Extended Drinking Water Monitoring Plan

Joint Base Pearl Harbor-Hickam Public Water System
#HI0000360 and Aliamanu Military Reservation PWS
#HI0000337
O‘ahu, Hawai‘i

June 2024

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ACRONYMS AND ABBREVIATIONS

AMR	Aliamanu Military Reservation
Army	United States Army
CDC	Child Development Center
CDH	Child Development Home
COA	Course of Action
COC	Chain of Custody
DBIDS	Defense Biometric Identification System
DOH	State of Hawaii, Department of Health
DW LTM Plan	Drinking Water Long-Term Monitoring Plan, dated June 2022
EDMS	Environmental Data Management System
EDWM	Extended Drinking Water Monitoring
ELIPS	Extraction Limited Ion Profile Screening
EPA	United States Environmental Protection Agency
EOC	Joint Base Pearl Harbor-Hickam Emergency Operations Center
GC/FID	Gas Chromatograph/Flame Ionization Detector
GC/MS	Gas Chromatograph and Mass Spectroscopy
HCl	Hydrochloric Acid
HNO_3	Nitric Acid
IDWST	Interagency Drinking Water System Team
JBPHH	Joint Base Pearl Harbor-Hickam
JP-5	Jet Propellent 5
LTM	Long-Term Monitoring
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MDV	Medical, Dental, and Veterinary
mg	Milligram
mL	Milliliter
MRL	Method Reporting Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAH	Navy Aiea Halawa
NAVFAC	Naval Facilities Engineering Systems Command
Navy	United States Navy
NIST	National Institute of Standards and Technology
PAH	Polycyclic Aromatic Hydrocarbon
PE	Performance Evaluation
PIANO	Paraffins, Isoparaffins, Aromatics, Naphthenes, and Olefin
PID	Photoionization Detector
Plan	Extended Drinking Water Monitoring Plan
POC	Point of Contact
PWS	Public Water System
QC	Quality Control
SDWB	Safe Drinking Water Branch, State of Hawaii, Department of Health
S:N	Signal-to-Noise Ratio
SOP	Standard Operating Procedure

System	Public Water System #HI0000360 and #HI0000337
TAT	Turn-Around Time
TIC	Tentatively Identified Compound
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TPH-D	TPH-Diesel
TPH-G	TPH-Gasoline
TPH-O	TPH-Oil
TTHMs	Total Trihalomethanes
µg/L	Micrograms per Liter
U.S.	United States
VOA	Volatile Organic Analysis
WQAT	Water Quality Action Team

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1. INTRODUCTION

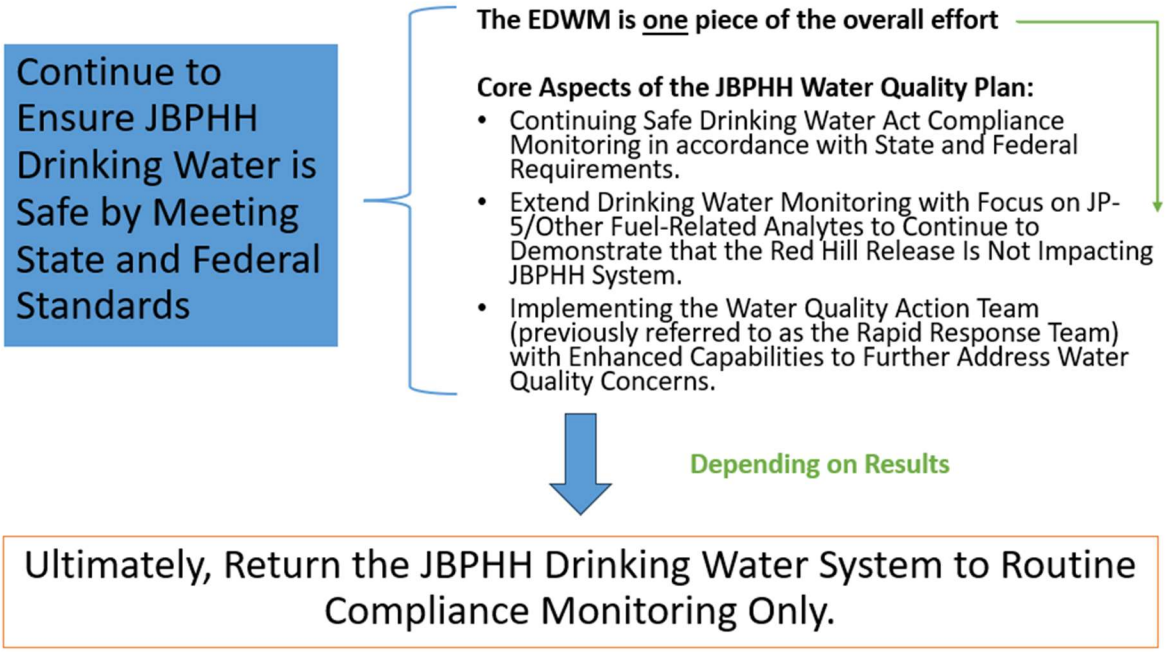
This Extended Drinking Water Monitoring (EDWM) Plan (Plan) was developed jointly by the U.S. Navy (Navy), the U.S. Army (Army), and a team of technical and subject matter experts. This Plan incorporates substantive comments and input provided by the United States (U.S.) Environmental Protection Agency (EPA) and State of Hawaii, Department of Health (DOH). As of March 2024, long-term monitoring (LTM) of the Public Water System (PWS) #HI0000360 and PWS #HI0000337 is complete. LTM was completed in accordance with the advisory requirements presented in the LTM Plan:

- *Drinking Water Long-Term Monitoring Plan for Joint Base Pearl Harbor-Hickam Public Water System #HI0000360 and Aliamanu Military Reservation PWS #HI0000337. O'ahu, Hawai'i, dated June 2022 (Interagency Drinking Water System Team [IDWST] 2022*; referred to herein as the DW LTM Plan).

For the purposes of this Plan, PWS #HI0000360 and PWS #HI0000337 will be considered a single distribution system divided into zones (System).

This Plan incorporates lessons learned from LTM (including refinements to analytical methods) and focuses on JP-5/other fuel-related analytes in order to continue to demonstrate that the November 2021 Red Hill release is not impacting the Joint Base Pearl Harbor-Hickam (JBPHH) System and, in conjunction with the other efforts summarized in Figure 1-1, continues to ensure the System meets all State and Federal Standards and remains safe for consumption. A figure explaining the overall JBPHH Water Quality Plan is shown below.

FIGURE 1-1: JBPHH WATER QUALITY PLAN



1.1 PRIMARY ELEMENTS OF THE EXTENDED DRINKING WATER MONITORING PLAN

This EDWM Plan has been implemented since the completion of LTM and reflects the most current sampling procedures and requirements. Surveillance metrics are applied to ensure that the water provided

by the System continues to be safe to drink and meets all State and Federal drinking water standards.[1] As stipulated in this Plan, the Navy will:

1) Sample the source, distribution lines, and houses/buildings for an additional 12 months to ensure that the drinking water continues to meet the requirements presented in this Plan. The sampling requirements outlined in this Plan will continue through March 2025;
2) Increase the number of zones being sampled from 19 to 20 by including Manana Housing in EDWM Sampling (shown on Figure 1-2);
3) Sample the houses on the System that were not sampled as part of the original DW LTM Plan (dated June 2022) with the goal to achieve 100% coverage (i.e., 100% of the houses on the System have been sampled at least once either during the original LTM Program or by end of 12-month EDWM Program). The Navy will provide residents with the opportunity to have their homes sampled with the overarching goal of sampling one hundred percent (100%) of all residences. Approximately 65% of residences within each Zone were sampled during LTM, leaving approximately 35% remaining during EDWM. Note: The Navy's objective is to sample 100% of the houses in Manana Housing during EDWM in order to be consistent with all other Zones;
4) Sample hydrants in zones where residences are sampled during the same month;
5) Sample the Waiawa Shaft (pre-chlorination and post-chlorination) and priority buildings (Schools, Child Care Centers, Medical Clinics) every month;
6) Sample the Navy Aiea-Halawa Shaft and Red Hill Shaft (pre-chlorination) quarterly for general water quality parameters;
7) Improve the analytical resolution of detections of Total Petroleum Hydrocarbon-Diesel (TPH-D) and TPH-Oil (TPH-O) via EPA Method 8015 by removing residual chlorine by quenching the sample with sodium thiosulfate—which is standard practice for drinking water samples—prior to sample collection, followed exclusively by micro-extraction (EPA Method 3511) prior to analysis via EPA Method 8015. This plan also includes a two-tiered approach for performing a detailed, quantitative analysis of petrogenic TPH detections;
8) Provide monthly and quarterly reports to EPA/DOH and the public/stakeholders (via the https://jbphh-safewaters.org website) which detail the status/progress of EDWM in each zone.
9) Collect EDWM Samples (in conjunction with the Navy's Water Quality Action Team's [WQAT's; formerly the Rapid Response Team]) at locations with consumer concerns regarding water quality. The protocols and procedures of the WQAT will be documented in a separate WQAT plan which will include Standard Operating Procedures (SOPs) for how the WQAT will respond to water quality concerns, collecting and analyzing drinking water samples, and implementing remedial actions (as necessary) based on the sample results. An overview of the Water Quality Action Team is presented in Figure 1-3.[2]

Note: In addition to the elements presented above, the EPA/DOH may analyze split samples during each month of sampling in order to independently assess the Navy's results.

[1] This Plan focuses on JP-5/other fuel-related analytes only in order to continue to demonstrate that the November 2021 Red Hill release is not impacting JBPHH System and, in conjunction with the other efforts summarized in Figure 1, continues to ensure the System meets all State and Federal Standards and remains safe for consumption.

[2] Note: The WQAT operates under a separate Water Quality Action Program implemented by the Navy at Red Hill and is not part of the EDWM Plan. This figure provides a high-level overview of the WQAT Program. If there are any discrepancies between this Figure and the WQAT Sampling Plan, the WQAT Sampling Plan will govern.

