021). The model assumes near daily exposure of young children to dissolved-phase JP-5 in tapwater over six years through use of the water for drinking (ingestion) as well as bathing (dermal exposure). The tapwater model further assumes potential inhalation of vapors during use of the water (e.g., showering and use of dishwashers and washing machines).

Calculated Action Levels

Action levels for three scenarios of impacts to drinking water wells by JP-5 were developed (Table 1): 1) Fresh JP-5 product released in immediate vicinity of a well and minimal degradation of hydrocarbons in the water, 2) Impact to well by plume of mixed, non-degraded and degraded related hydrocarbons and 3) Impact to well by degraded, non-volatile plume of JP-5 contaminated water. The toxicity factors and default, exposure parameter values were incorporated into the USEPA Regional Screening Level guidance model for tapwater (USEPA 2021) to yield corresponding action levels of 266 µg/L, 346 µg/L and 450 µg/L for each scenario (see Table 1).

The action levels are anticipated to be protective of human health under normal use of tapwater in the absence of other contaminants in the water and based on the chemical makeup of JP-5 jet fuel assumed in the models. Exceeding an action level indicates that additional evaluation of potential health risk is required (HIDOH 2017).

It is anticipated that action levels that take into consideration partially degraded plumes of JP-5 will be pertinent to most groundwater scenarios in Hawai'i. However, releases of fresh JP-5 in the immediate vicinity of a well with little time for degradation to occur before entering a drinking water system, require use of the more stringent action levels applicable to non-degraded fuel. Use of an action level based on complete oxidation of hydrocarbons is not recommended in absence of an extensive monitoring network that confirms the absence of non-degraded hydrocarbons in the water.

Application

As a default, hydrocarbon-related degradation products are assumed to have a similar toxicity as the parent compounds (HIDOH 2017). Polar compounds should therefore not be removed from water samples using silica gel cleanup or other methods prior to testing.

The action levels apply to the sum of all hydrocarbons and hydrocarbon-related degradation products associated with JP-5 jet fuel. Note that "Total Petroleum Hydrocarbon" is normally divided into three separate ranges of compounds by the laboratory based on the boiling points of the individual compounds (low, mid and high). Low-boiling point compounds are often referred to as "gasoline range." Medium boiling point compounds are often referred to as "diesel range." High boiling point compounds are often referred to as "oil range." The example JP-5 action levels apply to the sum of detections for each individual range.

As feasible, data can be adjusted to take into account overlap between two ranges and subsequent double counting (e.g., overlap of C10-C12 compounds for reporting of “gasoline range” and “diesel range” compounds). This should be discussed with the laboratory ahead of time and the method used to adjust for overlap described in the project report.

Individually targeted BTEXMN compounds and other individually targeted compounds identified for the project must be tested for and assessed separately. Reported concentrations of individually targeted compounds can be subtracted from the concentration of TPH reported for the related fuel range in order to avoid double counting, provided that the same test method was used for both sets of data. For example, reported concentrations of BTEX can be subtracted from the reported concentration of TPH associated with gasoline-range compounds prior to calculation of a Total TPH concentration provided that Method 8260 was used for both sets of data.

Non-detects for individual TPH ranges do not need to be not considered in summing Total TPH, provided that the laboratory Method Detection Level (MDL) does not exceed the MDL upper limit established for the project.

Note that the calculated action levels are very near to and in some cases might be slightly under typical laboratory Method Reporting Levels (MRL) for TPH in water. Detections of TPH above the laboratory Method Detection Level (MDL) and above the recommended action level but below the laboratory MRL should be verified by a review of the chromatogram for the sample.

References

HIDOH, 2017, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater – Hawaii Edition (Fall 2017): Hawai’i Department of Health, Office of Hazard Evaluation and Emergency Response.
https://health.hawaii.gov/heer/guidance/ehe-and-eals

USEPA, 2021, Regional Screening Levels: United States Environmental Protection Agency, Superfund, November 2021.

Table 1. Calculated action levels for TPH associated with JP-5 contaminated groundwater under different plume degradation scenarios.

Plume Degradation Scenario	JP-5 TPH Action Level	Notes
[1]Non-Degraded	266 µg/L	Applies to groundwater impacted by releases of fresh product in immediate vicinity of a production well with minimal degradation of JP-5 related hydrocarbons before entering a drinking water system.

Plume Degradation Scenario	JP-5 TPH Action Level	Notes
[2]**Mixed**	346 µg/L	Applies to partially degraded plumes that include a mixture of degraded and non-degraded JP-5 related hydrocarbons (considered applicable to most aged releases of JP-5).
[3]**Degraded**	450 µg/L	Applies to plumes where all hydrocarbons have undergone some degree of degradation and are no longer significantly volatile (requires extensive monitoring to support degradation state and use).

Notes

1. Assumes no degradation of hydrocarbons or associated reduction in volatility; considers exposure via ingestion, dermal contact and inhalation of vapors.
2. Assumes 50:50 mixture of non-degraded and degraded hydrocarbons with volatility of non-degraded compounds preserved; considers exposure via ingestion and dermal contact with reduced but still significant exposure via inhalation of vapors.
3. Assumes at least partial degradation of all hydrocarbons to non-volatile compounds and exposure via ingestion and dermal contact.

APPROVED

Kathleen Ho

Kathleen S. Ho
Deputy Director f Environmental Health

Jun 16, 2022

Date

Attachment 1: Derivation of JP-5 TPH Tapwater Action Levels

Attachment 1 (HIDOH January 27, 2022; rev 04/20/2022)
Derivation of JP-5 TPH Tapwater Action Levels

April 20, 2022, Updates

The February 12, 2022, version of this memorandum was updated to correct the following errors:

- Table 3. Calculation of dermal exposure parameters revised to exclude consideration of >EC8 aliphatic compounds and >EC16 aromatic compounds. Error in spreadsheet used to calculate values also corrected. Dermal parameter values for 1-methylnaphthalene added to table. Revised TPH parameter values used to update calculated TPH tapwater action levels.
- Table 4. Effective solubility values corrected (action levels not affected).
- Table 5. Proportion of xylenes in dissolved-phase, BTEXNM mixture revised to 74% from 75% (action levels not affected).
- Table 7. Oral and dermal weighted Reference Doses revised from 0.036 mg/kg-day to 0.035 mg/kg-day (action levels not affected).
- Table 8. Calculated TPH tapwater action levels revised to reflect updates to dermal exposure parameter values.

1.0. Conceptual Site Model

1.1 Groundwater Plume Degradation State Scenarios

Three scenarios of impacts to drinking water wells by JP-5 were considered: 1) Fresh JP-5 product released in immediate vicinity of a well and minimal degradation of hydrocarbons in the water, 2) Impact to well by plume of mixed, non-degraded and degraded related hydrocarbons and 3) Impact to well by degraded, non-volatile plume of JP-5 contaminated water. Under the first scenario, no degradation of hydrocarbons is assumed prior to the groundwater entering a drinking water system. The original volatility of the hydrocarbon compounds is retained. Exposure is assumed to occur via ingestion, dermal contact and inhalation of vapors. While rare, these scenarios pose the greatest risk to users of the water distribution system.

Under the second scenario, half of the original hydrocarbons in the dissolved-phase mixture are assumed to have partially degraded. These compounds are assumed to no long be significantly volatile. Exposure to the mixture is assumed to occur via ingestion, dermal contact and inhalation of vapors associated with the non-degraded, parent hydrocarbons still present in the plume. Although simplistic, consideration of a 50:50 mixture of non-degraded and degraded compounds equally split between BTEXMN and aliphatic and aromatic carbon ranges is adequate for development of initial action levels. This scenario is considered applicable to most releases of JP-5 to groundwater, where sufficient time has lapsed and environmental conditions allow at least partial degradation of the original hydrocarbons.

The third scenario applies to an aged or otherwise weathered plume characterized by at least partial degradation of all hydrocarbons. The volatility of the resulting mixture is assumed to be minimal, with risk driven by ingestion and dermal contact. Consideration of this release and exposure scenario should be supported by extensive monitoring of the plume and testing to verify the absence of original and potentially still volatile, parent hydrocarbons.

1.2 Primary Receptors of Concern

The primary receptors of concern are young children. Exposure to petroleum in tapwater is assumed to occur via direct ingestion of tapwater, dermal contact during bathing and/or inhalation of vapors during bathing. Children, with their higher body surface area to size ratio are at particular risk for increased toxicity from dermal exposures. Dermal exposure to non-degraded petroleum in tapwater focuses the uptake of more soluble and less volatile aromatic carbon range compounds that could penetrate the skin during bathing. Undegraded, highly volatile aliphatic compounds are assumed to be rapidly emitted from the water due to characteristic, very high Henry's Law Constants and not available for dermal uptake (USEPA 2021). The volatility of degraded compounds is assumed to be relatively low and the inhalation pathway insignificant (Zemo et al. 2013; 2016). Degraded light-end carbon range compounds as well as degraded BTEXMN are, however, assumed to be remain in the water and pose a dermal exposure risk.

1.3 Contaminants of Potential Concern (COPCs)

Noncancer health risk posed by dissolved-phase JP-5 in tapwater is assessed in terms of three components: 1) Individually targeted compounds such as benzene, toluene, ethylbenzene, xylenes, methylnaphthalenes and naphthalene (BTEXMN); 2) Non-specific compounds associated with aliphatic and aromatic carbon ranges and 3) Hydrocarbon-related degradation products. The latter includes complex mixtures of degradation products associated with the partial oxidation of BTEXMN- and carbon range compounds, sometimes referred to as "Hydrocarbon Oxidation Products (HOPs)" (Mohler et al. 2013; Zemo et al. 2013; CAEPA 2019). Under HIDOH guidance (HIDOH 2017), the sum total of non-degraded carbon ranges and hydrocarbon-related degradation products is collectively reported and assessed as "Total Petroleum Hydrocarbon (TPH)."

Cancer risk is assessed separately based on well-studied, individual compounds such as benzene, ethylbenzene and naphthalene and not addressed in this paper. These same compounds also pose noncancer health hazards and are included in consideration of exposure to degraded hydrocarbons in tapwater.

2.0 Methods

2.2 Predicted Makeup of Dissolved-Phase JP-5 in Water

The carbon range and BTEXMN makeup of dissolved-phase JP-5 in water that is in contact with fresh product can be initially estimated based on the weight percent and effective solubility of compounds in the parent fuel mixture. The effective solubility of individual components of a fuel is calculated in accordance with Raoult's Law as (after O'Reilly et al. 2001):

Attachment 1 (HIDOH January 27, 2022; rev 04/20/2022)
Derivation of JP-5 TPH Tapwater Action Levels

$$C_i = x_i \times S_i \qquad \text{Eq 1)}$$

where:

C_i = Effective solubility of the compound;
x_i = Mole fraction; and
S_i = Pure component solubility.

The mole fraction reflects the ratio of the number of moles of one component of a solution to the total number of moles representing all of the components, in this case TPH carbon ranges and BTEXMN, and is calculated as

$$x_i = \left[\frac{\frac{w_i \times 0.01}{MW_i}}{\frac{1}{MW_{ave}}}\right] \qquad \text{Eq 2)}$$

where:

w_i =Weight percent of the constituent in the mixture (converted to a fraction);

MW_i = Average molecular weight of the constituent; and

MW_{ave} = Average molecular weight of the mixture.

The equation assumes that the total mass of the fuel is equal to one mole.

Equations 1 and 2 can be simplified to:

$$C_i = \left(\frac{w_i \times 0.01}{MW_i} \times MW_{ave}\right) \times S_i. \qquad \text{Eq 3).}$$

An average molecular weight for JP-5 fuel of 185 was assumed for the calculations (NRC 1996). This equation can used to calculate effective solubilities for BTEXMN and carbon ranges based on published data for various fuel types. The effective solubilities are assumed to reflect the relative makeup of dissolved-phase hydrocarbons in water that is in direct contact with fresh product.

2.3 Calculation of Weighted Toxicity Factors

Weighted Harmonic Means

Physiochemical constants and toxicity factors for BTEXMN and carbon ranges compounds are provided in Table 1.The harmonic mean weighted to the relative proportion of targeted compounds in a mixture is used to calculate weighted toxicity factors for dissolved-phase mixtures (ORDEQ 2003). Use of the harmonic mean rather than arithmetic average biases the results to the more toxic component of the mixture. Weighted toxicity factors for non-degraded JP-5 compounds consider only the non-BTEXMN carbon range fraction of the mixture. Remaining BTEXMN compounds are assumed to be tested for and assessed separately. The weighted toxicity of degraded mixtures is, in contrast, based on the relative proportion of the combined carbon range and BTEXMN compounds in the original mixture.

Weighted Toxicity Factors

Weighted, oral Reference Doses (RfDs) are calculated as:

$$\text{Weighted RfD}_{\text{oral}}\ (\text{mg/kg-day}) = \frac{1}{[\frac{(\%\ Fraction\ A)}{Fraction\ A\ RfDoral}+\frac{(\%\ Fraction\ B)}{Fraction\ B\ RfD\ oral}+etc.]} \qquad \text{Eq 4)}$$

where:

- % Fraction "X" = Percent makeup of the subject carbon range fraction +/- BTEXMN relative to the total concentration of measured carbon ranges;
- Fraction "X" Toxicity Factor: Toxicity factor assigned to subject carbon range fraction +/- BTEXMN.

Weighted toxicity factors for dermal exposure are calculated using a similar approach:

$$\text{Weighted RfD}_{\text{dermal}}\ (\text{mg/kg-day}) = \frac{1}{[\frac{(\%\ Fraction\ A)}{Fraction\ A\ RfDdermal}+\frac{(\%\ Fraction\ B)}{Fraction\ B\ \ RfDdermal}+etc.]} \qquad \text{Eq 5).}$$

Dermal toxicity factors for non-degraded mixtures focus on more soluble and less volatile, C13+ aromatic compounds. Calculation of weighted, dermal toxicity factors for degraded mixtures again requires consideration of combined, original carbon range and BTEXMN mixture.

Weighted Reference Concentrations (RfCs) applicable to the inhalation exposure focus on volatile aromatic and aliphatic carbon ranges but were otherwise calculated in a similar manner:

$$\text{Weighted RfC}\ (\mu g/m^3) = \frac{1}{[\frac{(\%\ Fraction\ A)}{Fraction\ A\ RfC}+\frac{(\%\ Fraction\ B)}{Fraction\ B\ RfC}+etc.]} \qquad \text{Eq 6).}$$

Inhalation toxicity factors for non-degraded compounds focus on the relative makeup of volatile, C5-C12 aliphatic and C9-C12 aromatic carbon ranges in the dissolved-phase mixture. Inhalation toxicity factors are again not calculated for HOPs mixtures, since degraded carbon range and BTEXMN compounds are assumed to be of low volatility.

3.0 USEPA Tapwater Model

The tapwater model presented in the United States Environmental Protection Agency (USEPA) Risk-Based Screening Level (RSL) *User's Guide* document is used to calculate action levels for TPH associated with undegraded and degraded plumes of petroleum-contaminated water (USEPA 2021). Model equations are provided in the USEPA document.

3.1 Default Parameter Values

Exposure parameter values used in the USEPA tapwater model that are not specific to individual chemicals are summarized in Table 2. Parameter values reflect exposure assumptions for assessment of noncancer health hazards posed to children age 0 to 6 years old. Consideration of exposure of young children to contaminants in drinking water is assumed in the model to be protective of adults and other sensitive populations as well. Assessment of the ingestion and inhalation exposure pathways is relatively simple and focuses on the volume of tapwater consumed and indoor air inhaled per day by young children. Default ingestion rate and inhalation rate values noted in Table 2 were taken directly from the USEPA (2021) RSL guidance. A gastrointestinal absorption factor of "1" was used in the tapwater model for all compounds (i.e., 100% of compound available for absorption).

An exception to use of default, USEPA model assumptions is the period of time per day that residents might be exposed to volatile contaminants emitted to indoor air during use of showers, dishwashers, washing machines and similar indoor activities. The USEPA tapwater model assumes that these activities are carried on 24 hours a day with a single, instantaneous exchange of indoor air at the beginning of the next day. This is reflected in the model by use of a default, Resident Exposure Time to vapors in indoor air of 24 hours per day.

This assumption is excessively conservative. A more realistic Resident Exposure Time of 4.2 hours per day was selected for use in this memorandum. This assumes use of a shower by four residents for 0.54 hours each per day (USEPA 2021) and use of a dishwasher and laundry washing machine for one hour each per day. The default Exposure Frequency of 350 days per year and childhood Exposure Duration of six years used in the USEPA tapwater models were retained.

3.2 Weighted Dermal Exposure Parameter Values

Incorporation of the dermal contact pathway into the USEPA tapwater model for TPH and HOPs requires calculation of carbon range- and carbon range + BTEXMN-weighted values for several additional parameters. A detailed overview of the dermal exposure models is presented in USEPA (2004). Four chemical-specific parameters specific to dermal contact are utilized in the USEPA tapwater model (USEPA 2021):

- B: Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis = Chemical specific;
- τ_{event}: Dermal absorption lag time per event (hours/event) = chemical specific;
- t*: Time to reach absorption steady-state (hours) = 2.4 x τ_{even};
- KP: Dermal permeability constant (centimeters/hour).

A summary of published and calculated dermal parameter values for targeted individual compounds and carbon ranges is provided in Table 3. Parameter values for targeted carbon ranges and BTEXMN compounds were taken directly from the USEPA (2021) RSL guidance. Parameter values for both C9-C12 aromatics and C13-C22 aromatics are based on the default values presented for "Aromatics Medium," defined as C9-C16. These values, rather than less conservative values for "Aromatics High" (C17-C32) category, are applied to the full range of C13-C22 aromatics due to the anticipated predominance of smaller aromatics compounds in dissolved-phase mixtures.

Weighted harmonic mean dermal exposure factors for no-degraded and degraded JP-5 mixtures are calculated in the same manner as done for weighted toxicity factors:

Dermal Parameter (units vary): $= \frac{1}{\left[\frac{(\%\,Fraction\,A)}{Fraction\,A\,Parameter\,Value}+\frac{(\%\,Fraction\,B)}{Fraction\,B\,Parameter\,Value}+et\,.\right]}$ Eq 7)

where:

- % Fraction X = Percent makeup of the subject carbon range fraction +/- BTEXMN relative to the total concentration of measured carbon ranges;
- Fraction X Toxicity Factor: Dermal absorption parameter value assigned to subject carbon range fraction +/- BTEXMN.

4.0 Predicted, Relative Makeup of Dissolved-Phase Plume

4.1 Parent Fuel Makeup and Effective Solubility of COPCs

Table 4 presents the molecular weight, pure component solubility and average BTEXMN and aliphatic and aromatic carbon range makeup of JP-5. The default makeup of JP-5 neat fuel is based on summary review of Department of Defense military fuel specification requirements (USDOD 1998, 2004, 2016) provided by the US Navy (Mumly 2021). Although benzene is not intentionally included in JP-5 fuel, a default content of 0.03% is assumed to account for possible contamination of JP-5 from residual gasoline in refinery pipelines (CAEPA 2012; default content assumed for diesel fuels and current formulations for gasoline).

The effective solubility of BTEXMN and default, aliphatic and aromatic carbon ranges calculated using Equation 3 is included in Table 4. The effective solubilities are, for the purposes of this document, assumed to reflect the makeup of dissolved-phase hydrocarbons in immediate, direct contact with fresh JP-5 product. Compounds not related to BTEXMN and specified carbon ranges are assumed to make up a minimal part of the fuel. The sum of the calculated, effective solubilities predicts a concentration of dissolved-phase hydrocarbons in water in contact with fresh JP-5 of 29 mg/L (see Table 4). This likely over predicts the concentration of JP-5 ever to be detected in water samples due to dilution as dissolved-phase compounds diffuse away from free product.

4.2 Predicted Makeup of Dissolved-Phase Hydrocarbons

In Table 5, the effective solubility of the individual components in JP-5 is used to predict the relative BTEXMN and carbon range makeup of dissolved-phase JP-5 in water that is in direct contact with fresh fuel. Table 6 presents the makeup of dissolved-phase hydrocarbons in terms of the risk-based carbon ranges noted in Table 2. The result is assumed to represent the initial hydrocarbon composition of groundwater impacted by a fresh release of JP-5 fuel. The composition of the plume will change over time as the parent hydrocarbons begin to partially degrade. This will affect both the volatility and the weighted toxicity of compounds collectively tested for and reported as "TPH."

5.0 Calculation of Weighted Toxicity Factors

Table 7 summarizes weighted oral, dermal and inhalation toxicity factors for non-degraded and degraded TPH associated with JP-5 based on the relative makeup of dissolved-phase carbon range and BTEXMN noted in Table 6 and the three degradation scenarios described in Section 4.0. Toxicity factors pertinent to each degradation scenario are subsequently used to calculate a corresponding TPH (JP-5) tapwater action level for that specific scenario.

5.1 Non-Degraded and Degraded JP-5 Mixtures

A weighted, oral Reference Dose (RfD) of 0.030 mg/kg-day is calculated using Equation 4 for the predicted mixture of aliphatic and aromatic, carbon range compounds noted in Table 6 (see Table 7). A dermal RfD of 0.034 mg/kg-day is calculated using Equation 5. Equation 6 yields an inhalation Reference Concentration of 0.111 mg/m^3. These toxicity factors are assigned to TPH associated with non-degraded JP-5 mixtures.

An oral RfD of 0.035 is calculated for a combined mixture of dissolved-phase carbon range compounds and BTEXMN. The dermal RfD is assumed to be equivalent to the oral RfD, since degraded compounds are assumed to be non-volatile and have 100% absorption. These toxicity factors are assigned to TPH associated with non-degraded JP-5 mixtures. An inhalation RfC is not applicable since volatilization to air during use of the water is assumed to be minimal in comparison to exposure via direct ingestion and dermal contact.

5.2 50:50 Mixtures of Non-Degraded and Degraded Compounds

Plumes of petroleum-contaminated water are normally a mixture of undegraded and partially degraded compounds (HIDOH 2018; ITRC 2018). Weighted TPH toxicity factors for such mixed plumes can be calculated in the same manner as used for individual constituents based on Equations 4-7.

A 50:50 mixture of undegraded and degraded compounds is used as a default. This is reflected in Equations 4-6 by consideration of weight-percent makeup of 50% for both non-degraded TPH mixtures and degraded TPH mixtures. A final, oral RfD of 0.033 mg/kg-day is calculated based on the toxicity factor calculated for each type of mixture (see Table 7). A dermal RfD of 0.035 mg/kg-day and an inhalation RfC of 0.221 mg/m^3 are similarly calculated.

6.0 Calculation of Tapwater Action Levels

Risk-based TPH action levels calculated for the three, JP-5 plume degradation scenarios are summarized in Table 8.Weighted toxicity factors estimated for the parent, aliphatic-aromatic carbon range makeup of dissolved-phase hydrocarbons associated with JP-5 generated a risk-based action level for TPH of 211 µg/L based on the USEPA Tapwater screening level model. Toxicity factors estimated for a 50:50 mixture of non-degraded and degraded, dissolved-phase JP-5 in water yielded a TPH action level of 313 µg/L. Consideration of the oral and dermal toxicity factors estimated for plume where all parent hydrocarbons have partially degraded yielded a TPH action level of 447 µg/L.

The inclusion of degraded benzene in calculation of TPH action levels for the latter two plume scenarios increases the predicted overall oral and dermal toxicity of the plume by approximately 20% and reduces the action level by a similar amount. This is considered a conservative but necessary adjustment in the absence of more detailed data for a specific fuel release.

7.0 Comparison to Predicted Toxicities of Degraded Hydrocarbon Plumes

Zemo et al. (2016) evaluate the composition and toxicity of diesel-related metabolites in groundwater at different stages of degradation. This offers an alternative approach for assessment of health risk posed by fully degraded plumes of petroleum-contaminated water (HIDOH 2018). The suitability of the toxicity classification approach for petroleum-related metabolites is debated (CAEPA 2016; Hellmann-Blumberg et al. 2016; O'Reilly 2016; CRCC 2018). Preliminary recommendations presented by Zemo et al. (2016) are the most comprehensive to date and are a useful starting point for assessment of the weighted toxicity of metabolites in comparison to the parent, hydrocarbon compounds.

Five "polar families" or suites of metabolite-related alcohols, esters/acids, ketones, aldehydes and phenols were designated by Zemo et al. (2016; see also Zemo et al. 2013). Compounds within each suite were assigned a toxicity ranking of "Low" (RfD 0.1 to 1.0 mg/kd-day), "Low-Moderate" (RfD 0.01 to 0.1 mg/kd-day) or "Moderate" (RfD 0.001 to 0.01 mg/kd-day). Alcohols and acids/esters were predicted to be the least toxic of the metabolites. Ketones include a mix of low-toxicity and low-moderate toxicity compounds. Aldehydes were assumed to be of low-moderate toxicity. Phenols were assumed to have a moderate toxicity.

Progressive degradation of plumes of petroleum-contaminated water were predicted by Zemo et al. (2016) to be characterized by specific combinations of individual metabolites and metabolite suites (HIDOH 2018). Stage 1 degradation mixtures include a modest proportion (22%) of Low-Moderate and Moderate toxicity ketones and aldehydes. Undegraded, dissolved hydrocarbons, including BTEXMN, were assumed to still be present within the plume. As degradation proceeds, the plume was predicted to become progressively more dominated lower toxicity acids and esters as degradation continues.

Although not discussed by Zemo et al. (2016), a logical, next step is to calculate a corresponding range of weighted toxicity factors for each degradation stage (HIDOH 2018). This can be accomplished in the same manner as done for carbon range and BTEXMN mixtures discussed earlier in this paper. An oral RfD of 0.02 mg/kg-day for degraded diesel is calculated for Stage 1 metabolite mixture based on the lowest of range of toxicities proposed for individual metabolite suites (see HIDOH 2018). This is somewhat lower (higher toxicity) than the oral toxicity factor of 0.036 mg/kg-day calculated for degraded JP-5 noted in Table 7. A higher toxicity of dissolved-phase diesel is expected, however, due to the absence of lower-toxicity, C5-C8 aliphatic compounds in diesel fuel that are otherwise found in JP-5 and "dilute" the more toxic, degraded BTEXMN and heavier aromatic compounds that would be found in a dissolved-phase, diesel mixture.

The toxicity of hydrocarbon-related metabolite mixtures estimated based on Zemo et al. (2016) was predicted to decrease by a factor of up to three with increasing degradation and a progressive dominance of less toxic acids and esters. This suggests that the dissolved-phase makeup and weighted toxicity factors presented in Table 7 might be overly conservative for tapwater impacted by heavily degraded JP-5 compounds. A more detailed, site-specific analysis of both the chemistry and toxicity of degraded compounds would be required to further investigate this issue.

References

CAEPA, 2012, Leaking Underground Fuel Tank Guidance Manual: California Environmental Protection Agency, California State Water Resources Control Board, September 2012.

CAEPA, 2016, Petroleum Metabolites Literature Review and Assessment Framework: California Environmental Protection Agency, San Francisco Bay Regional Water Quality Control Board, June 27, 2016.

CAEPA, 2019, Environmental Screening Levels: California Environmental Protection Agency, San Francisco Bay Regional Water Quality Control Board, January 2019.

CRCC, 2018, Weathered Petroleum Hydrocarbons: Australia Department of Industry, Science, Energy and Resources, Cooperative Research Centre for Contamination Assessment and Remediation of the Environment, Technical Report series, Number 40, January 2018.

Hellmann-Blumberg U, Steenson RA, Brewer RC, Allen E. 2016. Toxicity of polar metabolites associated with petroleum hydrocarbon biodegradation in groundwater: Environmental Toxicology and Chemistry, Volume 35, pp.1900–1901. doi: 10.1002/etc.3463.

HIDOH, 2017, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater – Hawai'i Edition (Fall 2017): Hawai'i Department of Health, Office of Hazard Evaluation and Emergency Response.

ITRC, 2018, TPH Risk Evaluation at Petroleum-Contaminated Sites: Interstate Technology & Regulatory Council.

Mohler, R.E., O'Reilly, K.T, Zemo, D.A., Tiwary, A.K., Magaw, R.I. and K.A. Synowiec, 2013, Nontargeted analysis of petroleum metabolites in groundwater using GC×GC–TOFMS: Environmental Science and Technology, Volume 47, pp. 10471–10476. https://doi.org/10.1021/es401706m.

Mumy, K., 2021, Email to Diana Felton and Roger Brewer, December 14, 2021.

NRC, 1996, *Permissible Exposure Levels for Selected Military Fuel Vapors*: National Research Council (US) Subcommittee on Permissible Exposure Levels for Military Fuels, Washington (DC): National Academies Press (US).

ORDEQ, 2003, Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites: Oregon Department of Environmental Quality, Environmental Cleanup and Tanks Program, September 2003.

O'Reilly, K.T., McGaw, R.I and W.G. Rixey, 2001, Predicting the Effect of Hydrocarbon and Hydrocarbon-Impacted Soil on Groundwater: American Petroleum Institute, September 2001, Bulletin No. 14.

O'Reilly, K. 2016. Response to: Toxicity of polar metabolites associated with petroleum hydrocarbon biodegradation in groundwater: Environmental Toxicology and Chemistry, Volume 35, pp.1902–1903.