FIGURE 1-2: EDWM PLAN ZONES

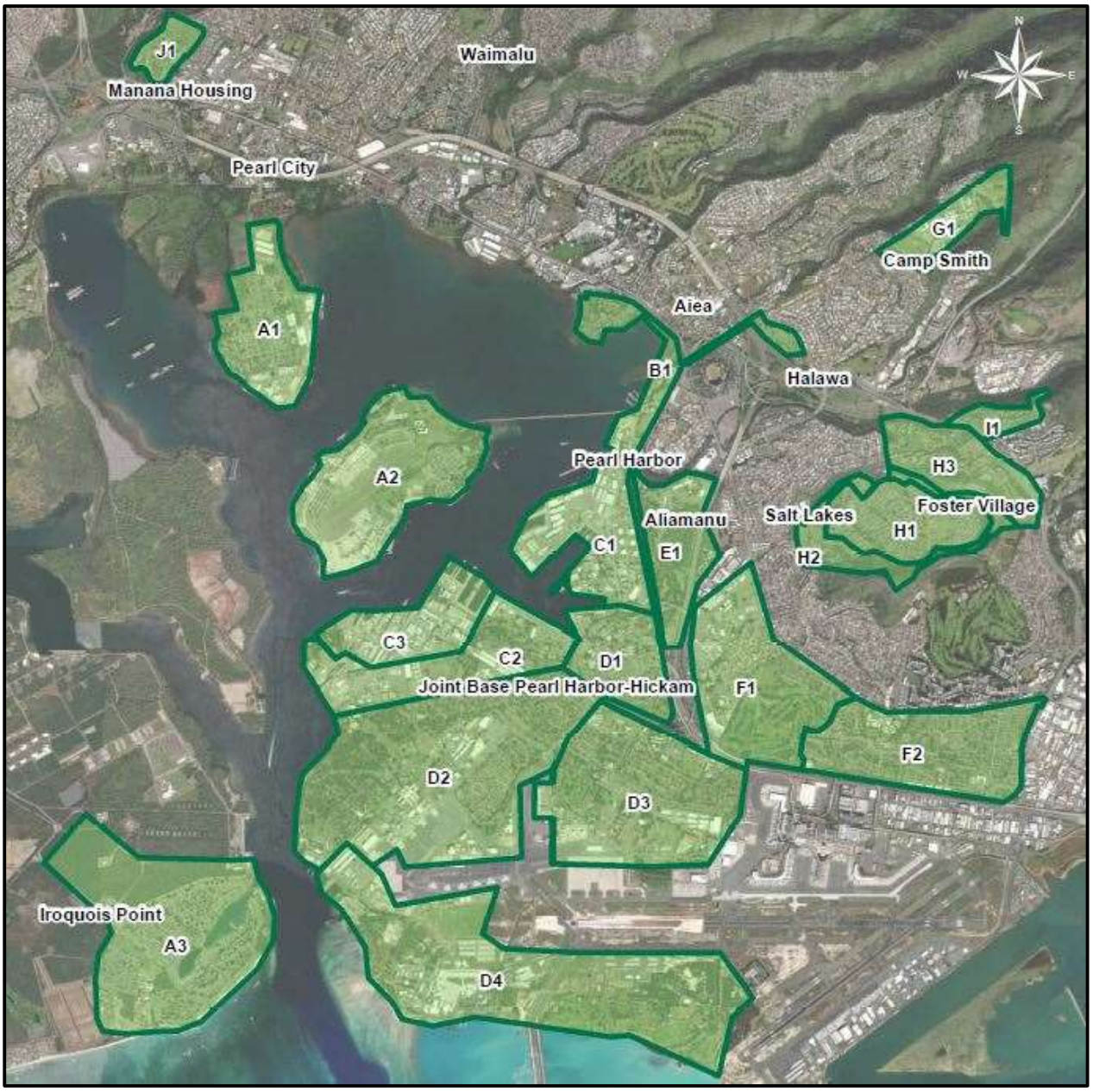
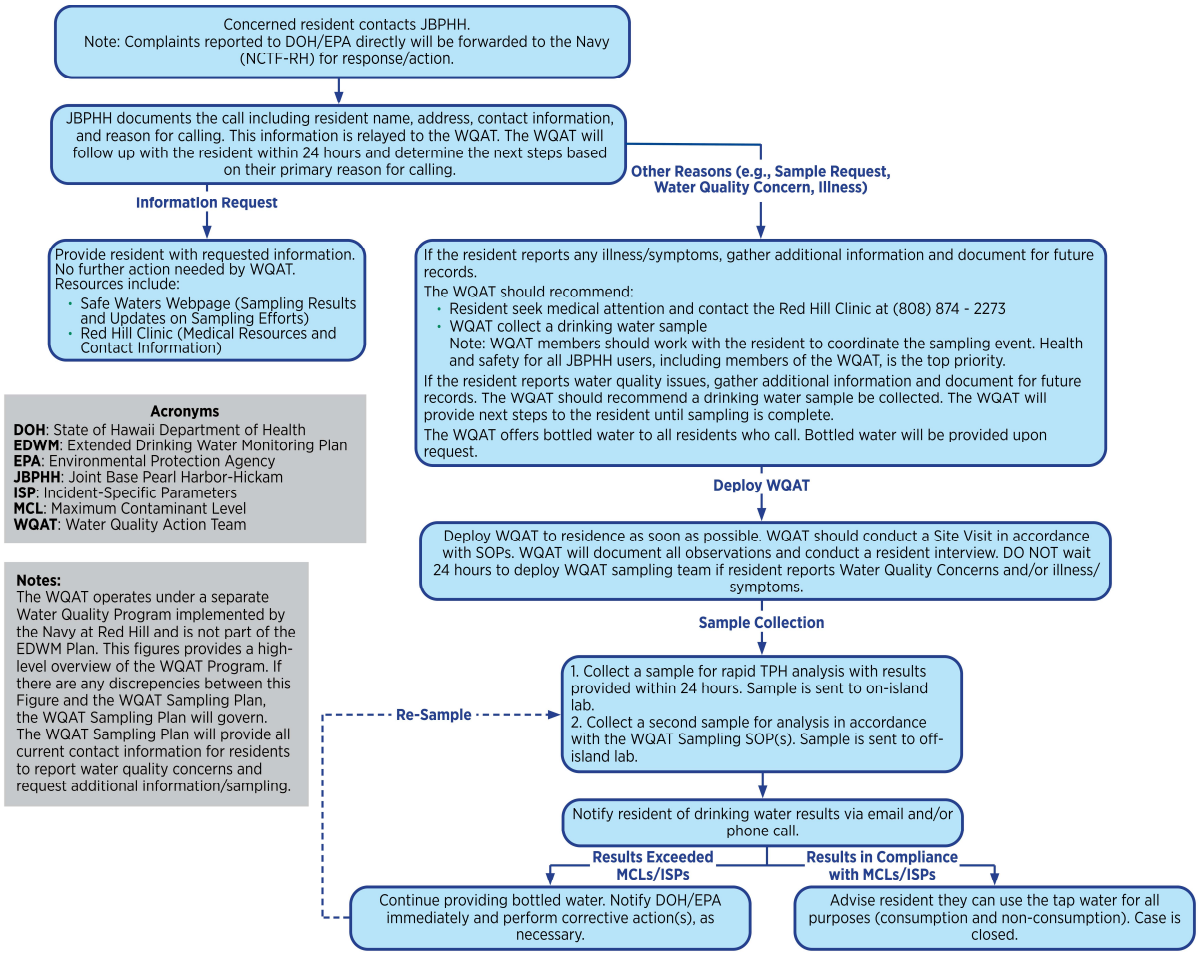


FIGURE 1-3: OVERVIEW OF THE WATER QUALITY ACTION TEAM



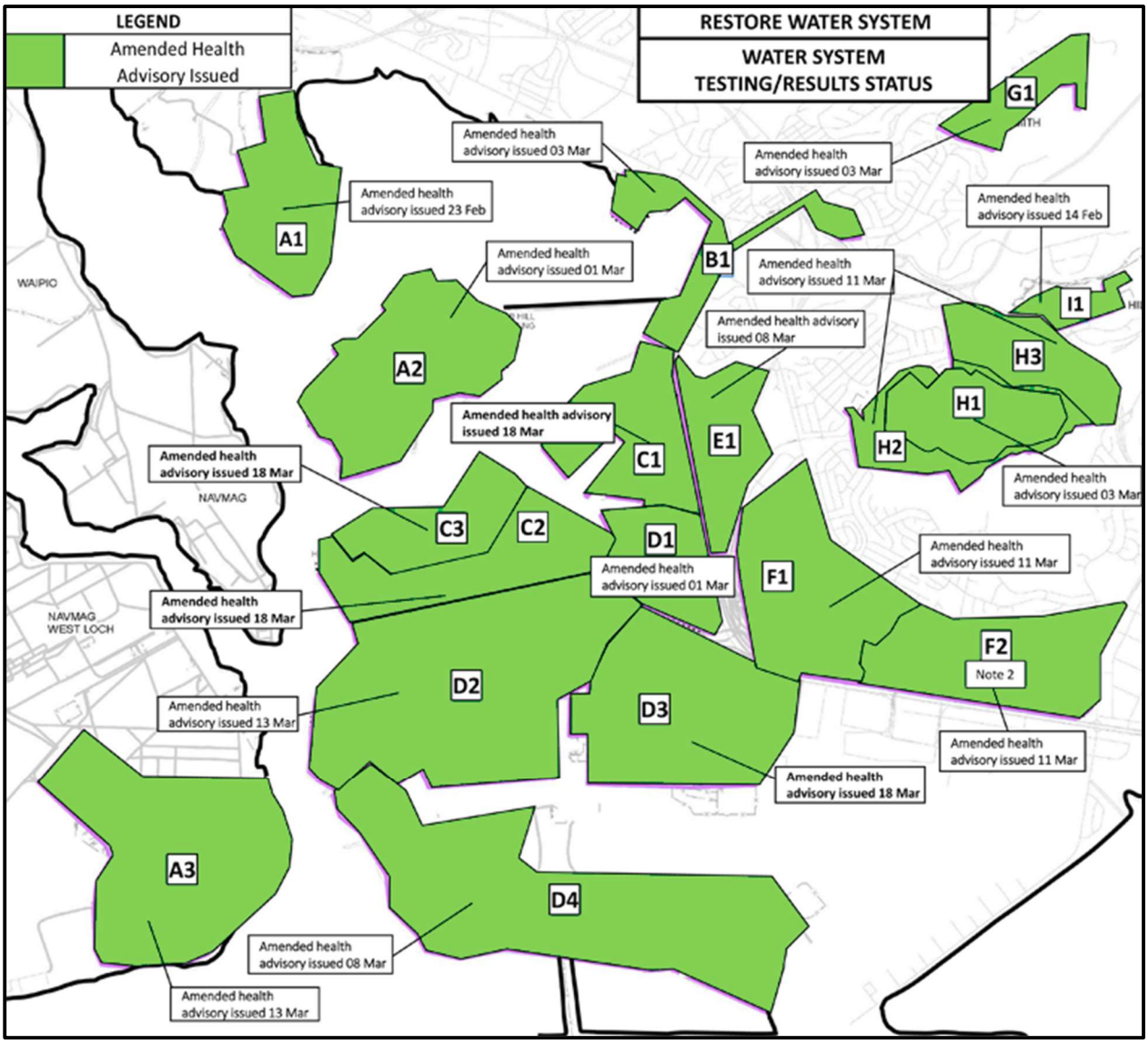
1.2 BACKGROUND

On November 20, 2021, approximately 20,000 gallons of JP-5 (petroleum, jet fuel) were released into the environment in the adit (tunnel) that is located above the Red Hill Shaft. Approximately 15,000 gallons were recovered during the initial emergency response. An unknown quantity of the unrecovered JP-5 migrated into the Red Hill Shaft. Both the Navy and DOH received complaints of a chemical or fuel odor and taste in the drinking water served by the System that serves approximately 93,000 consumers. On November 29, 2021, DOH issued a public health advisory recommending that Navy water system consumers avoid using water for consumption (e.g., drinking, cooking, and oral hygiene). The water distribution system was divided into 19 management zones (shown on Figure 1-2)[3] where systematic remedial action was conducted to remove petroleum contamination from the System through comprehensive flushing of the water distribution lines and premise plumbing.