USDOD, 1998, Detail Specification, Turbine Fuel, Aviation, Grades JP-4, JP-5, and JP-5/JP-8 ST: United States Department of Defense, MIL-DTL-5624T, September 18, 1998.

USDOD, 2004, Detail Specification, Turbine Fuel, Aviation, Grades JP-4 and JP-5: United States Department of Defense, MIL-DTL-5624U, January 5, 2004.

USDOD, 2016, Detail Specification, Turbine Fuel, Aviation, Grades JP-4 and JP-5: United States Department of Defense, MIL-DTL-5624U, March 28, 2016.

USEPA, 2004, Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment): U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, July 2004, EPA/540/R/99/005.

USEPA, 2021, Regional Screening Levels: United States Environmental Protection Agency, Superfund, May 2021.

Zemo D.A., O'Reilly K.T., Mohler R.E., Tiwary A.K., Magaw R.I. and K.A., Synowiec, 2013, Nature and estimated human toxicity of polar metabolite mixtures in groundwater quantified as TPHd/DRO at biodegrading fuel release sites: Groundwater Monitoring and Remediation, Volume 33 (4), pp.44–56.

Zemo, D.A. and K.T. O'Reilly. 2016. On the Basis for the 0.1 mg/L Water Quality Objective for "Taste and Odor" for Diesel in Groundwater (Letter to the Editor): Groundwater Monitoring & Remediation 36, No. 3. Summer 2016. https://doi.org/10.1111/gwmr.12174

Table 1. Example physiochemical constants and toxicity factors for BTEXMN and TPH carbon ranges.

	[1]Chemical/ Carbon Range	Molecular Weight	[2]Vapor Pressure (mmHg)	Solubility in Water (µg/L)	Henry's Constant (unitless)	Partition Coeff, k_{oc} (cm^3/g)	Diffusion Coefficient (cm^2/s) air	Diffusion Coefficient (cm^2/s) water	[3]RfD_{oral} (mg/kg-day)	[3]RfC_{inh} ($\mu g/m^3$)
	Benzene	78	95	1,790	0.23	146	0.09	1.0E-05	0.004	30
	Toluene	92	28	526	0.27	234	0.08	9.2E-06	0.08	5,000
	Ethylbenzene	106	9.6	169	0.32	446	0.07	8.5E-06	0.1	1,000
	Xylenes (total)	106	8.0	106	0.27	383	0.07	8.5E-06	0.2	100
	Naphthalene	128	0.085	31	0.018	1,544	0.06	8.4E-06	0.02	3
Volatile Carbon Ranges	C5-C8 Aliphatics	93	76	11,000	54	2,265	0.08	1×10^{-5}	0.04	600
	>C8-C12 Aliphatics	120	2.2	51,000	0.33	1,778	0.07	1×10^{-5}	0.01	100
	C9-C10 Aromatics	170	0.11	10	4,900	680,000	0.07	5×10^{-6}	0.03	100
Nonvolatile Carbon Ranges	>C12-C18 Aliphatics	280	0.0008	0.0015	110	4.0×10^{8}	-	-	0.01	100
	>C18-C36 Aliphatics	120	2.2	51,000	0.33	1,778	0.07	1×10^{-5}	3.0	nv
	>C10-C22 Aromatics	150	0.024	5,800	0.03	5,000	0.06	1×10^{-5}	0.03	100

1. BTEXMN constants from USEPA (2021). Solubility based on a temperature of 25°C. Carbon range constants from Massachusetts Department of Environmental Protection (MADEP 2002) except constants from C19-C36 Aliphatics (Gustafson et al., 1997; based on EC>16-35 aliphatics in Table 7). USEPA (2009) RfD and RfC for "high flash naphtha" referenced for C9+ aromatics.
2. Carbon range vapor pressures converted from atmospheres (1atm = 760 mmHg).
3. Toxicity factors for BTEXMN from USEPA Regional Screening Levels guidance (USEPA 2021). Carbon range reference doses and concentrations from USEPA (2009) unless noted (see also HIDOH 2017). C5-C8 aliphatics RfD from MADEP (2003). C19+ aliphatics not significantly volatile.

Attachment 1 (HIDOH January 27, 2022; rev 04/20/2022)
Derivation of JP-5 TPH Tapwater Action Levels

Table 2. Exposure parameter values and assumptions selected for calculation of TPH tapwater action levels.

Parameter	Abbreviation	Unit	[1]Value
Skin Area - child	SAres-c	cm^2	6,365
Volatilization Factor	K	L/m^3	0.5
Water ingestion rate - children	IRWc	L/d	0.78
[2]Exposure Time - residents	ET	hr/day	4.2
Exposure frequency - residents	EFr	d/y	350
Exposure duration - residents total	EDr	yrs	26
Exposure duration - children	EDc	yrs	6
Body weight - child	BWc	kg	15
Averaging time (years)	AT	yrs	70
Days/year conversion	-	d/yr	365
Target Hazard Quotient	THQ	-	1.0

Notes:
1. USEPA (2021) default tapwater exposure values except as noted.
2. Based on assumed daily use of showers and dishwashers (see Section 2.1).

**Attachment 1 (HIDOH January 27, 2022; rev 04/20/2022)
Derivation of JP-5 TPH Tapwater Action Levels**

Table 3. Chemical-specific parameter values selected for assessment of the dermal contact pathway.

Chemical	B (unitless)	T_{event} (hr/event)	t* (hr)	KP (cm/hr)	Basis
Benzene	0.05	0.29	0.69	0.01	USEPA (2004, 2021) default benzene values
Toluene	0.11	0.35	0.83	0.03	USEPA (2004, 2021) default toluene values
Ethylbenzene	0.20	0.41	0.99	0.05	USEPA (2004, 2021) default ethylbenzene values
Xylenes (Total)	0.20	0.41	0.99	0.05	USEPA (2004, 2021) default naphthalene values
Naphthalene	0.20	0.55	1.3	0.05	USEPA (2004, 2021) default naphthalene values
1-Methylnaphthalene	0.43	0.66	1.6	0.09	USEPA (2004, 2021) default 1-methylnaphthalene values
C6-C8 Aliphatics	0.72	0.32	1.2	0.20	USEPA (2021) default Aliphatic Low values
>C8-C12 Aliphatics	7.4	0.55	2.5	1.70	USEPA (2021) default Aliphatic Medium values
>C12-C18 Aliphatics	7.4	0.55	2.5	1.70	USEPA (2021) default Aliphatic Medium values
>C18 Aliphatics	9.8	0.95	4.3	1.96	USEPA (2021) default Aliphatic High values
>C8-C12 Aromatics	0.31	0.60	1.4	0.069	USEPA (2021) default Aromatics Medium values
>C12-C22 Aromatics	0.31	0.60	1.4	0.069	USEPA (2021) default Aromatics Medium values
TPH (JP-5) Undegraded	0.332	0.545	1.379	0.075	[1]Calculated based on predicted carbon range makeup of dissolved-phase, undegraded TPH
TPH (JP-5) Degraded	0.200	0.452	1.101	0.050	[1]Calculated based on predicted carbon range + BTEXMN makeup of dissolved-phase, degraded TPH
TPH (JP-5) 50:50 Degradation	0.250	0.494	1.224	0.060	[1]Calculated based on 50:50 mixture of undegraded and degraded TPH

Notes:
1. Refer to Tables 5-6 for a summary of the predicted carbon range and BTEXMN makeup of dissolved-phase TPH-related compounds in water that is in contact with fresh JP-5 fuel.

Attachment 1 (HIDOH January 27, 2022; rev 04/20/2022)
Derivation of JP-5 TPH Tapwater Action Levels

Table 4. Estimated carbon range and BTEXMN makeup of JP-5 jet fuel and theoretical effective solubility of fuel-related components in water in contact with fresh fuel.

Chemical/ Carbon Range	[1]Molecular Weight	[1]Pure Component Solubility (mg/L)	[2]Average Weight % in Neat Fuel	[3]Effective Solubility (mg/L)
Benzene	78	1,780	0.03%	1.3
Toluene	92	526	0.10%	1.1
Ethylbenzene	106	169	0.00%	0.0
Xylenes	106	178	4.6%	14
1-Methylnaphthalene	142	25.8	3.5%	1.2
2-Methylnaphthalene	142	24.6	0.00%	0.0
Naphthalene	128	31	3.0%	1.3
C5-C6 Aliphatics	81	36	0.00%	0.0
>C6-C8 Aliphatics	100	5.4	12%	1.2
>C8-C10 Aliphatics	130	0.43	16%	0.1
>C10-C12 Aliphatics	160	0.03	23%	0.0
>C12-C16 Aliphatics	200	7.6E-04	29%	0.0
>C16-C21 Aliphatics	270	2.5E-06	0.00%	0.0
>C21-C32 Aliphatics	400	1.5E-11	0.00%	0.0
>C8-C10 Aromatics	120	65	9.0%	9.1
>C10-C12 Aromatics	130	25	0.00%	0.0
>C12-C16 Aromatics	150	5.8	0.00%	0.0
>C16-C21 Aromatics	190	0.65	0.00%	0.0
>C21-C32 Aromatics	240	6.6E-03	0.00%	0.0
		Sum BTEXMN:	**11%**	**19**
		Sum Carbon Ranges:	**89%**	**10**
		Sum BTEXMN+ Carbon Ranges:	**100%**	**29**

Notes:
1. Constants for BTEXMN from USEPA (2021). Constants for carbon ranges after values presented in California LUFT Manual (CAEPA 2012; see also HIDOH 2017).
2. Default makeup of JP-5 neat fuel based on summary review of Department of Defense military fuel specification requirements (USDOD 1998, 2004, 2016) provided by the US Navy (Mumy 2021). Default benzene content of 0.03% included to account for possible contamination of JP-5 from gasolines in refinery pipelines.
3. See Equation 3 in text. Based on assumed average molecular weight of JP-5 of 185 (NRC 1996).

Attachment 1 (HIDOH January 27, 2022; rev 04/20/2022)
Derivation of JP-5 TPH Tapwater Action Levels

Table 5. [1]Theoretical, relatively makeup of dissolved-phase hydrocarbon mixture in water based on effective solubilities of components in fresh JP-5 at saturation (refer to Table 4).

Chemical/ Carbon Range	[2]Relative Carbon Range Makeup of Dissolved-Phase Hydrocarbons	[3]Relative BTEXMN Makeup of Dissolved-Phase Hydrocarbons	[4]Relative Volatile Carbon Range Makeup of Dissolved-Phase Hydrocarbons	[5]Relative CR+BTEXMN Makeup of Dissolved-Phase Hydrocarbons
Total BTEXMN				65%
Total Aliphatic Carbon Ranges				4.4%
Total Aromatic Carbon Ranges				31%
Benzene		6.7%		4.3%
Toluene		5.6%		3.6%
Ethylbenzene		0.00%		0.00%
Xylenes		74%		48%
Naphthalene		7.1%		4.6%
1-Methylnaphthalene		6.2%		4.0%
2-Methylnaphthalene		0.00%		0.00%
C5-C6 Aliphatics	0.00%		0.00%	0.00%
>C6-C8 Aliphatics	11%		11%	4.0%
>C8-C10 Aliphatics	0.95%		0.95%	0.34%
>C10-C12 Aliphatics	0.09%		0.09%	0.03%
>C12-C16 Aliphatics	0.00%			0.00%
>C16-C21 Aliphatics	0.00%			0.00%
>C21-C32 Aliphatics	0.00%			0.00%
>C8-C10 Aromatics	88%		88%	31%
>C10-C12 Aromatics	0.00%		0.00%	0.00%
>C12-C16 Aromatics	0.00%			0.00%
>C16-C21 Aromatics	0.00%			0.00%
>C21-C32 Aromatics	0.00%			0.00%

Notes

1. Theoretical makeup of dissolved-phase hydrocarbons assuming fresh spill in direct contact with fresh JP-5 fuel and individual components present in water at maximum effective solubility.
2. Relative makeup of dissolved-phase carbon ranges.
3. Relative makeup of dissolved-phase, BTEXMN compounds.
4. Relative makeup of dissolved-phase, volatile carbon range compounds (C5-C8 aliphatics, >C8-C12 aliphatics, >C8-C12 aromatics).
5. Combined carbon range and BTEXMN components.

Table 6. [1]Theoretical, relatively makeup of dissolved-phase hydrocarbon mixture in water based on effective solubilities of components in fresh JP-5 at saturation and grouped in terms of carbon range toxicity factors (refer to Table 1, Table 4 and Table 5).

Chemical/ Carbon Range	[2]Relative Hydrocarbon Makeup of Neat Fuel	[3]Relative Carbon Range Makeup of Dissolved-Phase Hydrocarbons	[4]Relative BTEXMN Makeup of Dissolved-Phase Hydrocarbons	[5]Relative Volatile Carbon Range Makeup of Dissolved-Phase Hydrocarbons	[6]Relative CR+BTEXMN Makeup of Dissolved-Phase Hydrocarbons
Total BTEXMN:	11%				65%
Total Carbon Ranges:	89%				35%
Benzene	0.03%		6.7%		4.3%
Toluene	0.10%		5.6%		3.6%
Ethylbenzene	0.0%		0.00%		0.00%
Xylenes	4.6%		74%		48%
1-Methylnaphthalene	3.5%		6.2%		4.0%
2-Methylnaphthalene	0.00%		0.00%		0.00%
Naphthalene	3.0%		7.1%		4.6%
C5-C8 Aliphatics	51%	11%		11%	4.0%
>C8-C18 Aliphatics	38%	1.0%		1.0%	0.37%
>C18-C32 Aliphatics	0.00%	0.00%		0.0%	0.00%
>C8 Aromatics	0.00%	88%		88%	31%
Sum:	**100%**	**100%**	**100%**	**100%**	**100%**

Notes
1. Theoretical makeup of dissolved-phase hydrocarbons assuming fresh spill in direct contact with fresh JP-5 fuel and individual components present in water at maximum effective solubility.
2. Refer to Table 4.
3. Relative makeup of dissolved-phase carbon ranges (used to derive weighted oral and dermal toxicity factors for non-degraded TPH compounds in Table 7).
4. Relative makeup of dissolved-phase, BTEXMN compounds (for general reference only).
5. Relative makeup of dissolved-phase, volatile carbon range compounds; used to derive weighted inhalation toxicity factor for non-degraded TPH compounds in Table 7).
6. Combined carbon range and BTEXMN components (used to derive weighted oral and dermal toxicity factors for non-degraded TPH compounds in Table 7).

Table 7. Calculated, weighted toxicity factors for [1]TPH associated with non-degraded, degraded and 50:50 mixtures of dissolved-phase JP-5 in tapwater.

	[2]TPH Associated with Non-Degraded Dissolved-Phase JP-5			[3]TPH Associated with Degraded Dissolved-Phase JP-5		[4]TPH Associated with 50:50 Mixture Non-Degraded:Degraded Dissolved-Phase JP-5		
TPH Category	**Oral RfD (mg/kg-day)**	**Dermal RfD (mg/kg-day)**	**Inhalation RfC (mg/m^3)**	**Oral RfD (mg/kg-day)**	**Dermal RfD (mg/kg-day)**	**Oral RfD (mg/kg-day)**	**Dermal RfD (mg/kg-day)**	**Inhalation RfC (mg/m^3)**
TPH (JP-5)	0.030	0.034	0.111	0.035	0.035	0.033	0.035	0.221

Notes
1. Total Petroleum Hydrocarbon (TPH) defined as sum of non-specific carbon range aliphatic and aromatic compounds and all hydrocarbon-related degradation products, including degradation products associated with BTEXMN.
2. Oral and dermal Reference Doses (RfDs) and Inhalation Reference Concentration (RfC) weighted with respect to carbon range makeup for fuel type noted in Table 6 (excludes BTEXMN). Intended to represent toxicity of TPH component of non-degraded, dissolved-phase fuel in water. Non-degraded BTEXMN assessed separately. Considers ingestion of drinking water, inhalation to vapors during water use and dermal contact during bathing. Volatile aliphatic compounds assumed lost during water use and not considered for dermal contact.
3. Weighted toxicity factors for combined carbon range plus BTEXMN makeup noted in Table 6. Intended to reflect toxicity of partially degraded hydrocarbons in water. Considers ingestion of drinking water and dermal contact during bathing. Degraded compounds assumed to not be significantly volatile and not available for exposure via inhalation. Degraded aliphatic compounds assumed to remain in water and be available for dermal contact during bathing.
4. Toxicity factors calculated for a 50:50 mixture of degraded and non-degraded TPH-related compounds.

Attachment 1 (HIDOH January 27, 2022; rev 04/20/2022)
Derivation of JP-5 TPH Tapwater Action Levels

Table 8. Calculated action levels for TPH associated with JP-5 contaminated groundwater under different plume degradation scenarios.

Plume Degradation Scenario	JP-5 TPH Action Level
[1]Non-Degraded	266 µg/L
[2]Mixed	346 µg/L
[3]Degraded	450 µg/L

Notes
1. Assumes no degradation of hydrocarbons or associated reduction in volatility; considers exposure via ingestion, dermal contact and inhalation of vapors.
2. Assumes 50:50 mixture of non-degraded and degraded hydrocarbons with volatility of non-degraded compounds preserved; considers exposure via ingestion and dermal contact with reduced but still significant exposure via inhalation of vapors.
3. Assumes at least partial degradation of all hydrocarbons to non-volatile compounds and exposure via ingestion and dermal contact.

Addendum (September 6, 2022): Values in Column 2 corrected
Attachment 1 (HIDOH January 27, 2022; rev 04/20/2022)

Table 6. [1]Theoretical, relatively makeup of dissolved-phase hydrocarbon mixture in water based on effective solubilities of components in fresh JP-5 at saturation and grouped in terms of carbon range toxicity factors (refer to Table 1, Table 4 and Table 5).

Chemical/ Carbon Range	[2]Relative Hydrocarbon Makeup of Neat Fuel	[3]Relative Carbon Range Makeup of Dissolved-Phase Hydrocarbons	[4]Relative BTEXMN Makeup of Dissolved-Phase Hydrocarbons	[5]Relative Volatile Carbon Range Makeup of Dissolved-Phase Hydrocarbons	[6]Relative CR+BTEXMN Makeup of Dissolved-Phase Hydrocarbons
Total BTEXMN:	11%				65%
Total Carbon Ranges:	89%				35%
Benzene	0.03%		6.7%		4.3%
Toluene	0.10%		5.6%		3.6%
Ethylbenzene	0.0%		0.00%		0.00%
Xylenes	4.6%		74%		48%
1-Methylnaphthalene	3.5%		6.2%		4.0%
2-Methylnaphthalene	0.00%		0.00%		0.00%
Naphthalene	3.0%		7.1%		4.6%
C5-C8 Aliphatics	12%	11%		11%	4.0%
>C8-C18 Aliphatics	68%	1.0%		1.0%	0.37%
>C18-C32 Aliphatics	0.00%	0.00%		0.0%	0.00%
>C8 Aromatics	0.00%	88%		88%	31%
Sum:	**100%**	**100%**	**100%**	**100%**	**100%**

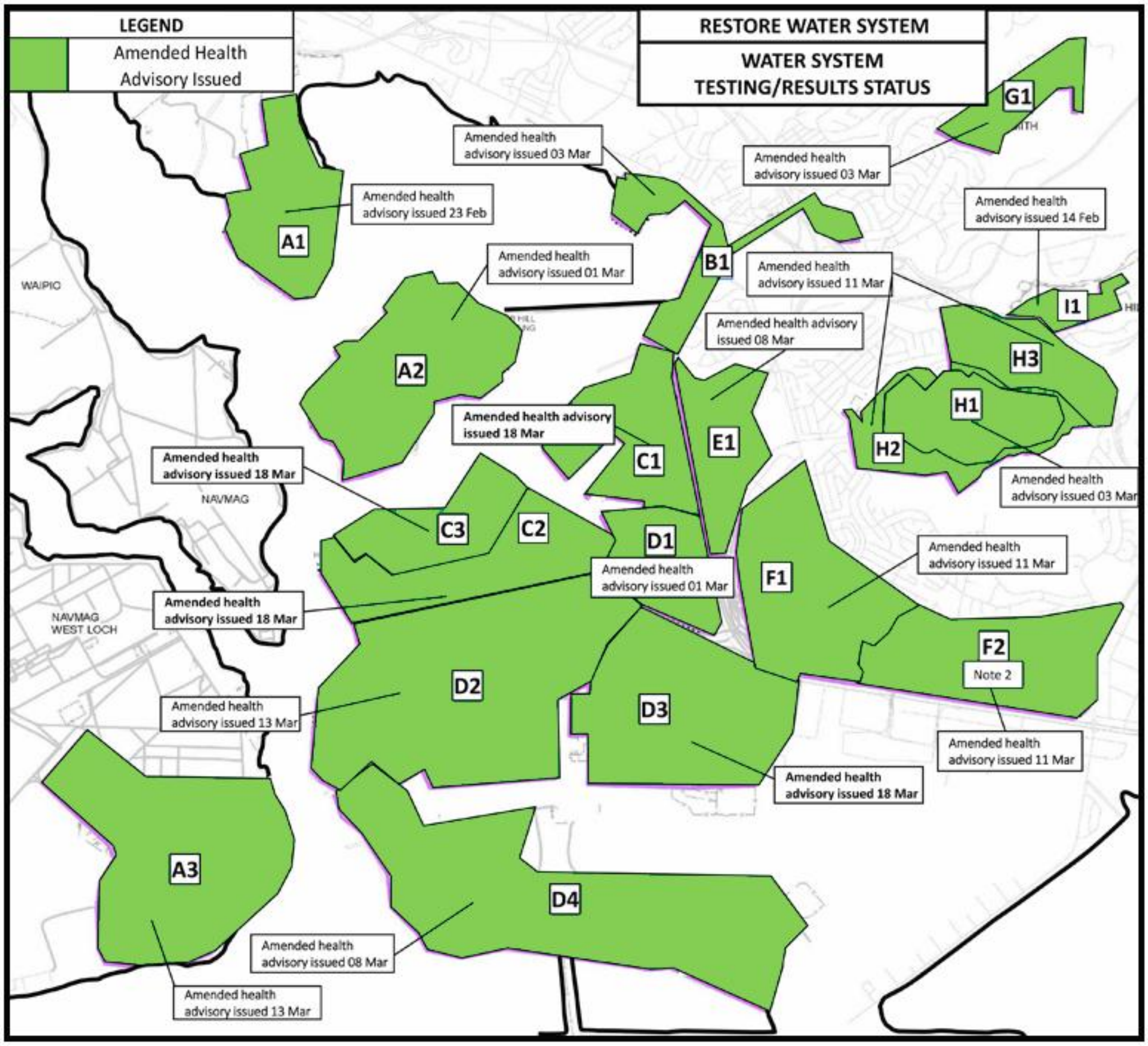
Notes

1. Theoretical makeup of dissolved-phase hydrocarbons assuming fresh spill in direct contact with fresh JP-5 fuel and individual components present in water at maximum effective solubility.
2. Refer to Table 4. (9/6/22: Carbon range makeup values of neat fuel corrected to match Table 4)
3. Relative makeup of dissolved-phase carbon ranges (used to derive weighted oral and dermal toxicity factors for non-degraded TPH compounds in Table 7).
4. Relative makeup of dissolved-phase, BTEXMN compounds (for general reference only).
5. Relative makeup of dissolved-phase, volatile carbon range compounds; used to derive weighted inhalation toxicity factor for non-degraded TPH compounds in Table 7).
6. Combined carbon range and BTEXMN components (used to derive weighted oral and dermal toxicity factors for non-degraded TPH compounds in Table 7).

Attachment 9

Map: Emergency Response Sample Locations

IDSWT Sampling Zones



Attachment 10

Map: LTM Sample Locations

LTM Sampling Zones

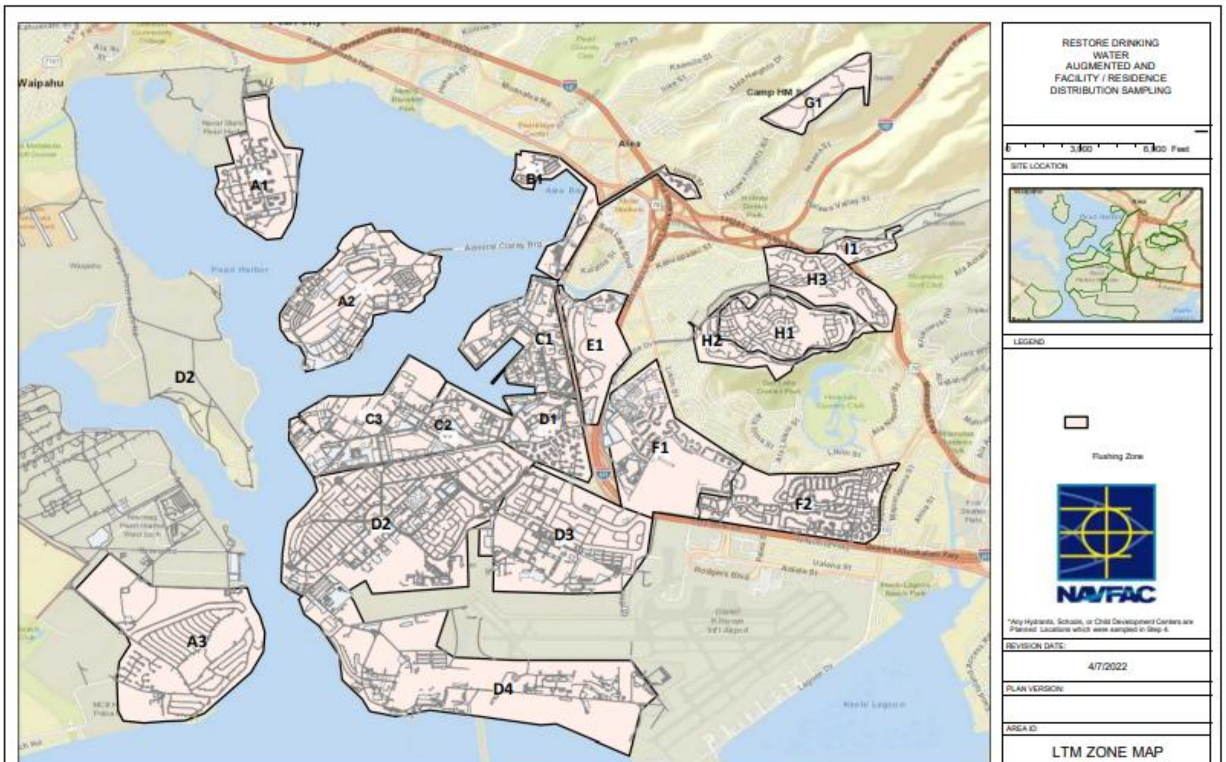


Figure 5: LTM Zone Map

Attachment 11

Map: EDWM Sample Locations

EDWM Sampling Zones

Attachment 12
Residence Resource Guide

SAFE. DELIBERATE. ENGAGED. COMMITTED.

JOINT BASE PEARL HARBOR-HICKAM
WATER RESPONSE

RESIDENT RESOURCES GUIDE

April 2025

jbphh-safewaters.org

A Note to Users

The Navy is pleased to provide you with this guide to understanding the Joint Base Pearl Harbor-Hickam (JBPHH) Drinking Water System. It gives information on where your water comes from, how it is tested and monitored for compliance with established standards for safe drinking water, and where to find water quality results.

As with every printed document in the digital age, this is a snapshot of the best available information at this time. Links to many external resources are provided in this guide for your convenience and easy reference.

Table of Contents

Introduction

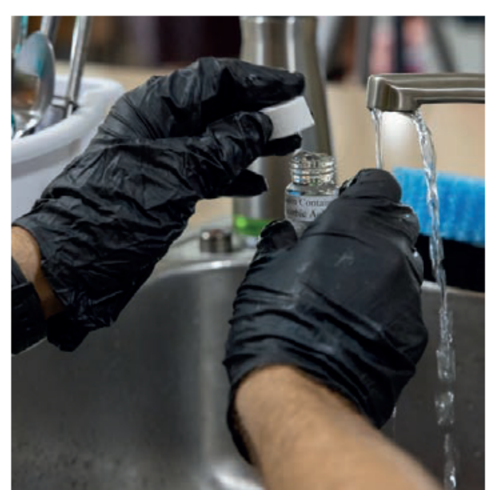
We are a Water Provider

Naval Facilities Engineering Systems Command (NAVFAC) Hawaiʻi operates and supplies drinking water to JBPHH. The Navy's goal is, and always has been, to provide you with safe and dependable drinking water. The JBPHH water distribution system currently serves 93,000 customers.

Meeting Drinking Water Standards

The U.S. Environmental Protection Agency (EPA) and State regulations require us to test your water for contaminants regularly, ensuring it is safe to drink. We report our test results to EPA and the State of Hawaiʻi Department of Health (DOH).

To ensure that tap water is safe to drink, EPA regulations provide specific limits on the type and level of contaminants allowed in water provided by water purveyors, including the Navy JBPHH water system. During regular compliance monitoring, we conduct tests for over 70 contaminants that have potential for being found in drinking water. These results are published annually. Visit: https://cnrh.cnic.navy.mil/ to view the reports.