[3] Manana Housing (the 20th Zone identified in this Plan) was not subject to the Health Advisories issued by DOH because the community was NOT on the JBPHH System in 2021. Manana Housing was switched to the JBPHH System after the Health Advisories were lifted in March 2022.

In order for DOH to amend its public health advisory, evidentiary benchmarks were developed, which included (among other things) sampling for indicators of contamination and response by-products as well as cross-connection surveys to understand the potential for contaminants to spread through the System. Beginning February 14, 2022, DOH began amending the health advisories for individual zones in accordance with the DOH Guidance on the Approach to Amending the Public Health Advisory (IDWST 2022). The health advisory amendment certified that drinking water in that zone was considered safe for consumption. By March 18, 2022, DOH had amended the health advisories for all 19 zones (see Figure 1-4) but had not lifted the health advisory for the entire JBPHH PWS. The Navy began long-term monitoring in accordance with the DW LTM Plan. On March 23, 2023, DOH lifted the health advisory for the entire system based on the results of extensive flushing, sampling, and testing activities performed in all 19 zones. Sampling in accordance with the DW LTM Plan was completed as of March 2024. LTM included the collection of over 9,200 drinking water samples from the source (i.e., Waiawa Shaft), distribution lines, houses/buildings, and conducting additional investigations to ensure drinking water was safe for human consumption (e.g., drinking, cooking, and oral hygiene).

FIGURE 1-4: DW LTM PLAN ZONES



2. EDWM SAMPLING PURPOSE AND IMPLEMENTATION

2.1 PURPOSE

The EDWM is a surveillance tool intended to identify and evaluate potential JP-5/other fuel-related impacts to continue to demonstrate that the November 2021 Red Hill release is not impacting the JBPHH System. The EDWM is one of the drinking water surveillance efforts that the Navy is implementing (see Figure 1-1) to continue to ensure the JBPHH drinking water is safe by meeting all State and Federal drinking water standards

2.2 IMPLEMENTATION

This Plan will be implemented through drinking water sampling.

2.2.1 EDWM Monthly Sampling

EDWM samples will be collected every month for 12 months. The EDWM sampling will focus on houses that were not sampled as part of the DW LTM Plan, with the goal of sampling 100% of the un-sampled houses on the System by the end of month 12 of EDWM (see Table 2-1). The Navy will sample the following locations and analyze for the parameters listed in Table 2-2:

- Waiawa Shaft (entry point to the distribution system): every month for most parameters and quarterly for others. Samples of the source water will be collected pre- and post-chlorination prior to distribution into the System.
- Navy Aiea/Halawa (NAH) Shaft and Red Hill Shaft raw, source water (pre-chlorination) quarterly. Note: These shafts do not provide drinking water to the JBPHH System. These samples are collected for information purposes only.
- Houses that were not sampled during the LTM Program will be selected for sampling in each of the 20 zones on the System (shown on Figure 1-2 and Table 2-1). A single drinking water sample will be collected from each house.
    - Approximately 65% of residences within each Zone were sampled during LTM, which leaves approximately 35% remaining to be sampled during EDWM. Note: 100% of the houses in Manana Housing will be sampled during EDWM in order to be consistent with all other Zones. 100% coverage is the overarching goal; however, the Navy will not force residents to have their homes sampled.
- Priority Buildings (i.e., Schools, Child Care Centers, Medical Clinics) in all zones every month; and
- Fire hydrants in zones where residences were sampled during the month (fire hydrants in zones where residences were not sampled during the month will not be sampled).

Note: EDWM Monthly Sampling will be implemented on a geo-spatial basis. Residences will be sampled each month in each zone and the sample locations will be geographically distributed throughout the zone to provide spatial coverage along the water supply lines. Commercial/industrial buildings will not be sampled as part of this Plan.

Additional details on the EDWM sample site selection process is provided in Section 3.1 of this Plan and in Appendix A for Scheduling and Sample Site Selection.

In accordance with Section 3.1.1 of this Plan, the Navy will provide a schedule and location of these samples to the EPA/DOH Safe Drinking Water Branch (EPA/DOH SDWB)[4] for their awareness one week prior to sample collection and will provide resident notification of sample collection. EPA/DOH SDWB may analyze split samples during each month of sampling in order to independently assess the Navy's results.

[4] The schedule will be provided to EPA/DOH SDWB in PDF format for map(s) of prospective/actual sampling locations and Excel format for chart of prospective sampling locations.

TABLE 2-1: ESTIMATE OF THE NUMBER OF SAMPLES BY ZONE AND BY MONTH

ZONE Name	ZONE	Residences[1]	CDH[2]	CDCs[3]	Schools[4]	MDVs[5]	Distribution System[6]	Shaft[7]	Residences Sampled	Residences Remaining[8]	Samples[9] (M1-M12)
Pearl City Peninsula	A1	635	1	-	-	-	6	-	423	212	248
Ford Island	A2	411	-	1	-	-	10	-	303	108	172
Iroquois Point	A3	1,459	-	-	2	-	8	-	959	500	652
McGrew/Halawa	B1	227	-	-	-	-	2	-	167	60	68
Sub Base	C1	-	-	1	-	4	6	-	-	-	96
Hale Alii Marine Barracks Hospital Point	C2	32	-	-	-	1	7	-	25	7	47
Shipyard Hospital Point	C3	6	-	-		-	2	-	6	-	8
Hale Moku Hokulani	D1	508	-	2	1	-	6	-	342	166	298
Hickam Hale Na Koa Officer Field Area Onizuka Village	D2	1,577	-	1	1	2	11	-	1,119	458	610
Earhart Village	D3	912	-	6	4	1	8	-	615	297	725
Hawaii Air National Guard	D4	-	-	-	-	1	2	-	-	-	20
Makalapa	E1	89	-	1	1	-	4	-	84	5	105
NEX Moanalua Terrace	F1	752	-	1	1	2	8	-	512	240	380
Catlin Park Maloelap Doris Miller Halsey Terrace Radford Terrace	F2	1,435	1	2	-	-	14	-	976	459	575
Camp Smith	G1	10	-	-	-	-	1	-	10	-	4
AMR	H1	918	-	4	-	-	3	-	635	283	391
AMR	H2	230	-	-	-	-	3	-	150	80	92
AMR	H3	379	-	-	-	-	3	-	248	131	143
Red Hill Housing	I1	135	-	-	1	-	1	-	93	42	106
Manana Housing[10]	J1	168	-	-	-	-	-	-	2	166	166
Waiawa Shaft	SH	-	-	-	-	-	-	1	-	-	24
NAH Shaft	SH	-	-	-	-	-	-	1	-	-	24
Red Hill Shaft	SH	-	-	-	-	-	-	1	-	-	24
	Total	**9,883**	**2**	**19**	**11**	**11**	**105**	**3**	6,669	3,214	**4,954**

Field Duplicates	10%
Field Blanks / Trip Blanks	480
PE Samples[11]	300
Requested/RR Samples[12]	5%
Split Samples with EPA[13]	TBD
Resamples	5%
Samples / Team / Day	7
Working Days / Month	20

Normal Samples/Month[9]	413
Field Dups	42
Requested/RR	21
Resamples	21
EPA Split Samples	TBD
Samples/Month	**497**
Samples/Day[14]	25
# Teams[15]	4
Total Samples	**5,962**

Notes:

1. Samples will be taken from the remaining residences in each zone (i.e., residences not sampled in LTM) in order to pursue 100% coverage by the end of the 12-month EDWM.
2. One sample will be taken from each child development home (CDH) each month.
3. Two samples will be taken from each child development center (CDC) each month.
8. Residence locations that were not sampled during the emergency phase or Long-Term Monitoring (LTM Periods 1 through 7).
9. Samples required per month for one year of extended drinking water monitoring.
10. Manana Housing samples will be taken from 100% of the total number of residences.

4. Five samples will be taken from each School each month.
5. One sample will be taken from each medical, dental, and veterinary (MDV) clinic each month.
6. One sample will be taken from each hydrant each month where residential sampling is conducted in that zone; sample from previously sampled hydrants. Larger zones may take more than one month to complete sampling. For planning purposes, it's assumed that each hydrant will be sampled twice.
7. The Entry Point to Distribution System is the Waiawa Shaft. Raw water locations (Red Hill Shaft and Navy Aiea-Halawa Shaft) will also be sampled for information purposes only.
11. Monthly Blind Performance Evaluation (PE) Samples forJP-5. Two samples per month at each of the following concentrations: 266 µg/L and 80 µg/L.
12. Requested and Water Quality Action Team samples. .
13. The EPA/DOH may analyze split samples during each month of sampling in order to independently assess the Navy's results.
14. The number of samples per day assumes 20 working days per month.
15. The number of teams assumes that each team collects seven samples per day.