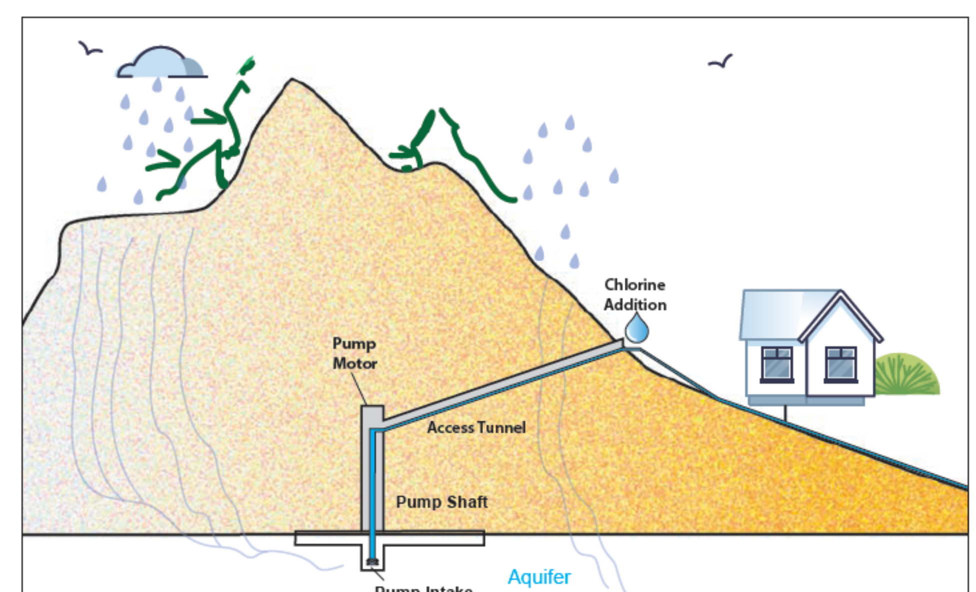


Our Natural Drinking Water Sources

Hawaiʻi is the most remote island archipelago in the world. Fresh water is a precious resource, essential to life here on the islands.

The island of Oʻahu relies on underground aquifers for fresh drinking water. These underground aquifers depend on steep mountains and humid trade winds to generate rainfall. Healthy forests and vegetation capture the rain and absorb water into the ground. Fresh water slowly percolates down into the earth through porous rock where it becomes trapped in hardened non-porous rock. This process of rain to aquifer takes an average of 25 years on Oʻahu. Water is distributed to homes less than 25 miles from when it originally fell as rain.

The Navy pumps groundwater from the aquifer through a system of shafts, wells, and tunnels. It is then disinfected, fluoridated, and piped into the JBPHH drinking water distribution system.



Ensuring Water Quality on Base

We pump it.

Historically, our drinking water comes from the Waimalu and Moanalua groundwater aquifer systems via three supply wells/shafts: Waiawa, Navy Aiea-Hālawa, and Red Hill.

The Red Hill and Navy Aiea-Hālawa Shafts were taken offline on November 28, 2021, and December 3, 2021, respectively, due to the 2021 Red Hill Shaft fuel release. Since December 3, 2021, drinking water for the JBPHH Water System has been supplied solely by water from the Waiawa Shaft.

We treat it.

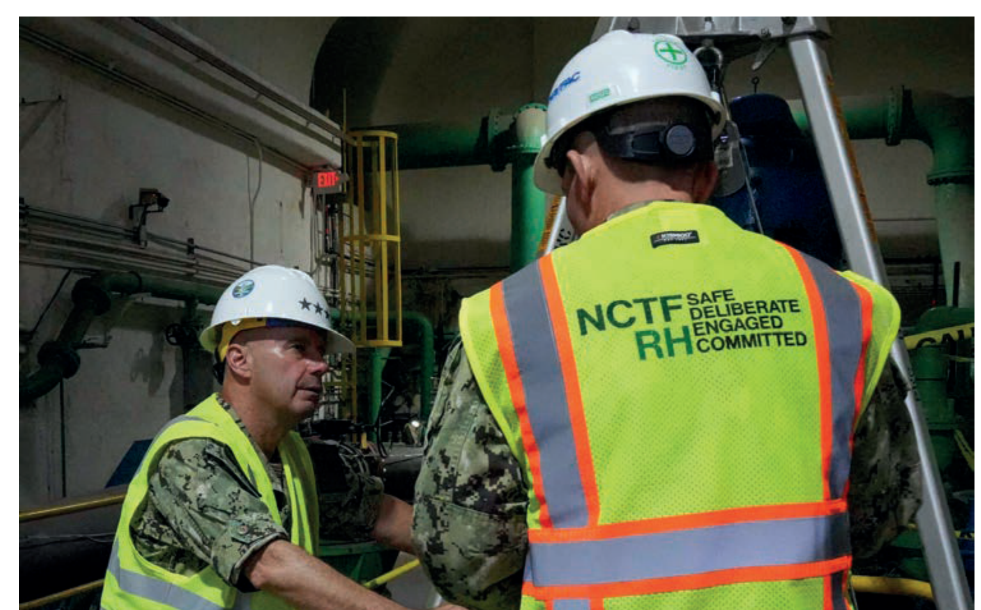
In accordance with Navy policy, chlorine and fluoride are added to the water supply after the water is pumped from the ground. The Navy's goal is to maintain concentrations of approximately 0.7 parts per million (ppm) for fluoride and 0.2 ppm for chlorine throughout the distribution system.

Drinking Water Systems and Operations

We test it.

During Routine Compliance Monitoring, we conduct tests for over 70 contaminants that have the potential for being found in drinking water and share an annual report of those findings. Visit https://cnrh.cnic.navy.mil/ for reports. Keep reading to learn more about routine compliance monitoring.

In addition to routine compliance monitoring, the Navy has extensively monitored the drinking water system since 2022 through two programs, the Drinking Water Long-Term Monitoring Program (LTM) and the Extended Drinking Water Monitoring Program (EDWM). The Navy collected more than 15,000 samples since the beginning of these programs. The data collected demonstrates the Navy's drinking water continues to meet all Federal and State drinking water standards. Sample results can be found at jbphh-safewaters.org. Keep reading to learn more about extended monitoring.



Contractors assigned to Navy Closure Task Force - Red Hill (NCTF-RH) conduct groundwater quality monitoring inside the Red Hill Bulk Fuel Storage Facility (RHBFSF), Hālawa, Hawai'i, April 4, 2024. In addition to its mission to safely decommission the facility, NCTF-RH is responsible for long-term environmental monitoring and remediation of the land and groundwater around the facility. (U.S. Navy photo by Mass Communication Specialist 1st Class Glenn Slaughter).

2021 Red Hill Shaft Fuel Release and Response

2021 Red Hill Shaft Incident

On November 20, 2021, a mixture of JP-5 (jet fuel) and water was released from a fire suppression drain line into the Red Hill Shaft, contaminating the drinking water system. Consequently, the Red Hill Shaft was disconnected from the JBPHH water system and has remained offline since November 28, 2021.

As a result of the fuel release, the Navy, in cooperation with DOH, EPA, and the U.S. Army, implemented a set of plans and corrective actions to flush the drinking water system, conduct intensive testing to ensure safe drinking water, remove the fuel from the storage tanks, and remediate the aquifer and drinking water system.

Red Hill Shaft Recovery and Monitoring Plan

https://www.cpf.navy.mil/Portals/52/Downloads/JBPHH-Water-Updates/2022-01-26-red-hill-shaftrecovery-and-monitoring-plan.pdf

Drinking Water Distribution Recovery Plan

https://www.cpf.navy.mil/Portals/52/DrinkingWater-Distribution-System-Recovery-Plan.pdf

Drinking Water Sampling Plan

https://www.cpf.navy.mil/Portals/52/Downloads/JBPHH-Water-Updates/Drinking%20Water%20Sampling%20Plan%20Addendum_V6_010422_Final2.pdf

The recovery effort segmented the JBPHH Water System and Aliamanu Military Reservation Water System into 19 zones and set forth precise standard operating procedures for the flushing and sampling of each zone. All water mains, laterals, and buildings of the Navy drinking water distribution system were flushed with water from the Waiawa Shaft, restoring safe drinking water to all Navy water system users. Extensive testing continues to confirm that flushing of the system was effective. Other corrective measures, such as fixture replacement, were also implemented.

On March 18, 2022, after verification of recovery efforts and a thorough review of sampling results, the DOH declared the drinking water safe for all 19 zones.

In summary, here's what we did:

Disconnected the system. The contaminated water source at Red Hill was physically disconnected from our drinking water system to prevent any future contamination.

Flushed. With the help of the DOH, the Navy flushed all water distribution lines and then collected samples from those lines to confirm the quality of the new water. The water has been safe to drink since March 2022, per the DOH.

Treated. In accordance with Navy policy, chlorine and fluoride are added to the water supply after the water is pumped from the ground. The Navy consistently monitors the distribution system to maintain levels of 0.7 parts per million (ppm) fluoride and 0.2 ppm chlorine.

Routinely Tested. Since 2021, the Navy has collected more than 15,000 drinking water samples and run more than 672,000 tests. The Navy has collected more than 1,500 of those samples from schools and child development centers. The DOH and the U.S. EPA also test the JBPHH drinking water system. Tests look for over 70 contaminants and establish confidence that the JBPHH water system provides safe, clean water.

Attachment 12 - Residence Resource Guide

Where We are Today

Closing down the Red Hill Bulk Fuel Storage Facility. The Navy is defueling and closing the existing fuel storage tanks at Red Hill. This closure will be a complete and permanent shutdown of the Red Hill facility by April 2027.

The water at JBPHH is safe to drink. Following the Red Hill incident, the DOH has repeatedly certified that since March 2022 the water in the JBPHH drinking water system is safe to drink.

Source water from the Waiawa Shaft is safe to drink. Our current source of water is completely separate from the shaft that was contaminated. The Navy exclusively uses the Waiawa Shaft for the JBPHH distribution system. This water is consistently tested and verified as safe to drink. Testing results show the water meets or exceeds state and federal regulations for safe drinking water.

The Navy's Red Hill Shaft is physically disconnected from the Navy water system. No drinking water is drawn from this shaft, and the JBPHH distribution system has been completely flushed with clean water and declared safe.

No additional contamination is occurring in the water system. A cross-connection control investigation showed that the distribution system is protected, resulting in no additional sources of contamination.

The groundwater below and around Red Hill is being monitored. The monitoring data are showing no elevated readings and no JP-5 components. Testing is ongoing by the Navy and multiple third-party agencies.

We are extracting and testing water from the Red Hill Shaft. Though the shaft is closed and cut off from the JBPHH distribution system, water still exists in the Red Hill Shaft, and the Navy wants to monitor it. So, we are pumping out the water, cleaning it, testing it, and returning the filtered water to Hālawa Stream.

Drinking Water Compliance Standards

Access results from Routine Compliance Monitoring

Drinking Water Compliance Standards

Navy	Other Drinking Water Providers	Standard
✓	✓	Routine Compliance Monitoring
✓	✓	Lead and Copper Rule
✓	☐	Lead in Priority Area Policy
✓	☐	Water Quality Action Team
✓	☐	Legacy Compliance Sampling
✓	☐	Extended Drinking Water Monitoring

Routine Compliance Monitoring Required for all public water systems
- Ensures periodic water quality sampling of the JBPHH drinking water system.
- Tests the source water and distribution system for microbiological indicators and chemical contaminants.
- ✓ Sample results continue to demonstrate the drinking water complies with all federal and state drinking water standards.

Lead and Copper Rule Required for all public water systems
- Tests for lead in 20% of elementary schools and childcare facilities every year and reach 100% in a five-year sampling period.
- Establishes a limit (called an action level) for lead and copper that, if exceeded in more than 10 percent of drinking water samples, requires corrective actions to reduce lead or copper levels.
- Requires an inventory of Service Lines Materials. Completed in 2024, no service lines at JBPHH are known to be lead service lines.
- ✓ Sample results continue to demonstrate the drinking water meets the drinking water standard.

Lead in Priority Area Policy DoD requirement for all Navy installations
- Mandates, through ongoing Department of Defense policy, that the Navy test the drinking water every five years at all child development centers, youth centers, and schools.
- ✓ Sample results demonstrate the drinking water remains below action levels.

Responses to the 2021 Red Hill Fuel Spill to Ensure there are No Impacts to the Water System

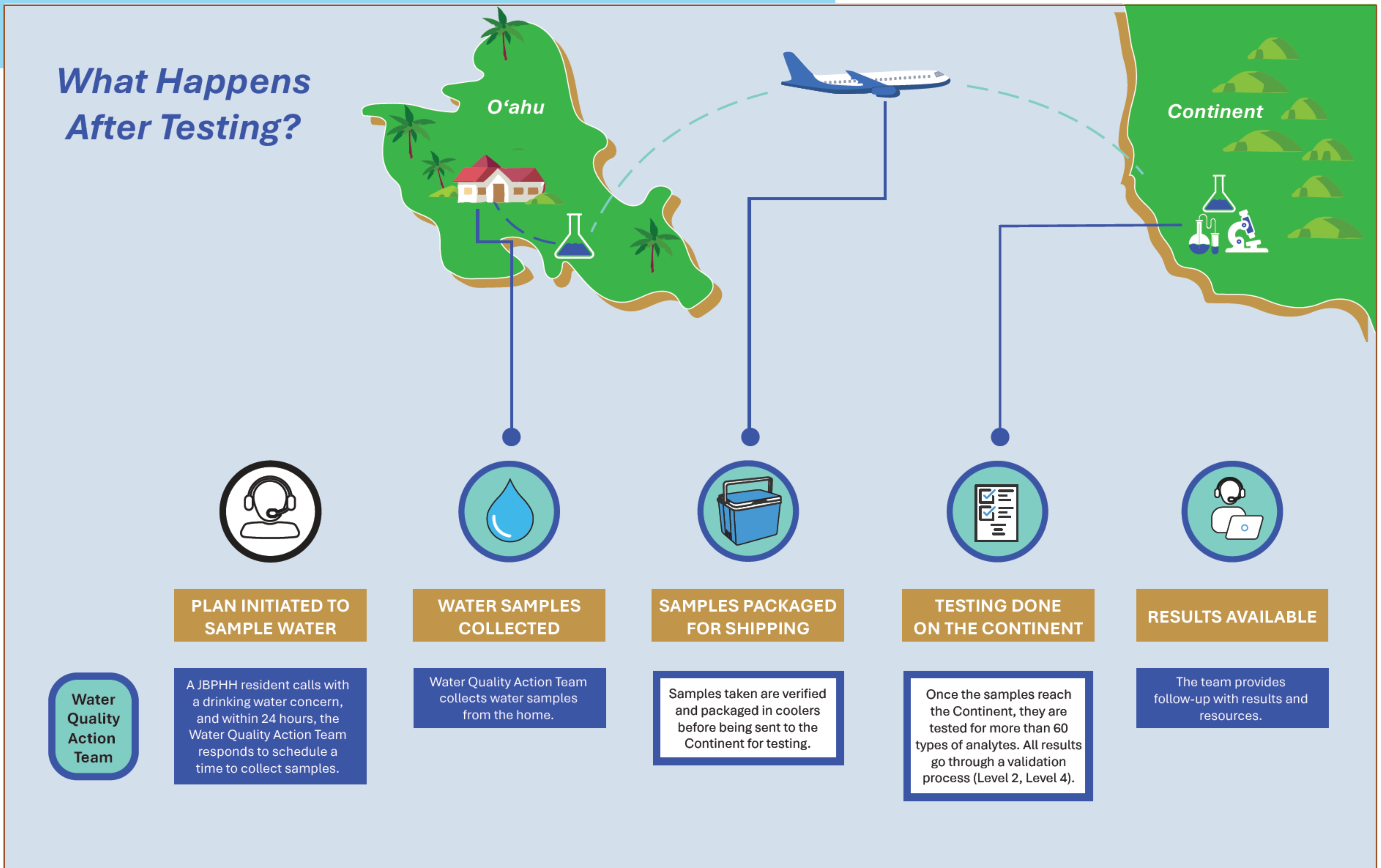
Water Quality Action Team Voluntary at JBPHH
- Operates a call center to promptly address and respond to consumer concerns about water quality.
- Provides drinking water quality assessments and information to residents and consumers.

Legacy Compliance Sampling (Long-Term Monitoring, EPA mandated for JBPHH) *Completed
- *Completed a two-year water quality sampling program from 2022-2024 for 50+ analytes.*
- *Accomplished sampling goals and posted results at https://jbphh-safewaters.org.*

Extended Drinking Water Monitoring (Voluntary, then added to EPA mandates for JBPHH) *Nearing Completion
- *Conducting extensive sampling and analysis of JBPHH drinking water system for 50+ analytes from 2024-2025.*
- *Testing drinking water within 100% of homes by March 2025 (primary goal).*
- *Performing monthly testing of water at all childcare facilities, schools, medical facilities, and veterinary facilities (secondary goal).*

Access results from Extended Drinking Water Monitoring and Legacy Compliance Sampling

Resident Support and Water Testing



Navy Water Quality Action Team

The Navy operates a call center to promptly address and respond to consumer concerns about water quality.

The team provides drinking water quality assessments and information to residents on the JBPHH drinking water system.

If residents have concerns about the quality of their water, the Water Quality Action Team (WQAT) is available to collect drinking water samples and conduct a water quality investigation.

Residents can call the JBPHH Drinking Water Call Center, which will dispatch the WQAT to investigate. The Call Center can be reached at: (808) 210-6968.

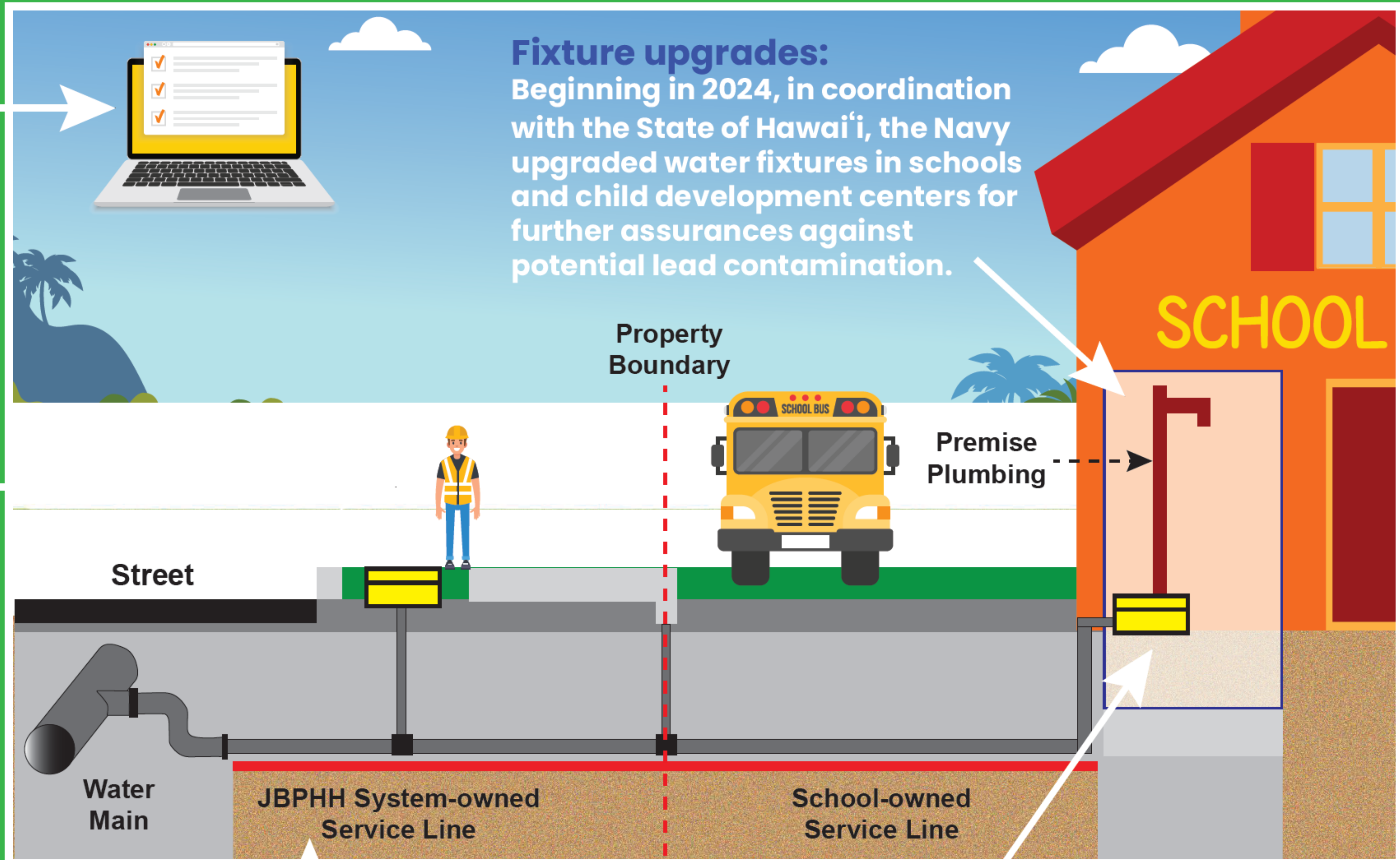
THE WATER IS SAFE TO DRINK. We continue to improve our practices to ensure this.

Online resources:
jbphh-safewaters.org

Customer service call line: (808) 210-6968

Response team:
The Navy provides immediate response related to drinking water quality and information.

Service line checks:
The Navy completed a comprehensive inventory of all water service lines in the distribution system to ensure no lead was present in any materials.



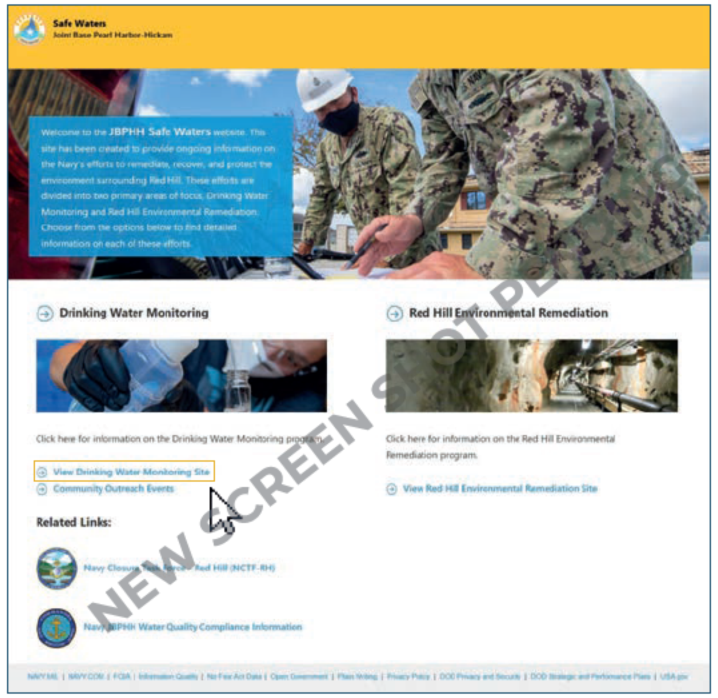
Plumbing replacements:
At all schools and child development centers, if any lead exceedances were detected, the Navy promptly took action to replace on-site plumbing and water fixtures.

How Do I Find My Results?

Safe Waters
Joint Base Pearl Harbor-Hickam

SEARCH WITH INTERACTIVE MAP

STEP 1

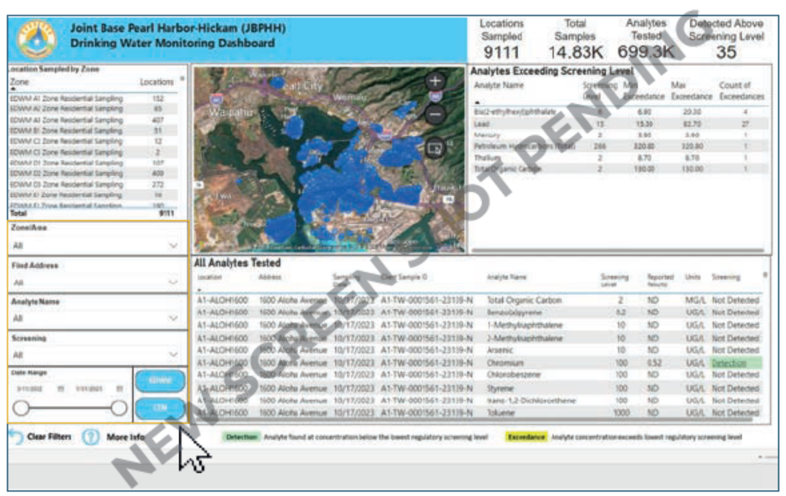


VISIT HTTPS://JBPHH-SAFEWATERS.ORG
CLICK View Drinking Water System Site

STEP 2

CLICK View Interactive Drinking Water Results Map

STEP 3



Use drop-down bars on the left of the screen to search by zone, address, analyte name, screening, and dates

To ensure a continuous supply of safe drinking water, the Navy implemented a Long-Term Monitoring plan for 24 months until March 2024. All drinking water sampling results were compiled and published on our Safe Waters website (see link below) to provide the public full access to the most recent data reports and updates. In March 2024, the Navy extended the drinking water monitoring program for an additional year to ensure water continues to be safe to drink and continues to meet all state and federal drinking water standards.

Drinking Water Long-Term Monitoring Plan
https://health.hawaii.gov/about/files/2022/08/JBPHH-Drinking-Water-LTM-Plan-FINAL-20220823.pdf

Extended Drinking Water Monitoring Plan (EDWM)
https://jbphh-fewaters.org/public/JBPHH_EDWM_Plan_17Jun24.pdf

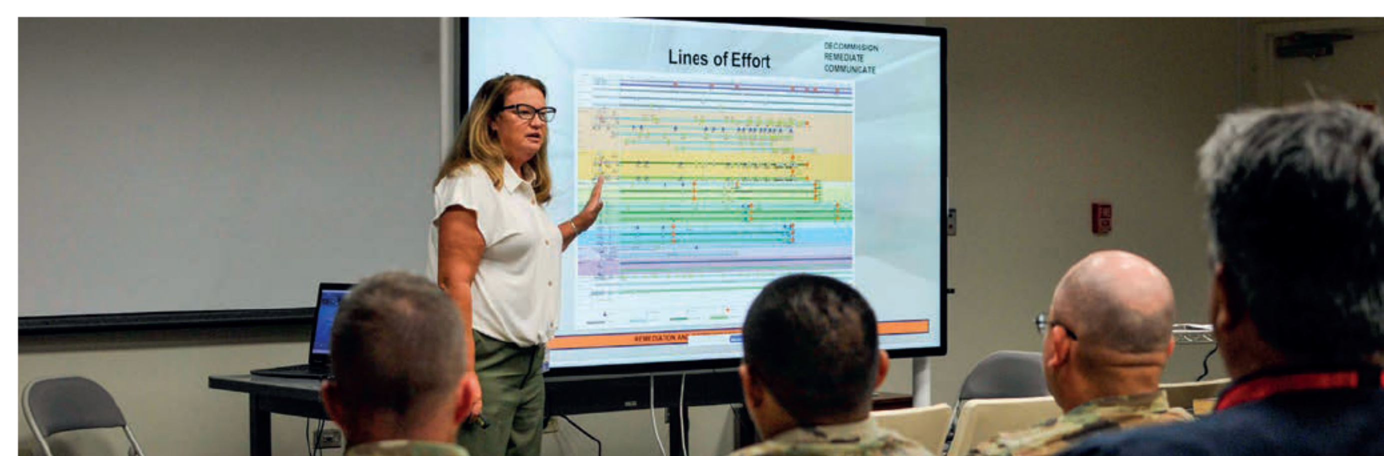
Sharing Additional Resources

The Navy remains vigilant to ensure the drinking water is safe. We are committed to providing the community with the latest information about the safety of JBPHH's drinking water, ongoing water quality monitoring, and test results.

Public Information and Outreach

Your involvement matters, so we hope you can join us to learn more and stay informed.

- Visit the JBPHH Safe Waters website.
- Reach out to the Water Quality Call Center.
- Attend Town Hall public meetings and open houses.
- Participate as we present and discuss information with Neighborhood Boards.
- Stop by a Drinking Water Information Booth in JBPHH neighborhoods and at malls.
- Read letters and messages from the Joint Base Commander.
- Spend time with the digital water system maps to access drinking water sampling results.



Resources and Contacts

Water Quality Concerns

- **Water Quality Call Center:** If residents have concerns about the quality of their water, the Water Quality Action Team (WQAT) is available to collect drinking water samples and conduct a water quality investigation. Residents can call the JBPHH Drinking Water Call Center, which will dispatch the WQAT to investigate. The Call Center can be reached at: (808) 210-6968.
- **Hawaiʻi Department of Health Safe Drinking Water Branch:** 808-586-4258, SDWB@doh.hawaii.gov
- **U.S. Environmental Protection Agency** Desk Line: 415-947-4406

Other Contacts

- **Red Hill Community Liaison:** 808-321-7692

Medical References

- **Tripler Army Medical Center:** 888-683-2778, opt. 3
- **Red Hill Clinic:** Provides medical assessments for all TRICARE-eligible beneficiaries and individuals granted Secretarial Designee status, endorsing symptoms that may be related to the Red Hill fuel spill. Individuals continuing to experience symptoms are encouraged to call 833-415-3024, Monday-Friday, 8 a.m.-4 p.m., to schedule an appointment.
- **Red Hill Registry:** Seeks community members impacted by the fuel spill at Red Hill. redhillregistry.org
- **Red Hill Public Health Assessment Activities:** www.atsdr.cdc.gov/red-hill/factsheet/index.html

Other Helpful Links

Scan the QR codes to stay up to date with the latest information.