TABLE 2-2: EDWM ANALYTICAL LIST

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 524.2	Benzene[1]	71-43-2	5	0.25	0.5	All	M	M/M	n/a	n/a
EPA 524.2	n-Butylbenzene	104-51-8	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 524.2	sec-Butylbenzene	135-98-8	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 524.2	Tert-Butylbenzene	98-06-6	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 524.2	Ethyl Benzene[1]	100-41-4	700	0.25	0.5	All	M	M/M	n/a	n/a
EPA 524.2	Isopropylbenzene	98-82-8	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 524.2	n-Propylbenzene	103-65-1	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 524.2	Toluene[1]	108-88-3	1000	0.25	0.5	All	M	M/M	n/a	n/a
EPA 524.2	1,2,4-Trimethylbenzene[1]	95-63-6	—	0.26	0.5	All	M	M/M	n/a	n/a
EPA 524.2	1,3,5-Trimethylbenzene[1]	108-67-8	—	0.25	0.5	All	M	M/M	n/a	n/a
EPA 524.2	Xylenes (Total) [1] • m,p-Xylenes • o-Xylenes	 1330-20-7 95-47-6	10000 — —	0.25 0.25 0.25	0.5 0.5 0.5	All	M	M/M	n/a	n/a
EPA 525.2	1-Methylnaphthalene[1]	90-12-0	—	0.25	0.5	All	M	M/M	n/a	n/a
EPA 525.2	2-Methylnaphthalene[1]	91-57-6	—	0.25	0.5	All	M	M/M	n/a	n/a
EPA 525.2	Naphthalene[1]	91-20-3	—	0.25	0.5	All	M	M/M	n/a	n/a
EPA 525.2	Acenaphthylene	208-96-8	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 525.2	Anthracene	120-12-7	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 525.2	Benzo[a]pyrene	50-32-8	0.2/0.2	0.01	0.02	All	M	M/M	n/a	n/a
EPA 525.2	Benzo[b]fluoranthene	205-82-3	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 525.2	Benzo[k]fluoranthene	207-08-9	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 525.2	Benzo[g,h,i]perylene	191-24-2	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 525.2	Chrysene	218-01-9	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 525.2	Dibenz[a,h]anthracene	53-70-3	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 525.2	Fluorene	86-73-7	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 525.2	Indeno[1,2,3-cd]pyrene	193-39-5	__	0.25	0.5	All	M	M/M	n/a	n/a
EPA 525.2	Phenanthrene	85-01-8	__	0.25	0.5	All	M	M/M	n/a	n/a

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	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	—[2]	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
EPA 524.2	Total trihalomethanes (TTHM): • Chloroform • Bromoform • Bromodichloromethane • Dibromochloromethane	TTHMs 67-66-3 75-25-2 75-27-4 124-48-1	80	0.25	0.5	All	M	n/a/M	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
SM 9223 B or Equivalent	Total Coliform	TOTAL_COL		—	—	All	M	n/a	n/a	n/a
SM 9215 B (IDEXX EasyDisc R2A (ASTM D8516-23))	Heterotrophic Plate Count: • Sample Hot Water • Sample Cold Water	HPC	—	—	—	All	M	M/M	Q	Q

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 200.7	**Cations**:		—			n/a	n/a	M/M	Q	Q
	• Sodium	7440-23-5		51	400					
	• Potassium	7440-09-7		250	1000					
	• Calcium	7440-70-2		53	400					
	• Magnesium	7439-95-4		31	200					
	• Iron	7439-89-6		10	20					
	• Manganese	7439-96-5		1.1	5					
EPA 200.7	Silica	7631-86-9	—	320	430	n/a	n/a	M/M	Q	Q
EPA method 300.1 Rev. 1.0	**Anions**:					n/a	n/a	M/M	Q	Q
	• Chloride	16887-00-6	—	400	500					
	• Sulfate	14808-79-8	—	400	500					
	• Fluoride	16984-48-8	4000	50	100					
	• Ortho-Phosphate-P	14265-44-2	—	35	50					
	• Chlorite	14998-27-7	1000	5	10					
	• Bromide	24959-67-9	—	25	50					
	• Bromate	15541-45-4	10	5	10					
	• Chlorate	14866-68-3	—	5	10					
EPA 504.1	Ethylene Dibromide	106-93-4	0.05	0.005	0.022	n/a	Q	Q	n/a	n/a
EPA 8270SIM	2-(2-Methoxyethoxy)-Ethanol	1002-67-1	—	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.

[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.

[2] There is currently no established MCL by EPA or DOH for TPHs. Total TPHs are being analyzed as another line of evidence for determining if JP-5 is potentially impacting the System and for identifying locations where additional investigation (e.g., additional analysis of laboratory data) may be required. TPH analytical methods (i.e., 8015) are not fuel-specific methods. These methods report the total amount (or concentration) of hydrocarbons present in the sample. Hydrocarbons can be petroleum (e.g., crude oil, JP-5, and other fuels), biogenic (i.e., organic compounds produced by living organisms such as algae or bacteria), or pyrogenic (i.e., produced via combustion). Many hydrocarbons are naturally occurring and are present in drinking water. Total TPH results alone do not indicate the presence of fuel in the System. Other key indicator analytes are used as a line of evidence for determining if JP-5 is impacting the System.

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

[3] These are not MCLs. These are Action Levels. Lead and copper are regulated by a treatment technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps.

3. EDWM Sampling Operations

The EDWM sampling operations are executed by three core teams (further detailed in the subsections below):

- Sampling preparation, supply inventory and management, and sample shipping operations
- Field sampling operations
- Chemists, data managers, and data quality control (QC) managers

Sampling operations—including field operations, sample scheduling and tracking, site notification, sample preparation, sample shipment, and sample transportation to the laboratory—are detailed in Appendix A.

3.1 Sample Site Selection

The quantity and locations of samples will be identified through the guidance in this section and the procedures described in Appendix A, SOP 3. The number of samples by zone and by month are summarized in Table 2-1. Zone, neighborhood, and address information for all associated schools, child development centers (CDCs), child development homes (CDHs), and medical, dental, and veterinary (MDV) clinics are presented in Table 3-1.

3.1.1 Scheduling and Sample Site Selection

The Navy will provide to EPA/DOH SDWB the selected sampling sites for review **at least one week** prior to the commencement of sampling to coordinate split sampling, as needed. The Navy will issue notices to residents. This process is further discussed in Appendix A of this Plan. Procedures for site selection are detailed in Appendix A, Scheduling and Sample Site Selection.

The EDWM sampling will focus on houses that were not sampled as part of the DW LTM Plan. The goal is to have 100% of the unsampled houses on the System sampled by the end of month 12 of EDWM (see Table 2-1).[5] Commercial/industrial buildings will not be sampled as part of this Plan.

MDV clinics and compromised communities (i.e., Long-Term Facilities, Retirement Communities, Independent Communities, Residential Care Homes) that service vulnerable populations will be included/listed in the EDWM as priority building sampling locations.

Table 3-1: Location Information for Schools, CDCs, CDHs, and MDV Clinics

Zone	Neighborhood / Bldg. Description	Category
A1	Pearl City Peninsula	CDH
A2	BLDG 350 – Ford Island CDC	CDC
A3	Iroquois Point Elementary	School
A3	Iroquois Point Preschool	School
C1	BLDG 1655 – Pier Side CDC	CDC
C1	BLDG 1535 – Medical Clinic/SARP – Pearl Harbor	MDV
C1	BLDG 1407 – Naval Station Pearl Harbor Dental & Navy Branch Health Clinic	MDV
C1	BLDG 1514 – Navy Medical Readiness Clinic (MRC)	MDV

[5] Approximately 65% of residences within each Zone were sampled during LTM, which leaves approximately 35% remaining to be sampled during EDWM. Note: 100% of the houses in Manana Housing will be sampled during EDWM in order to be consistent with all other Zones. 100% coverage is the overarching goal; however, the Navy will not force residents to have their homes sampled.

Zone	Neighborhood / Bldg. Description	Category
C1	BLDG 584 – CNSG MIDPAC Clinic	MDV
C2	BLDG 1750 – Pearl Harbor Navy Shipyard Environmental (Occ. Health) Clinic	MDV
D1	BLDG 204 - Kids Cove 24/7 CDC	CDC
D1	BLDG 930 - Center Drive CDC LE	CDC
D1	Pearl Harbor Kai Elementary School	School
D2	Hickam Elementary	School
D2	BLDG 63H - Hickam Harbor CDC	CDC
D2	BLDG 559H – 15th Medical Group & Hickam Pharmacy	MDV
D2	BLDG 554H – Occupational Health Clinic	MDV
D3	Hickam Main CDC	CDC
D3	Hickam West CDC	CDC
D3	BLDG 1859H – Makai Rec Center	CDC
D3	Pearl Harbor Church of Christ	CDC
D3	BLDG 1330 – Hickam Youth Center	CDC
D3	BLDG 1335H - Hickam School Age Center	CDC
D3	Chester Nimitz Elementary School	School
D3	Holy Family Catholic Academy (Holy Trinity School)	School
D3	Assets School	School
D3	Mokulele Elementary School	School
D3	BLDG 1864H – Public Health Command – Pacific Veterinary Clinic	MDV
D4	BLDG 3365H – Clinical Lab – Epidemiology	MDV
E1	BLDG 81 – Montessori Center	CDC
E1	Hale Keiki School	School
F1	Pearl Harbor Elementary	School
F1	Moanalua Pre-School – Kama'aina Kids	CDC
F1	Hook Orthodontics, Moanalua Shopping Center	MDV
F1	Pearl Family Dental Care, Moanalua Shopping Center	MDV
F2	Catlin School Age Children	CDC
F2	Peltier CDC	CDC
F2	Halsey Terrace	CDH
H1	BLDG 1783 – AMR CDC	CDC
H1	BLDG 1782 – AMR Child Youth Services Center	CDC
H1	BLDG 1795 – AMR Youth Activities Center	CDC
H1	BLDG 1875 – AMR YMCA	CDC
I1	Red Hill Elementary School	School

3.1.2 Alternate Sample Sites and Event Changes

Alternate sample site locations may be required for instances such as, but not limited to:

- High ambient photoionization detector (PID) reading
- Vacant location with no water or stagnant water
- Loose pets
- No key available from facility maintenance
- Ill resident in the home
- Unaccompanied minor in home
- Continued missed appointments by the tenant
- Tenants unwilling to support sampling

- Other unsafe conditions

In these instances, an alternate sample location (i.e., a different residence that was not sampled under the previous DW LTM program) and event change are required. Sampling teams have the capability to reprint labels in the field and update field logs to accommodate sample location changes. Procedures for selecting an alternate site, adjusting sample labels and chain of custody (COC) forms, and creating an Environmental Data Management System (EDMS) event change are presented in Appendix A, Scheduling and Sample Site Selection. Sample sites and event changes will be documented to include why a location was not sampled.

3.2 Field Sampling Operations

Field staff are responsible for collecting samples each day according to assignments prepared by the scheduling team. Field staff begin their day at the sample staging area to receive their assignments and sample collection kits. The sampling teams end their day at the sample staging area to return the sample collection containers so they can be prepared for transport to the analytical laboratories.