Joint Base Pearl Harbor-Hickam Safe Waters
jbphh-safewaters.org

- Provides ongoing information on the Navy's efforts to remediate, recover, and protect the environment surrounding Red Hill
- Two primary areas: Drinking Water System and Red Hill Environmental Remediation

Joint Base Pearl Harbor-Hickam Facebook Page
facebook.com/JBPHH

- Features daily joint base water updates
- Imagery and resources related to water response efforts
- Infographic and information

Navy Region Hawaii Facebook Page
facebook.com/NavyRegionHawaii

- Frequent updates and information about joint Base Pearl Harbor-Hickam drinking water

Navy Closure Task Force-Red Hill
www.navyclosuretaskforce.navy.mil

- Documentary library for defueling and closure of Red Hill Bulk Fuel Storage Facility
- Photos and media gallery related to water response efforts and drinking water testing

jbphh-safewaters.org

Attachment 13

Table: Identification of Exceedances Reported in Drinking Water Samples

Attachment 13 - Table Identification of Exceedances Reported in Drinking Water Samples

Location	Address	Sampling Date	Client Sample ID	Analyte Name	Screening Level	Reported Results	Units	Screening	Results
A1-AUST0193	193 Austin Court	5/10/2022	A1-TW-0001600-22114-N	Lead	15	15.3	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
A3-108S6733B	6733B 108th Street	6/16/2022	A3-TW-0016179-22132-N-R1	Lead	15	15.3	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
A3-DOVE5706	5706 Dovekie Avenue	4/25/2023	A3-TW-0016460-22342-N	Bis(2-ethylhexyl)phthalate	6	6.9	UG/L	Exceedance	Bis(2-ethylhexyl)phathalate is an organic compound used as a plasticizer in the production of PVC. This compound is a colorless viscous liquid that is soluble in oil but not in water. As of November 24, 2023, all exceedances of bis(2-ethylhexyl)phathalate found in the JBPHH water system have been cleared by replacing the affected fixture, flushing water through the building, and collecting confirmation samples (results less than the project ISPs) from the fixture and bracketing locations. Click "More Info" below to go JBPHH Safe Waters website for more information.
A3-IBIS6224A	6224A Ibis Avenue	10/20/2023	A3-TW-0017121-23157-N	Bis(2-ethylhexyl)phthalate	6	9.4	UG/L	Exceedance	Bis(2-ethylhexyl)phathalate is an organic compound used as a plasticizer in the production of PVC. This compound is a colorless viscous liquid that is soluble in oil but not in water. As of November 24, 2023, all exceedances of bis(2-ethylhexyl)phathalate found in the JBPHH water system have been cleared by replacing the affected fixture, flushing water through the building, and collecting confirmation samples (results less than the project ISPs) from the fixture and bracketing locations. Click "More Info" below to go JBPHH Safe Waters website for more information.
A3-IBIS6224A	6224A Ibis Avenue	10/26/2023	A3-TW-0017121-23157-N-R1	Bis(2-ethylhexyl)phthalate	6	20.3	UG/L	Exceedance	Bis(2-ethylhexyl)phathalate is an organic compound used as a plasticizer in the production of PVC. This compound is a colorless viscous liquid that is soluble in oil but not in water. As of November 24, 2023, all exceedances of bis(2-ethylhexyl)phathalate found in the JBPHH water system have been cleared by replacing the affected fixture, flushing water through the building, and collecting confirmation samples (results less than the project ISPs) from the fixture and bracketing locations. Click "More Info" below to go JBPHH Safe Waters website for more information.
A3-IBIS6224A	6224A Ibis Avenue	10/27/2023	A3-TW-0017121-23157-N-R2	Bis(2-ethylhexyl)phthalate	6	17.4	UG/L	Exceedance	Bis(2-ethylhexyl)phathalate is an organic compound used as a plasticizer in the production of PVC. This compound is a colorless viscous liquid that is soluble in oil but not in water. As of November 24, 2023, all exceedances of bis(2-ethylhexyl)phathalate found in the JBPHH water system have been cleared by replacing the affected fixture, flushing water through the building, and collecting confirmation samples (results less than the project ISPs) from the fixture and bracketing locations. Click "More Info" below to go JBPHH Safe Waters website for more information.
D1-BLDGD1-22	Pearl Harbor Kai Elementary, Building D1-22	3/16/2022	D1-TW-0015098-22060-N-1	Mercury	2	3.9	UG/L	Exceedance	Metals are chemicals that are not derived from living sources and in general do not contain carbon. A root cause analysis was completed on all mercury exceedances and found that there was a lab error/contamination. All buildings with exceedances have been flushed and resampled with non-detect results. Click "More Info" below to go JBPHH Safe Waters website for more information.
D1-BLDGD1-22	Pearl Harbor Kai Elementary, Building D1-22	3/31/2022	D1-TW-0015098-22060-N-1-R1	Lead	15	18.8	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
D1-BLDGD1-22	Pearl Harbor Kai Elementary, Building D1-22	4/1/2022	D1-TW-0015098-22060-N-1-R2	Lead	15	26.3	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
D2-BLDG641H	Hickam Elementary, P1, Building 641H	2/26/2024	D2-TW-0015498-23337-N-1-R1	Petroleum Hydrocarbons (Total)	266	320.8	UG/L	Exceedance	Total Petroleum Hydrocarbons is the calculated total of the detected values (if any) of Petroleum Hydrocarbons as Gasoline, as Diesel, and as Oil.

D2-CHAL2417D	2417D Challenger Loop	9/27/2024	D2-TW-0008333-24092-N	Lead		15	44.2	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
D2-CHAL2438B	2438B Challenger Loop	1/23/2023	D2-TW-0007989-22342-N	Lead		15	59	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
D2-HYD1610	FH:074	4/25/2022	D2-DL-0000583-22102-N	Lead		15	63.4	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
D2-HYD1610	FH:074	4/29/2022	D2-DL-0000583-22102-N-R1	Lead		15	27.9	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
D2-HYD2291	FH 73	4/29/2022	D2-DL-0017894-22102-N	Lead		15	22.9	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
D2-LEWA0266	266 Lewa Hia Loop	7/27/2023	D2-TW-0007635-23157-N	Lead		15	36.9	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
D2-LEWA0276	276 Lewa Hia Loop	3/28/2022	D2-TW-0008225-22072-3-N	Lead		15	15.5	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
D3-HALE1034	1034 Halehaka Street	1/10/2024	D3-TW-0009680-23342-N	Lead		15	23.8	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
E1-BLDG0081	Montessori Center of Pearl Harbor, Building 81	3/22/2022	E1-TW-0015290-22067-N-4	Lead		15	30.2	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
F1-BLDG2655	Building 2655	10/5/2022	F1-TW-0015332-22160-N-1	Lead		15	59.8	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
F1-BOUG4857	Moanalua Pre-School - Kamaaina Kids, 4857 Bougainville Dr	3/29/2022	F1-TW-0014170-22070-N-3	Lead		15	33.4	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
F1-HYD029A	FH ID: FH:29A	3/6/2024	F1-DL-0017723-23335-N	Thallium		2	8.7	UG/L	Exceedance	Metals are chemicals that are not derived from living sources and in general do not contain carbon. Metals include antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, copper, cyanide, fluoride, lead, mercury, nitrate, nitrite, selenium, and thallium. These contaminants get into drinking water supplies through industrial discharge or spills, erosion of natural deposits, corrosion, sewage discharge, fertilizer runoff, and other sources.
F1-KIDD4933	4933 Kidd Court	8/28/2023	F1-TW-0008807-23155-N	Lead		15	16.6	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
F1-MOAN0001	Pearl Harbor Elementary School, 1 Moanalua Ridge	2/9/2023	F1-TW-0017726-22340-N-1	Lead		15	17.2	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.

F2-ANDE2807	2807 Anderson Avenue	8/18/2023	F2-TW-0010735-23155-N	Lead	15	21.1	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
F2-ANDE2807	2807 Anderson Avenue	8/24/2023	F2-TW-0010735-23155-N-2	Lead	15	33.6	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
F2-ARIZ2774	2774 Arizona Road	1/25/2023	F2-TW-0010776-22340-N	Lead	15	23.9	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
F2-BLDG0603	Building 603	9/6/2022	F2-TW-0014192-22160-N	Lead	15	42	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
F2-BLDG0603	Building 603	9/12/2022	F2-TW-0014192-22160-N-2	Lead	15	20.6	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
F2-HYD0047	FH 47	3/24/2022	F2-DL-0017750-22070-N	Total Organic Carbon	2	130	MG/L	Exceedance	Total organic carbon (TOC) is the measure of the total amount of carbon in water that is found in organic compounds. Organic carbon can provide a food source for bacteria and other microorganisms, which can lead to the growth of harmful pathogens. One of the most common sources is decaying plant and animal material. Other sources of organic carbon in water include industrial and agricultural runoff, wastewater treatment plants, and stormwater runoff. As of April 8, 2022, all TOC exceedances found in the JBPHH water system have been cleared by flushing water through the building and resampling with results less than the project screening level. Click "More Info" below to go JBPHH Safe Waters website for more information.
F2-MURR0763	763 Murray Drive	5/26/2022	F2-TW-0010102-22130-N	Lead	15	31	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
F2-TIAR1711	1711 Tiare Court	3/24/2022	F2-TW-0009316-22070-N	Lead	15	20.6	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
H1-AMAP3738	3738 Amapa Lane	4/15/2022	H1-TW-0013218-22092-A	Lead	15	22.4	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
H1-CALA3055	3055 Calamondin Way	4/14/2022	H1-TW-0013356-22092-A	Lead	15	22.3	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.
H1-KOUL4697	4697 Kou Lane	1/24/2024	H1-TW-0013063-23327-A	Lead	15	82.7	UG/L	Exceedance	Lead in drinking water can be caused by old faucets or pipes that need to be replaced. As of Feb 1, 2024, all exceedances of lead found in the JBPHH water system have been cleared by updating fixtures and flushing water through the building. Click "More Info" below to go JBPHH Safe Waters website for more information.

Attachment 14

Table: Summary of Detections of TPHs, VOCs, and SVOCs during LTM and EDWM (March 2022 – March 2025)

Attachment 14. Summary of Detections of TPHs, VOCs, and SVOCs during LTM and EDWM (March 2022 – March 2025)

Method	Analyte[1]	Typical Source	No. of Samples[2]	No. of Detects	Detection Frequency (%)	Detected Concentrations (ppb)			SL[3] (ppb)	No. of Samples > SL
						Minimum	Maximum	Average		
EPA 8015/8260	Total Petroleum Hydrocarbons	TPH is petroleum and can contaminate drinking water through spills and other releases into the environment	15,518	2,666	17%	48	1,552	74	--[4]	--[5]
EPA 524.2	Benzene	Discharge from factories; Leaching from gas tanks and landfills	15,475	1	0.0065%	0.50	0.50	0.50	5	0
	Ethylbenzene	Discharge from petroleum refineries	15,475	4	0.026%	0.27	0.32	0.30	700	0
	Toluene	Discharge from petroleum factories	15,475	3	0.019%	0.26	0.57	0.40	1,000	0
	Trichloroethene (TCE)	Discharge from metal degreasing sites and other factories	8,638	1	0.012%	0.93	0.93	0.93	5	0
	Xylenes, Total	Discharge from petroleum or chemical factories	15,475	9	0.058%	0.25	0.64	0.37	10,000	0
	1,2-Dichloroethene (Total)	Discharge from industrial chemical factories	8,638	6	0.069%	0.58	2.2	1.6	100	0
	1,4-Dichlorobenzene	Discharge from industrial chemical factories	8,638	13	0.15%	0.26	1.5	0.58	75	0
	Methylene chloride	Discharge from pharmaceutical and chemical factories	8,638	1	0.012%	1.5	1.5	1.5	5	0
	Total Haloacetic acids	By-product of drinking water disinfection	8,636	346	4.0%	0.51	29	1.4	60	0
	Total Trihalomethanes	By-product of drinking water disinfection	15,475	8,142	53%	0.25	6.5	2.3	80	0
EPA 525.2	1-Methylnaphthalene	Used to make other chemicals such as dyes, and resins; also, present in cigarette smoke, wood smoke, tar, asphalt, and at some hazardous waste sites	15,474	1	0.0065%	0.33	0.33	0.33	--	--
	2-Methylnaphthalene	Used to make other chemicals such as dyes, and resins; also used to make vitamin K; and is present in cigarette smoke, wood smoke, tar, asphalt, and at some hazardous waste sites	15,474	1	0.0065%	0.25	0.25	0.25	--	--
	Naphthalene	Found in coal tar or crude oil and is used in the manufacture of plastics, resins, fuels, and dyes, and as a fumigant	15,474	6	0.039%	0.27	1.6	1.0	--	--
	1,2-Dibromoethane (EDB)	Pesticide for felled logs and beehives; chemical intermediate for dyes, resins, waxes, and gums	485	3	0.62%	0.0085	0.020	0.016	0.05	0
	Benzo(a)pyrene	Leaching from linings of water storage tanks and distribution lines	15,474	467	3.0%	0.010	0.13	0.041	0.2	0
	Benzo(g,h,i)perylene	Found in heavy oils, coal tar, and is used in the preservation of wood as well as in the manufacture of dyes, plastics and pesticides	4,458	2	0.045%	0.36	0.40	0.38	--	--
	Bis(2-ethylhexyl)phthalate	Discharge from rubber and chemical factories	8,613	252	2.9%	0.38	9.4[6]	1.1	6	4
	Phenanthrene	Found in heavy oils, coal tar, and is used in the preservation of wood as well as in the manufacture of dyes, plastics and pesticides	4,420	3	0.068%	0.27	0.41	0.34	--	--

Notes:

--: No screening level established.

Exceeds Screening Level. More information on exceedances is provided in Attachment 13.

[1] This is not the full list of analytes tested for during LTM and EDWM. The full list of chemicals is available in the LTM Plan and EDWM Plan. Only analytes that have been detected in at least one LTM or EDWM sample are listed.

[2] The number of samples is the sum of samples collected during LTM (March 2022 – March 2024) and EDWM (April 2024 – March 2025). Details about these results are provided on Safewaters.org and are summarized in the LTM Reports (by Zone) and the EDWM Reports (by Quarters).