3.2.1 Field Sampling Team Staffing and Schedule

Field sampling operations are controlled by a senior operations manager, with assistance from a deputy operations manager. Each sampling team will consist of two (2) staff, a vehicle, and a sampling kit.

Prior to sampling, the field team will inspect all supplies and consumables to ensure they are acceptable for use. EDWM sample collection procedures are detailed in Appendix A Drinking Water Sample Collection SOPs.

3.2.2 EPA/DOH Field Oversight Team

The EPA/DOH field oversight team will be provided with Defense Biometric Identification System (DBIDS) access to JBPHH to randomly inspect the field sampling and/or sampling operations for quality assurance. The Navy, U.S. Marine Corps, and Army must provide base access to EPA/DOH personnel engaged in this oversight. Upon receipt of the sampling plan, if EPA/DOH representatives desire to inspect sampling operations, EPA/DOH will submit for DBIDS installation access to allow for a week of processing. The Department of Defense must either provide EPA/DOH staff or the EPA/DOH contractor with DBIDS credentials (for the duration of EDWM) or escort upon request.

3.3 Chemistry and Data Management

A team of chemists and data managers will track and verify the laboratory data as it is uploaded into EDMS. Dedicated staff and redundant chemist lab coordinators will focus on communicating with each lab. Lab coordinators serve as the primary liaison with the water quality labs, and their daily contact with the labs results in quicker lab processing of samples.

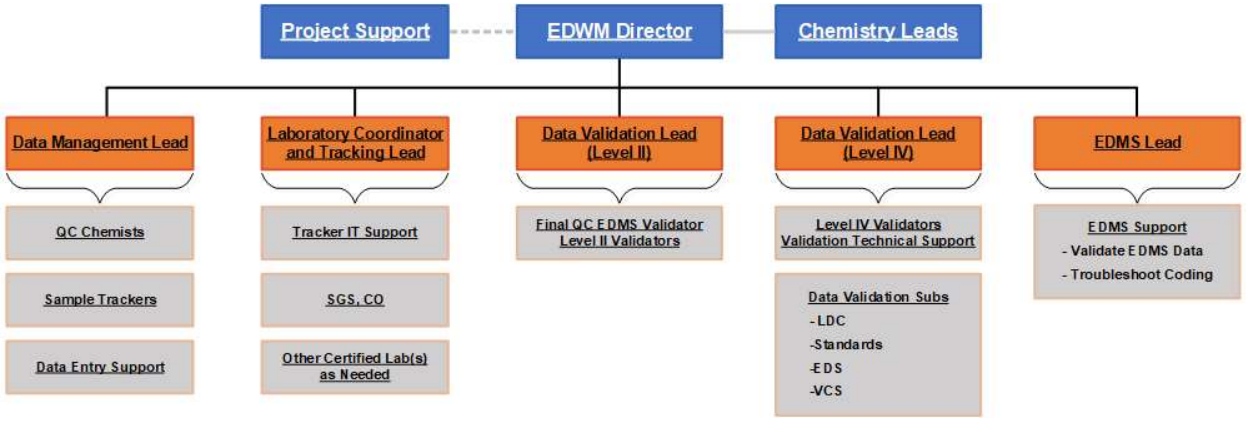
Lab coordinator responsibilities are listed below:

- Coordinate with the lab
- Act as the lab point of contact (POC)
- Input sample status into the tracker
- Check that the lab uploaded data
- Review initial lab data

Additional dedicated staff will serve in support and back-up roles for each of the lab coordinators, in many cases assigning people from the labs or other time zones, to promote full-time coordination.

The team of chemists and data managers is presented in Figure 3-1.

FIGURE 3-1: CHEMISTRY TEAM



3.3.1 Laboratory Analytical

Analytical laboratories are currently under contract to provide an expedited turn-around-time (TAT) on sample analytical results. However, there may be instances when the requested TAT is exceeded and will have to be individually managed.

Table 3-2 lists, for each parameter, the sample containers, preservatives, and applicable holding times as required by SW-846 and state and federal drinking water methods. All required analytical supplies, sample containers and preservatives, and shipping supplies will be provided by the analytical laboratory.

TABLE 3-2: SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

Parameter	Analytical Method	Container	Preservative	Holding Times (Extraction/ Analysis)
Volatile Organic Compounds (including TTHMs)	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	7 days to extraction/ 40 days extraction to analysis
Metals (Copper and Lead Only)	200.8	250 mL Poly	1 mL HNO_3, pH<2	6 months
Mercury	245.1	250 mL Poly	1 mL HNO_3, pH<2	28 days

Parameter	Analytical Method	Container	Preservative	Holding Times (Extraction/ Analysis)
JP-5 (TPH-D and TPH-O)	3511 (Hexane) with High Volume Injection)/8015 (Micro-Extraction)	3 x 60 mL Glass VOA	0.5 mL HCl (added in the laboratory). Quench with sodium thiosulfate (added prior to sample collection).	7 days (unless preserved in the field)
JP-5 (TPH-G)	5030/8260	3 x 40 mL Glass VOA	0.5 mL HCl	14 days
TOC	SM 5310	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)	Hach Method 08021	This parameter will be analyzed in the field.		
Temperature (Field Test)	170.1	This parameter will be analyzed in the field.		
pH (Field Test)	150.3	This parameter will be analyzed in the field.		
Conductivity (Field Test)	SM 2510 B	This parameter will be analyzed in the field.		
Turbidity (Field Test)	SM 2130 B	This parameter will be analyzed in the field.		
Total Alkalinity	SM 2320 B	150 mL Plastic or Glass	Cool to ≤ 4 °C	14 days
Coliform, Total	SM 9223 B	125 or 150 mL Sterilized Plastic Bottle	$Na_2S_2O_3$, and cool to < 10 °C	24 hours
Heterotrophic Plate Count w/ R2A Agar	SM 9215 B	125 or 150 mL Sterilized Plastic Bottle	$Na_2S_2O_3$, and cool to < 10 °C	8 hours
Cations	200.7	Plastic or Glass	Acidify to pH < 2 with HNO_3	6 months
Silica	200.7	200 mL Plastic	Cool to ≤ 4 °C	28 days
Anions (Bromide, fluoride, chloride, sulfate)	300.1 Rev. 1.0	500 mL Plastic or Glass	Cool to ≤ 4 °C	28 days
Anions (bromate and chlorate)	300.1 Rev. 1.0	500 mL Plastic or Glass	50 mg/L EDA and Cool to ≤ 4 °C	28 days
Anions (ortho-Phosphate-P)	300.1 Rev. 1.0	500 mL Plastic or Glass	Cool to ≤ 4 °C	48 hours

Parameter	Analytical Method	Container	Preservative	Holding Times (Extraction/ Analysis)
Anions (chlorite)	300.1 Rev. 1.0	500 mL Plastic or Glass	50 mg/L EDA and Cool to ≤ 4 °C	14 days
Ethylene Dibromide	504.1	40 mL Teflon Septum Glass	75 µg/L $Na_2S_2O_3$	14 days
2-(2-Methoxyethoxy)-Ethanol	8270SIM (Direct Injection)	2 x 40 mL Glass VOA	Unpreserved	7 days
PIANO VOCs	5030C/8260D	2 x 40 mL Glass VOA	25 mg Ascorbic / 3 drops HCl	14 days
PAHs/Alkylated PAHs	3510C (Methylene chloride)/8270E -SIM	2 x 1 L Amber Glass	Quench with sodium thiosulfate (added prior to sample collection).	7 days to extraction/ 40 days extraction to analysis
Saturated Hydrocarbons	3510C (Methylene chloride)/8015 D	2 x 1 L Amber Glass	Quench with sodium thiosulfate (added prior to sample collection).	7 days to extraction/ 40 days extraction to analysis

Note: All samples will be chilled to < 6°C, unless otherwise noted.
EPA Method 8015 is not a drinking water method and is typically run on unchlorinated water samples. However, the JBPHH drinking water samples are chlorinated. Therefore, EDWM samples will be quenched with sodium thiosulfate prior to sample collection to stop chemical reactions from occurring between chlorine and reagents added to the sample by the laboratory as required by the method. This is done for drinking water analysis (e.g., drinking water methods 524.2 and 525.2/525.3).
n-Paraffins, Iso-paraffins, Aromatics, Naphthenes, and Olefins (PIANO).
Polycyclic aromatic hydrocarbons (PAHs) and Alkylated-PAHs.

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

3.3.2 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% of the number of normal samples and field reagent blanks from all Zones. Trip blanks will be collected daily during each sampling event in accordance with the procedures described in Naval Facilities Engineering Systems Command (NAVFAC) Pacific Environmental Restoration Program Project Procedure III-B, *Field QC Samples* (Water, Soil; Navy 2015) and as specified in the respective drinking water methods. The following additional QC measures will be implemented:

- The number of reagent field blanks will be doubled, and all reagent field blanks will be submitted "blind" to the laboratory (i.e., the sample number and chain of custody will not indicate that the sample is a blank).
- Matrix spike (MS)/matrix spike duplicate (MSD) samples for Method 8015 will be spiked at the MRL (80 µg/L) in order to be more consistent with expected results.

- Monthly Blind Performance Evaluation Samples for JP-5 will be submitted to the laboratory. A minimum of 2 samples per month will be submitted to the laboratory at the following concentrations of JP-5: 266 µg/L and 80 µg/L.

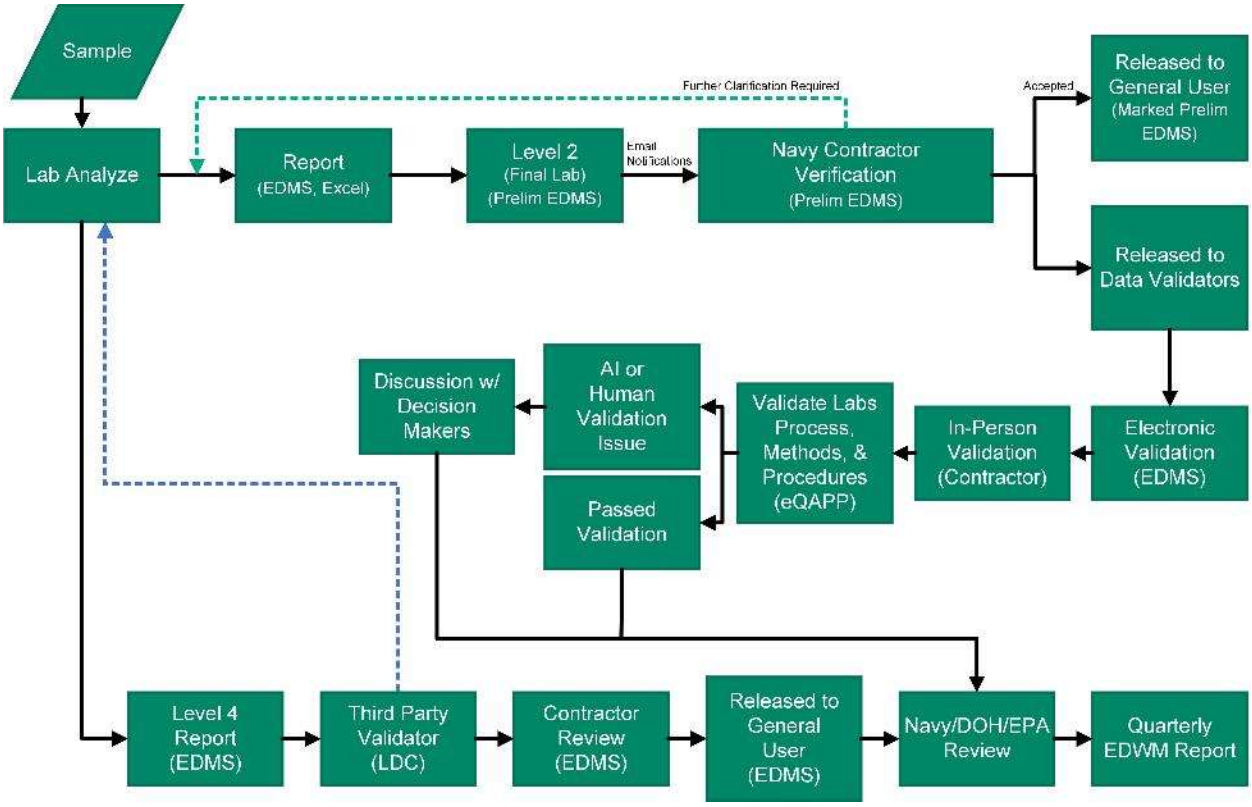
EPA/DOH may analyze split samples during each month of sampling in order to independently assess the Navy's results. The analytical laboratory will report non-detected results to the MDL. Values between the MDL and the MRL will be flagged as estimates ('J' flag).

Level 2 and Level 4 data packages will be provided by the laboratory for all EDWM samples that are collected according to the schedule in Figure 4-2. Ten percent of the drinking water compliance samples (randomly selected from all Zones) will undergo Level 4 data validation by an independent validator (i.e., the validator will be independent of the laboratory that performed the analyses). This percentage of samples undergoing Level 4 validation is per zone each month and may be increased depending on the number, type, and severity of corrective actions that are identified by the data validator; however, the percentage per Zone in each period can fluctuate to accommodate the number of samples collected. The remaining samples will undergo Level 2A data validation.

3.3.3 Laboratory Data Review Process

Figure 3-2 illustrates the laboratory data analysis and validation process. As shown in Figure 3-2, once lab data is entered into EDMS and verified, Level 2 and Level 4 validation efforts start. Level 2A validation includes both a computerized validation and manual review/validation by chemists. Both processes generally act together to produce the Level 2A validation in a timely manner. However, as is the case with any laboratory analyses, some samples will not pass this QC step and will be singled out for further discussion with the Navy/Army Team. A record of the discussion and decision must be memorialized and submitted to EPA/DOH. Level 4 validation is a separate process that starts with the labs providing Level 4 data packages, which are reports that are hundreds or thousands of pages long. Those packages are validated by a data validator contractor, an independent third-party validator, and further reviewed for approval by the Navy/Army Team.

FIGURE 3-2: LAB DATA REVIEW PROCESS FLOWCHART



3.4 DATA MANAGEMENT

Data will be uploaded to EDMS and be available in a comprehensive, full system view, as well as per Zone. All field sample results associated with the EDWM program will also be included in EDMS in accordance with the Interagency Drinking Water System Team – Data Management Plan, dated 24 January 2022 (IDWST 2022).

4. EDWM SCHEDULE

The EDWM sampling will begin in April 2024, one month after the completion of the 24-month LTM Sampling Program (i.e., March 2024), as summarized in Figure 4-1. Sampling will be performed on a monthly basis as specified in Table 2-1 and Table 2-2. Analytical data will be evaluated and posted to the https://jbphh-safewaters.org/ website on a monthly basis. Depending on when data validation is complete, results from some samples may not be available/posted on the website until the following month. Quarterly reports that summarize the previous 3-months of EDWM data will be posted on the https://jbphh-safewaters.org/ website in July 2024, October 2024, and January 2025. The final quarterly report will be included in the Final Report for the entire 12-Month EDWM Sampling Program and will be posted May 2025. The total number of samples collected from month to month will be similar to that presented in Table 2-1, to the extent practicable, in order to ensure laboratory capacity.

FIGURE 4-1: 12-MONTH EDWM SAMPLING SCHEDULE

First Quarter			Second Quarter			Third Quarter			Fourth Quarter			EDWM Complete
1	2	3	4	5	6	7	8	9	10	11	12	
Apr '24	May '24	June '24	July '24	Aug '24	Sep '24	Oct '24	Nov '24	Dec '24	Jan '25	Feb '25	Mar '25	May '25
Sample Per Tables 2-1 & 2-2	Sample Per Tables 2-1 & 2-2	Sample Per Tables 2-1 & 2-2	Sample Per Tables 2-1 & 2-2	Sample Per Tables 2-1 & 2-2	Sample Per Tables 2-1 & 2-2	Sample Per Tables 2-1 & 2-2	Sample Per Tables 2-1 & 2-2	Sample Per Tables 2-1 & 2-2	Sample Per Tables 2-1 & 2-2	Sample Per Tables 2-1 & 2-2	Sample Per Tables 2-1 & 2-2	
Analysis & Monthly Report on Website	Analysis & Monthly Report on Website	Analysis & Monthly Report on Website	Analysis & Monthly Report on Website	Analysis & Monthly Report on Website	Analysis & Monthly Report on Website	Analysis & Monthly Report on Website	Analysis & Monthly Report on Website	Analysis & Monthly Report on Website	Analysis & Monthly Report on Website	Analysis & Monthly Report on Website	Analysis & Monthly Report on Website	
			First Quarterly Report			Second Quarterly Report			Third Quarterly Report			Fourth Quarterly & **Final Report**

The subtasks and assumed days to complete are presented in Figure 4-2.

FIGURE 4-2: 12-MONTH EDWM SUBTASKS AND ASSUMED BUSINESS DAYS TO COMPLETE

EDWM Subtasks	Sampling	Sample Shipping	Laboratory Analysis	Lab Reports (Level I Package)	Level II Data Validation	Level II Packages Available to Navy/ Army	Navy/ Army Data Review	Lab Results (Level IV)	Level IV Data Validation	Level IV Available Navy/ Army	Analysis and Monthly Update on Website	HI DOH Review	Total Duration
Monthly Sampling	20	2	3	1	3	1	5	7	7	1	3	2	55

5. RESPONSE TO A DETECTION OR AN EXCEEDANCE

5.1 SAMPLE RESULT EXCEEDANCE DATA PACKAGE

In the event monitoring identifies an exceedance of an MCL presented in Table 2-2, the System will provide EPA/DOH an information package on the sample of concern. The information package will include, but not be limited to:

1. Notification to the EPA and DOH SDWB within 24 hours of receipt of a report of an anticipated exceedance from the laboratory (preliminary, DO NOT wait until Level 2 validation is complete). The resident will also be notified (if the sample was collected from a residence);
2. Location address and Zone;
3. Field crew notes (which will be scanned daily and posted to EDMS); and
4. Select information from the Sample Tracker Spreadsheet (or its replacement when the tracker is moved to EDMS).

Proceed to Section 5.2 for the course of action (COA) scenarios the System will execute within five (5) calendar days of reporting the exceedance. The schedules and milestones within Section 5.2 are subject to change with the approval of EPA/DOH.

5.2 NEXT STEPS AFTER DETECTION OR EXCEEDANCE

Following receipt of data indicating a detection or an exceedance of an MCL presented in Table 2-2, additional action will be taken in accordance with the applicable COA provided in this section. Four (4) COAs were developed to cover the following scenarios:

- COA 1: Distribution System (i.e., Fire Hydrant) Exceedance of an MCL
- COA 2: House/Building Exceedance of an MCL
- COA 3: Detection of TPH via Method 8015/8260
- COA 4: Detection of Other Analytes with No Respective MCL, Except Water Quality Parameters and HPC, or at Concentrations Less than the MCL in the Distribution System

The applicable COA is contingent on where (e.g., distribution system, residence, other buildings) the detection/exceedance occurred and what analyte was detected/exceeded. A list of analytes and the associated COA is provided in Table 2-2. The schedules and milestones within this section are subject to change in consultation with EPA/DOH. EPA/DOH SDWB will notify the Navy/Army to request site access should EPA/DOH SDWB decide to collect samples for any of the following COAs. The Navy/Army shall provide for prompt access.

5.2.1 COA 1 – Distribution System (i.e., Hydrant) Exceedance of an MCL

This COA applies when monitoring identifies an exceedance of an MCL presented in Table 2-2 within the water distribution system at a hydrant during EDWM. The Navy must inform EPA/DOH SDWB prior to steps 3 through 8 below.

1. Notify EPA/DOH SDWB within 24 hours of receipt of the lab report (preliminary, DO NOT wait until Level 2 validation is complete).
2. Provide EPA/DOH SDWB an information package consisting of items 1-4 listed in Section 5.1.
3. The Navy will identify a minimum of two (2) bracketing hydrant points in addition to the original exceedance location (3 total).
4. Inspect the hydrant for presence of lubricants that may be present due to routine operation/maintenance, document the findings, and notify EPA/DOH SDWB. If lubricants are found, then the COA may stop at this step. Otherwise, proceed to step 5.

5. Flush each hydrant sufficiently to bring fresh water from the nearest mainline junction.
6. Re-Sample.
7. Analyze for the method(s) specified for each exceeded analyte(s).
8. If the results of re-sampling of the initial hydrant are above MCLs, but results from bracketed samples are below MCLs, repeat sampling of the initial hydrant for the analyte(s) in question.
9. Refer to "Remedial Actions" for different re-sampling result outcomes for the associated response.

5.2.2 COA 2 – House/Building Exceedance of an MCL

This COA is for analyte exceedance(s) reported within a house/building premise plumbing during EDWM. The Navy must inform EPA/DOH SDWB prior to steps 5 through 10 below.