[3] Screening levels are based on Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act.

[4] DOH developed an Incident-Specific Parameter (ISP) of 266 parts per billion (ppb) for TPHs during LTM; however, during EDWM, screening levels were based on MCLs, and the Navy investigated all TPH detections, regardless of the reported concentration. There is no established MCL for TPHs.

[5] All TPH results reported during LTM were below the ISP of 266 ppb. The ISP of 266 ppb was not used as the compliance value in EDWM. Only one TPH result during EDWM exceeded the ISP of 266 ppb, which was investigated by the Navy and confirmed to be associated with a food-grade lubricant in a fire hydrant (see Attachment 4 and the EDWM Quarterly Reports on Safewaters.org).

[6] Bis(2-ethylhexyl)phthalate was detected at concentrations greater than the MCL at two locations during LTM. Additional investigation into these detections demonstrated these are not fuel-related. Detailed information is available in the LTM Reports for Zone A3 on Safewaters.org.

EDWM: Extended Drinking Water Monitoring; LTM: Long-Term Monitoring; ppb: parts per billion; SL: screening level; SVOCs: semi-volatile organic compounds; TPHs: total petroleum hydrocarbons; VOCs: volatile organic compounds

Attachment 15
Consumer Call Log (17 February 2022 – 04 March 2022)

Call Center Rollup - By Date
Multiple Zones
Multiple Dates

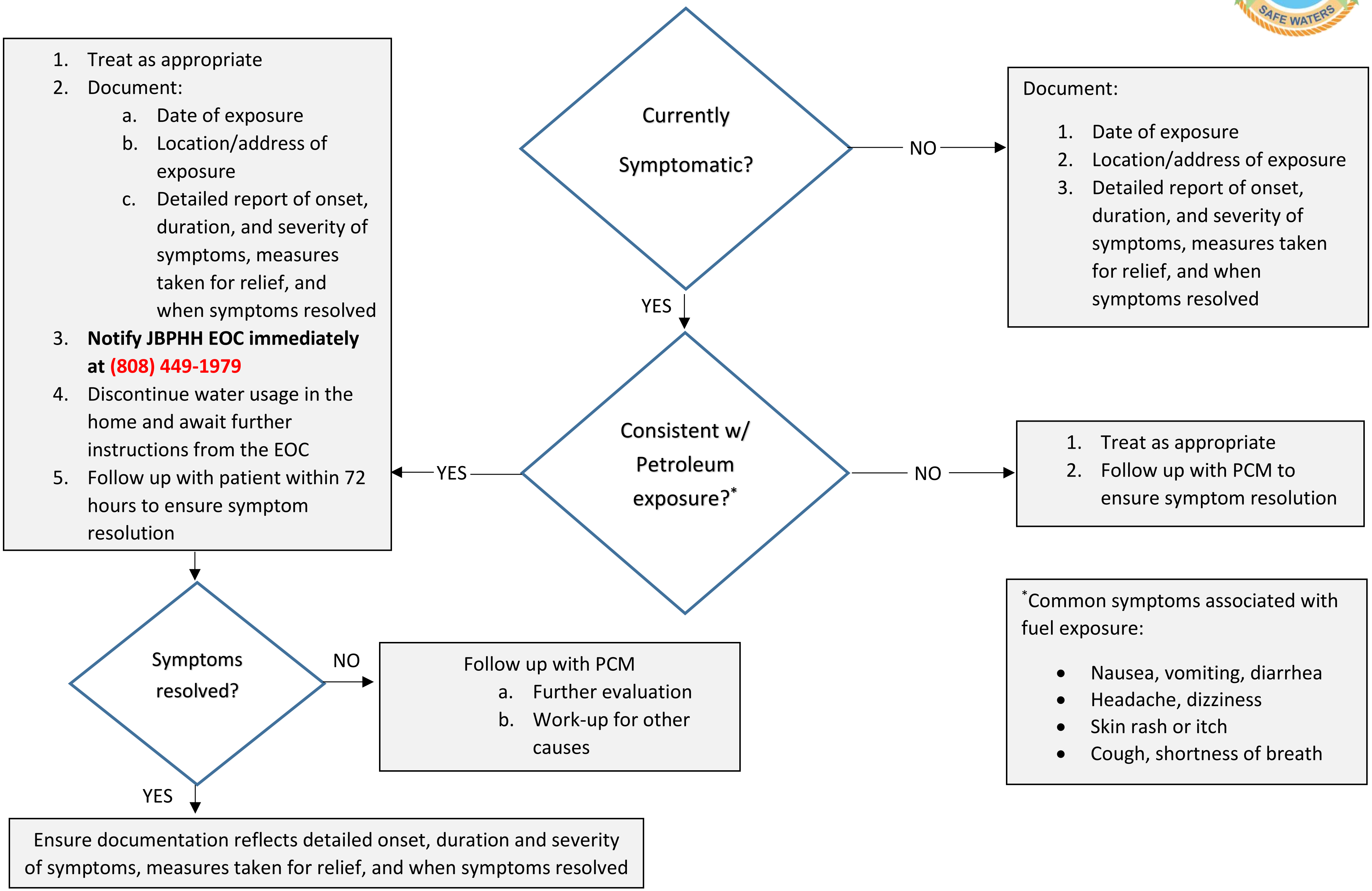
Ticket Number	Concerns Addressed	Zone	Location	Address	Property Manager	Tenant Name	Call Back Phone Number	Email	Military Branch	Military Rank	Command	Scheduled Date/Time	Call Date/Time	Call Answered By	Site Visit Conducted	Flushed	Sample Tested	Exceedance	Issue Notes	Call Notes
1-41	☐	Flushing Zone D3	D3-OHAN0553	553 Ohana Nui Circle		[redacted]					130th Engineer Brigade		2022-02-17 14:08	[redacted]	N	Y	N		Member's info was brought to call center by CAPT Spitzer. Member was very professional when we spoke to him. Company Commander Phone: [redacted] (Army) [redacted] called at 1300 on 2/17/22.	Resident called 28Feb to cancel appointment for 2 PCSing.
1-82	☐	Flushing Zone H1	H1-GOLD6036	6036 Gold Lane		Record Missed in Original Flushing						1/26/2022 7:58:00 AM	2022-02-23 10:43	[redacted]	N	Y	N			
1-121	☐	Flushing Zone I1	I1-BASS1164	1164 Basswood Place		[redacted]	--		USA			2/18/2022 12:00:00 AM	2022-03-02 13:56	[redacted]	Y	N	Y		The resident complained that their water had foaming and sediment.	
1-122	☐	Flushing Zone I1	I1-BASS1172	1172 Basswood Place		[redacted]			USCG			2/25/2022 12:00:00 AM	2022-03-02 14:03	[redacted]	Y	N	N		The resident was assessed at 1300 today and a flush team was already standing by to execute. The re-flush began around 1330 on 25FEB22.	
1-123	☐	Flushing Zone I1	I1-BUTT1508	1508 Buttonwood Place		[redacted]			USAF			2/15/2022 12:00:00 AM	2022-03-02 14:10	[redacted]	Y	N	Y		The resident complained of an odor and sheen in their water.	
1-124	☐	Flushing Zone I1	I1-COWS1613	1613 Cowslip Lane		[redacted]			USAF			2/18/2022 12:00:00 AM	2022-03-02 14:15	[redacted]	Y	N	Y		Resident complained that they had irritation on their skin after showering.	
1-125	☐	Flushing Zone I1	I1-EAGL1309	1309 Eagle Circle		[redacted]			USA			2/18/2022 12:00:00 AM	2022-03-02 14:17	[redacted]	Y	N	Y		Two of the three assessment team members claimed they could smell an odor.	
1-126	☐	Flushing Zone I1	I1-HUDS1269	1269 Hudson Way		[redacted]			USA			2/18/2022 12:00:00 AM	2022-03-02 14:19	[redacted]	Y	N	Y		Resident complained that a black substance was coming out of the master bathroom shower.	
1-127	☐	Flushing Zone H2	H2-MORI6828	6828 Morishige Lane		[redacted]	--		USA			2/18/2022 12:00:00 AM	2022-03-02 14:21	[redacted]	Y	N	Y		Resident complained that there was an odor in the upstairs bathroom.	
1-128	☐	Flushing Zone H3	H3-GREW0185	185 Grewia Place		[redacted]			USA			2/18/2022 12:00:00 AM	2022-03-02 14:23	[redacted]	Y	N	Y		The resident complained that there was a sheen in the laundry room and kitchen. The resident also expressed concerns regarding PVC piping and absorbance in the pipe. The resident had a fish tank and all the fish in the tank had died.	
1-129	☐	Flushing Zone I1	I1-EAGL1316	1316 Eagle Circle		[redacted]			USA			2/18/2022 12:00:00 AM	2022-03-02 14:25	[redacted]	Y	N	N		Resident was concerned that his initial flush was not done according to standard.	
1-130	☐	Flushing Zone I1	I1-EAGL1324	1324 Eagle Circle		[redacted]			USA			2/22/2022 12:00:00 AM	2022-03-02 14:27	[redacted]	Y	N	Y		The resident had concerns with the water in both bathrooms.	
1-131	☐	Flushing Zone I1	I1-EAGL1320	1320 Eagle Circle		[redacted]			USA			2/15/2022 12:00:00 AM	2022-03-02 14:28	[redacted]	Y	N	Y		The assessment team never entered the residence.	
1-132	☐	Flushing Zone H3	H3-BOWE0177	177 Bower Place		[redacted]			USA			2/18/2022 12:00:00 AM	2022-03-02 14:30	[redacted]	Y	N	N		Resident complained that they have experienced burning sensations from their eyes and that their child has experience nose bleeds.	
1-133	☐	Flushing Zone I1	I1-LAUR1902	1902 Laurel Place		[redacted]			USA			2/18/2022 12:00:00 AM	2022-03-02 14:33	[redacted]	Y	N	N		Resident was not home, asked to reschedule another assessment date.	
1-134	☐	Flushing Zone I1	I1-PAPA1804	1804 Papaw Place		[redacted]			USA			2/17/2022 12:00:00 AM	2022-03-02 14:34	[redacted]	Y	N	Y		The resident complained of an odor.	
1-135	☐	Flushing Zone I1	I1-TAMP1552	1552 Tampa Drive		[redacted]			USMC			2/18/2022 12:00:00 AM	2022-03-02 14:52	[redacted]	N	N	N		The resident will have to reschedule another assessment date due to quarantine.	
1-138	☐	Flushing Zone H3	H3-OCTO0147	147 Octopus Lane								2/23/2022 12:00:00 AM	2022-03-03 14:28	[redacted]	Y	N	Y		Resident complained that they smell a strong odor throughout their house.	
1-140	☐	Flushing Zone D3	D3-OHAN0781	781 Ohana Nui Circle	Hickam Communities	[redacted]	--	[redacted]	USA	[redacted]	ufarpac	3/4/2022 3:00:00 PM	2022-03-04 12:21	Flush Team	N	N	Y			

Call Center Rollup - By Date
Multiple Zones
Multiple Dates

	On Site Notes	Delivered In Person	Delivery Date/Time	Delivered By Name	Delivered By Phone	Received By Name	Received By Phone	Test Results Delivery Notes	Conclusions
8Feb at 1500. Resident is									
	The assessment team did not smell an odor nor did they see any sheen/foam in the water. A sample was taken on 18FEB22.	0			--		--		
	The re-flush began around 1330 on 25FEB22.	0			--		--		
	The assessment team did not notice an odor, nor could they recreate a sheen. The resident's homes was sampled by the site lab on 15FEB22 and was analyzed as a non-detect. Regardless, the resident asked specifically for a "full" test. The assessment team informed the resident that they would be able to sample and test at the SiteLab. A sample was taken on 18FEB22 and this will be the home's second set of results from the SiteLab.	0			--		--		
	The assessment team did not notice an odor or see a sheen in the water. A sample was taken on 18FEB22.	0			--		--		
	The smell was very faint and was only in the upstairs hallway bathroom. COL Galloway, [redacted] , & [redacted] were notified. The other assessment team went to the home and none of the members were able to smell an odor that was claimed by the other assessment team. A sample was taken on 18FEB22. Resident will have his home re-flushed tomorrow at 1400 hours.	0			--		--		
	The assessment team did not smell an odor nor did they see any black substance from the water. A sample was taken on 18FEB22.	0			--		--		
	The assessment team did not notice an odor or see sheen in the water. A sample was taken on 18FEB22.	0			--		--		
	The resident has cleaned the [fish] tank before, but was able to show the assessment team a sheen that had accumulated. The assessment team was unable to recreate a sheen during their visit. The resident has requested a re-flush of their home. A sample was taken on 18FEB22.	0			--		--		
	The assessment team did not smell an odor nor did they see any sheen in the water. The resident has requested a re-flush of their home.	0			--		--		
	The team took a sample on 22FEB22.	0			--		--		
	The resident's homes was sampled by the site lab on 15FEB22 and was analyzed as a non-detect. Regardless, the resident continued to ask the team for a "full" test.	0			--		--		
	The assessment team did not notice any odor and did not experience any irritation when running the water. The resident has requested a re-flush of their home.	0			--		--		
	Resident was not home, asked to reschedule another assessment date.	0			--		--		
	The assessment team was unable to smell any odor but took a sample at the home (17FEB22)	0			--		--		
		0			--		--		
	A sample was taken on 23FEB22.	0			--		--		
		0			--		--		The resident reported another issue following rapid response visit (Ticket # 1-270 on 3/15/2022). The resident was contacted to ensure there were no further concerns and the Navy is considering this ticket closed out.

Attachment 16

Patient Encounter Flow Chart for Water Exposure Health Concerns


Currently Symptomatic?
NO
Document:
1. Date of exposure
2. Location/address of exposure
3. Detailed report of onset, duration, and severity of symptoms, measures taken for relief, and when symptoms resolved
YES
Consistent w/ Petroleum exposure?*
NO
1. Treat as appropriate
2. Follow up with PCM to ensure symptom resolution
YES
1. Treat as appropriate
2. Document:
a. Date of exposure
b. Location/address of exposure
c. Detailed report of onset, duration, and severity of symptoms, measures taken for relief, and when symptoms resolved
3. Notify JBPHH EOC immediately at (808) 449-1979
4. Discontinue water usage in the home and await further instructions from the EOC
5. Follow up with patient within 72 hours to ensure symptom resolution
Symptoms resolved?
NO
Follow up with PCM
a. Further evaluation
b. Work-up for other causes
YES
Ensure documentation reflects detailed onset, duration and severity of symptoms, measures taken for relief, and when symptoms resolved
*Common symptoms associated with fuel exposure:
• Nausea, vomiting, diarrhea
• Headache, dizziness
• Skin rash or itch
• Cough, shortness of breath