1. Notify EPA/DOH SDWB within 24 hours of receipt of the lab report (preliminary, DO NOT wait until Level 2 validation is complete).
2. Provide information package items 1-4 listed in Section 5.1.
3. Provide additional investigator information within 24 hours of a reported exceedance to include the following items, pending availability:
    a. Available plumbing as-builts; and
    b. Maintenance records for the subject facility or residence.
4. Notify the house/building tenant of the exceedance and provide a recommendation regarding water use.
5. If the Navy/Army team suspects the contaminant of exceedance originated from the fixture, the Navy/Army may elect to: 1) replace the fixture; 2) sample;[6] 3) flush for a minimum of 15 minutes; and 4) re-sample. If the post-flush confirmation sampling results do not exceed MCLs in Table 2-2, then the COA may stop at this step. If the post-flush confirmation sampling results exceed MCLs in Table 2-2, proceed to step 6.
6. The Navy/Army will direct sampling for the original fixture location plus a minimum of one additional interior fixture in the subject building.
7. The Navy/Army will consult with EPA/DOH to determine if bracketed sampling (i.e., sampling one house upstream and one house downstream of the subject home) is required based on Steps 1 – 6. Re-sample without pre-flushing.
8. Analyze for the method(s) specified for the exceeded analyte(s) from Table 2-2.
9. Once the Navy verifies that the exceedance is cleared with validated laboratory data, the Navy will notify the tenant and EPA/DOH that the house/building can resume water use with no recommended restrictions.
10. Refer to "Remedial Actions" in Section 5.3 for different re-sampling result outcomes for the associated response.

5.2.3 COA 3 – Detection of TPH via Method 8015/8260

This COA is for TPH-G, TPH-D, and/or TPH-O (Total TPHs) detected via method 8260/8015. A two-tiered approach will be followed to perform additional, detailed analyses of TPH detections. The complexity and analytical resolution increases in each tier. Not all locations will proceed to Tier 1 and/or Tier 2. An Initial Assessment will be performed to determine if additional evaluation via Tier 1 and/or Tier 2 is necessary. The Initial Assessment includes an assessment of blank contamination and an assessment of TPH-O. The tiers are summarized below, followed by a detailed description of the SOPs:

- **Initial Assessment:** This step is to verify the TPH result reported by the laboratory is not associated with blank contamination (i.e., method blank, field blank, and/or blind blank). If the results are associated with blank contamination, the sample will not be evaluated under Tier 1 or Tier 2. If

[6] Pre-flush sampling may be skipped with EPA/DOH approval.

additional information is needed, that location may be re-sampled and re-evaluated. The initial assessment also evaluates if TPH was detected in the TPH-G, TPH-D, or TPH-O ranges. If the TPH result is associated with TPH-O, no further evaluation is warranted because TPH-O is not associated JP-5/other Fuels and is likely indicative of a location-specific impact (e.g., lubricants used at the location). If the results are not associated with blank contamination (or the results of the re-sample are not associated with blank contamination) and the TPH result is not associated with TPH-O, the evaluation will proceed to Tier 1.

- **Tier 1:** A screening step used to determine (in most cases) whether or not Tier 2 is performed (see Table 5-1 for details). Tier 1 includes a detailed review of laboratory method blanks, chromatograms, and Mass Spectral Confirmation to determine if the Method 8015 TPH detection is due to laboratory contamination, a petrogenic source (i.e., JP-5/other fuel-related analytes), a non-petrogenic source, or inconclusive. The results of Tier 1 will be documented in a Technical Memorandum. If Tier 1 concludes that the Method 8015 TPH detection is not due to a JP-5/other fuel-related petrogenic source, then the Tiered evaluation will STOP at Tier 1. Otherwise, the evaluation will proceed to Tier 2.
- **Tier 2**: Includes a quantitative evaluation of petroleum hydrocarbons using advanced analytical methods. Drinking water samples will be analyzed using detailed, forensic methods:
    - EPA Method 8260D – PIANO
    - EPA 8270E-SIM – PAHs and alkylated-PAHs
    - EPA 8015D – Saturated Hydrocarbons

  A quantitative evaluation of the human health risks associated with potential exposure to these constituents in drinking water will be performed.

Table 5-1 presents the criteria for determining where Tier 1 and Tier 2 will be performed.

TABLE 5-1: SUMMARY OF NUMBER OF TIER 1/TIER 2 EVALUATIONS FORECASTED FOR EDWM

Tier Trigger	Required Number of Locations	Maximum Number of Tiered Analyses Performed
Tier 1: EDWM locations with 8015-MEQ TPH result > MDL	See →	• 50 locations: 8015-MEQ TPH result > MDL and < MRL • 50 locations: 8015-MEQ TPH result > MRL and < 150 µg/L • All locations: 8015-MEQ TPH result >= 150 µg/L
Tier 2: EDWM locations with 8015-MEQ TPH result > MDL and < MRL And Triggered by Tier 1	None required unless triggered by Tier 1	50 locations
Tier 2: EDWM locations with 8015-MEQ TPH result > MRL And Triggered by Tier 1	None required unless triggered by Tier 1	200 locations
Tier 2: Locations with a previous 8015 TPH detection (using non-quenched/separatory funnel preparatory method) result > 50 µg/L during LTM	50 Required regardless of the outcome of Tier 1. These locations will be spatially and temporarily (i.e., locations will be sampled over the duration of EDWM) distributed throughout the JBPHH System and representative of the range of TPH concentrations detected during LTM	50 locations

Background: Method 8015 will be performed on drinking water samples using micro-extraction (Method 3511) and quenching of the samples with sodium thiosulfate. The Navy must inform EPA/DOH SDWB regarding actions to be taken prior to each step below.

1. Notify EPA and DOH SDWB within 24 hours of receipt of the lab report (preliminary, DO NOT wait until Level 2 validation is complete).
2. Provide information package items 1-4 in Section 5.1.
3. Provide additional investigator information within 24 hours of a reported detection to include the following items, pending availability:
    a. Available plumbing as-builts; and
    b. Maintenance records for the subject facility or residence.
4. Notify the house/building tenant of the detection and provide a recommendation regarding water use.

Initial Assessment

5. Compare the results and chromatograms of the respective method blank, field blank, and/or blind blank. If there is evidence of blank contamination (determined using numerical and pattern recognition), the sample will not be evaluated under Tier 1 or Tier 2. If additional information is needed, that location may be re-sampled and re-evaluated. If there is also evidence of blank contamination in the duplicate sample, then flag the result with "B" or "UB" and conclude that the result was due to lab contamination.

❖ ***Decision Rule***: If the Total TPH result is associated with blank contamination, the evaluation will STOP here, and the findings will be documented in a Tech Memo. If the duplicate result is above the MRL and there is no evidence of blank contamination, then proceed to the next step. If the results of the blank contamination evaluation are inconclusive, then proceed to the next step.

6. Compare the Total TPH chromatograms to chromatograms for TPH-O (using numerical and pattern recognition).

❖ ***Decision Rule:*** If the Total TPH result is conclusively identified as TPH-O and does not include contributions from TPH-G and/or TPH-D, the evaluation will STOP here, and the findings will be documented in a Tech Memo. If the Total TPH result <u>is not</u> conclusively identified as TPH-O, then proceed to Tier 1.

Tier 1: Mass spectral Confirmation

7. Analyze the sample from Method 8015 using full scan Gas Chromatograph and Mass Spectroscopy (GC/MS) via Method 8270. Be sure that the MRL is the same or lower than the MRL (typically 80 µg/L) from Method 8015 (Gas Chromatograph/Flame Ionization Detector [GC/FID]). Evaluate the Total Ion Chromatogram of the sample and its corresponding method blank.
    - ***Step 1***: For the sample, retain all peaks that are above a 3:1 signal-to-noise (S:N) ratio.
    - ***Step 2***: For peaks retained from Tier 1: Step 1, retain all peaks that have a response greater than 5 times that found in the method blank.
    - ***Step 3***: Obtain the mass spectrum and perform a background subtraction (including all blank contamination present below the MRL/MDL) for each peak retained from Tier 1: Step 2.
    - ***Step 4***: Perform a Tentatively Identified Compound (TIC) search evaluation on each peak retained from Tier 1: Step 3 by comparing the corrected mass spectrum to a National Institute of Standards and Technology (NIST) mass spectral library.[7] Retain the top 5 probability matches for each. Retain a list of all TICs with an 80% probability match or higher.

❖ **Decision Rule**: Multiple lines of evidence will be evaluated and the results will be documented in a Tech Memo. Evaluate chromatograms, Extraction Limited Ion Profile Screening (ELIPS), and additional chemistry data from the laboratory to determine if the detected TPH is JP-5/other fuel-

[7] The NIST library match should also include the class of compound and not just individual chemical name (e.g., also try to match trimethylbenzenes as a class rather than restricting the library match to individual analytes only [e.g., 1,2,4-trimethylbenzene]).

related analytes or is associated TPH-O, and/or with "naturally occurring" hydrocarbons. If results are conclusive (i.e., TPH detect is not associated with JP-5/other fuel-related analytes) – the results of the evaluation will be documented in a Technical Memorandum and the COA will STOP here.
Process: Compare all analytes retained from Tier 1: Step 4 to the list of all analytes associated with PIANO/PAHs/Alkylated PAHs/Saturated Hydrocarbons analyses. If there are any analytes identified from Tier 1: Step 4 that appear on the PIANO/PAHs/Alkylated PAHs/Saturated Hydrocarbons analyses list, proceed to Tier 2.

Tier 2: Perform Quantitative Evaluation of Petroleum Hydrocarbons[8]

8. Perform a detailed quantitative analysis by a forensic laboratory using the additional sample volume.[9] The target analyte list for PIANO, PAHs/Alkylated PAHs, and Saturated Hydrocarbon analyses is presented in Table 5-2. This list is based on the analytes that were detected in 16 samples that were collected on 03 July 2023 from seven tanks at Red Hill that stored JP-5 (i.e., Tank 07, Tank 08, Tank 09, Tank 10, Tank 11, Tank 12, and Tank 20). Only a subset of the analytes detected are soluble in water.
   Process: The human health risk evaluation will be performed using the results of the PIANO, PAHs/Alkylated PAHs, and Saturated Hydrocarbon analyses. The purpose of this evaluation is to estimate the risk to human health associated with petroleum hydrocarbons at locations where JP-5/other fuel-related analytes have been detected and were not conclusively identified as "naturally occurring" hydrocarbons under Tier 1. The SOP for conducting the risk evaluation, including the assumptions made for developing the risk model, assessment of Control/Background locations, and decision criteria are presented in Appendix B.

- **Decision Rule**: Multiple lines of evidence will be evaluated, and the results will be documented in a Tech Memo. Additional lines of evidence include evaluating drinking water results spatially. For example, if TPH were detected at a residence location, the evaluation would include reviewing the TPH results from drinking water samples at neighboring houses (if available) collected during that sampling period. If TPH was detected at a hydrant, then drinking water results from an upgradient and downgradient hydrant will be evaluated to determine if this is a location-specific issue or a distribution system issue. Additional sampling (e.g., bracketed residential sampling, bracketed sampling of hydrants) may be required. If the results of the human health risk evaluation of the PIANO, PAHs/Alkylated PAHs, and Saturated Hydrocarbon analyses are within acceptable limits presented in Appendix B and/or are consistent with Control/Background locations, no further analysis/documentation is needed. Otherwise, the Navy will consult with EPA/DOH for next steps (e.g., flushing/resampling, appliance replacement, water heater replacement, et cetera).

5.2.4 COA 4 – Detection of Other Analytes with No Respective MCL, Except Water Quality Parameters and HPC, or at Concentrations Less than the MCL in the Distribution System

This COA is for any analyte detected in the System with no respective MCL, except water quality parameters and HPC, or at concentrations less than the respective MCL.

1. Notify EPA/DOH SDWB within 24 hours of receipt of the lab report (preliminary, DO NOT wait until Level 2 validation is complete).
2. Consult with EPA/DOH for next steps (e.g., additional flushing, resampling, no-action).

[8] This step will only be reached if the Total TPH detected is 1) potentially petrogenic and 2) is not TPH-O (i.e., the Total TPH is potentially JP-5/other fuel-related analytes) based on Tier 1.
[9] If the extra sample volume is not within the required holding time, resampling may be required.

5.3 REMEDIAL ACTIONS

This section provides response guidance after re-sampling results. Should the re-sample indicate either non-detect or below the MCLs, no further action is needed. Should the re-sample indicate a continuing exceedance, an attempt to provide remedial action will be made within 48 hours of preliminary re-sample results. If the re-sampled exceedance is at the:

- Original Location only – Re-flush house/building/hydrant only, investigate fixture or hydrant.
- Original Location and at the additional interior fixture – Re-flush house/building only, investigate premise plumbing materials.
- Original Location and at the Bracketed samples – EPA/DOH SDWB to direct further actions.
- Additional interior fixture only – Re-flush house/building only, investigate fixture.
- Bracketed samples only – EPA/DOH SDWB will direct further actions.

5.4 RE-SAMPLING METHOD(S)

Table 2-2 provides re-sampling methods required for each detected or exceeded analyte. Detected analyte(s) must be analyzed for according to the specified method(s).

TABLE 5-2: MRLS/MDLS FOR PIANO, PAH/ALKYL PAH, AND SATURATED HYDROCARBONS ANALYSES

Method	CAS_NO	ANALYTE	Surrogate Analyte for Target Reporting Level (Noted, if used)	Detected in 03 July 2023 JP-5 Product Samples from Red Hill Tanks?[1]	Maximum Target Reporting Level (µg/L)[2]	MRL (µg/L)	MDL (µg/L)
APAH	83-32-9	Acenaphthene		TRUE	53	0.01	0.00128
APAH	208-96-8	Acenaphthylene	TPHs (Aromatic High)	TRUE	0.60	0.01	0.002
APAH	120-12-7	Anthracene		TRUE	180	0.01	0.00181
APAH	92-52-4	Biphenyl		TRUE	0.083	0.01	0.00233
APAH	132-65-0-C1	C1-Dibenzothiophenes BS	TPHs (Aromatic High)	TRUE	0.60	0.01	0.00146
APAH	86-73-7-C1	C1-Fluorenes	Fluorene	TRUE	29	0.01	0.00177
APAH	91-20-3-C1	C1-Naphthalenes	Naphthalene	TRUE	0.012	0.01	0.00197
APAH	132-65-0-C2	C2-Dibenzothiophenes	TPHs (Aromatic High)	TRUE	0.60	0.01	0.00146
APAH	86-73-7-C2	C2-Fluorenes	Fluorene	TRUE	29	0.01	0.00177
APAH	91-20-3-C2	C2-Naphthalenes	Naphthalene	TRUE	0.012	0.01	0.00197
APAH	132-65-0-C3	C3-Dibenzothiophenes	TPHs (Aromatic High)	TRUE	0.60	0.01	0.00146
APAH	86-73-7-C3	C3-Fluorenes	Fluorene	TRUE	29	0.01	0.00177
APAH	91-20-3-C3	C3-Naphthalenes	Naphthalene	TRUE	0.012	0.01	0.00197
APAH	91-20-3-C4	C4-Naphthalenes	Naphthalene	TRUE	0.012	0.01	0.00197
APAH	132-65-0	Dibenzothiophene	TPHs (Aromatic High)	TRUE	0.60	0.01	0.00146
APAH	86-73-7	Fluorene		TRUE	29	0.01	0.00177
APAH	91-20-3	Naphthalene		TRUE	0.012	0.01	0.00197
APAH	85-01-8	Phenanthrene	TPHs (Aromatic High)	TRUE	0.60	0.01	0.0012
PIANO	488-23-3	1,2,3,4-Tetramethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.214
PIANO	527-53-7	1,2,3,5-Tetramethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.152
PIANO	526-73-8	1,2,3-Trimethylbenzene		TRUE	5.5	2	0.223
PIANO	95-93-2	1,2,4,5-Tetramethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.155
PIANO	95-63-6	1,2,4-Trimethylbenzene		TRUE	5.6	2	0.207
PIANO	135-01-3	1,2-Diethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.296
PIANO	933-98-2	1,2-Dimethyl-3-Ethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.127
PIANO	934-80-5	1,2-Dimethyl-4-Ethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.245
PIANO	6876-23-9	1,2-Dimethylcyclohexane (trans)	TPHs (Aliphatic Low)	TRUE	2.80	2	0.294
PIANO	108-67-8	1,3,5-Trimethylbenzene		TRUE	6.0	2	0.23
PIANO	141-93-5	1,3-Diethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.249
PIANO	2870-04-4	1,3-Dimethyl-2-Ethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.149
PIANO	874-41-9	1,3-Dimethyl-4-Ethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.194
PIANO	934-74-7	1,3-Dimethyl-5-Ethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.236

Method	CAS_NO	ANALYTE	Surrogate Analyte for Target Reporting Level (Noted, if used)	Detected in 03 July 2023 JP-5 Product Samples from Red Hill Tanks?[1]	Maximum Target Reporting Level (µg/L)[2]	MRL (µg/L)	MDL (µg/L)
PIANO	2532-58-3	1,3-Dimethylcyclopentane (cis)	TPHs (Aliphatic Low)	TRUE	2.8	2	0.301
PIANO	1758-88-9	1,4-Dimethyl-2-Ethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.187
PIANO	2207-04-7	1,4-Dimethylcyclohexane (trans)	TPHs (Aliphatic Low)	TRUE	2.8	2	0.26
PIANO	611-14-3	1-Methyl-2-Ethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.17
PIANO	527-84-4	1-Methyl-2-Isopropylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.217
PIANO	1074-17-5	1-Methyl-2-N-Propylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.249
PIANO	620-14-4	1-Methyl-3-Ethylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.316
PIANO	535-77-3	1-Methyl-3-Isopropylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.258
PIANO	1074-43-7	1-Methyl-3-N-Propylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.202
PIANO	99-87-6	1-Methyl-4-Isopropylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.212
PIANO	1074-55-1	1-Methyl-4-N-Propylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.25
PIANO	90-12-0	1-Methylnaphthalene		TRUE	0.11	**5**	**1.47**
PIANO	3074-71-3	2,3-Dimethylheptane	TPHs (Aliphatic Medium)	TRUE	10.0	2	0.228
PIANO	589-43-5	2,4-Dimethylhexane	TPHs (Aliphatic Low)	TRUE	2.8	2	0.243
PIANO	2216-30-0	2,5-Dimethylheptane	TPHs (Aliphatic Medium)	TRUE	10.0	2	0.335
PIANO	91-57-6	2-Methylnaphthalene		TRUE	3.6	**5**	1.32
PIANO	871-83-0	2-Methylnonane	TPHs (Aliphatic Medium)	TRUE	10.0	2	0.283
PIANO	3221-61-2	2-Methyloctane	TPHs (Aliphatic Medium)	TRUE	10.0	2	0.512
PIANO	4032-86-4	3,3-Dimethylheptane	TPHs (Aliphatic Medium)	TRUE	10.0	2	0.242
PIANO	4110-44-5	3,3-Dimethyloctane	TPHs (Aliphatic Medium)	TRUE	10.0	2	0.202
PIANO	922-28-1	3,4-Dimethylheptane	TPHs (Aliphatic Medium)	TRUE	10.0	2	0.34
PIANO	926-82-9	3,5-Dimethylheptane	TPHs (Aliphatic Medium)	TRUE	10.0	2	0.282
PIANO	589-81-1	3-Methylheptane	TPHs (Aliphatic Low)	TRUE	2.8	2	0.385
PIANO	589-34-4	3-Methylhexane	TPHs (Aliphatic Low)	TRUE	2.8	2	0.32
PIANO	5911-04-6	3-Methylnonane	TPHs (Aliphatic Medium)	TRUE	10.0	2	0.279
PIANO	2216-33-3	3-Methyloctane	TPHs (Aliphatic Medium)	TRUE	10.0	2	0.224
PIANO	589-53-7	4-Methylheptane	TPHs (Aliphatic Low)	TRUE	2.8	2	0.344
PIANO	2216-34-4	4-Methyloctane	TPHs (Aliphatic Low)	TRUE	2.8	2	0.334
PIANO	110-82-7	Cyclohexane		TRUE	1,300	2	0.247
PIANO	124-18-5	Decane (C10)	TPHs (Aliphatic Medium)	TRUE	10.0	2	0.271
PIANO	112-40-3	Dodecane (C12)	TPHs (Aliphatic High)	TRUE	6000	5	0.657
PIANO	100-41-4	Ethylbenzene		TRUE	0.15	**2**	**0.216**
PIANO	1640-89-7	Ethylcyclopentane	TPHs (Aliphatic Low)	TRUE	2.8	2	0.265
PIANO	142-82-5	Heptane		TRUE	0.60	**2**	0.348

Method	CAS_NO	ANALYTE	Surrogate Analyte for Target Reporting Level (Noted, if used)	Detected in 03 July 2023 JP-5 Product Samples from Red Hill Tanks?[1]	Maximum Target Reporting Level (µg/L)[2]	MRL (µg/L)	MDL (µg/L)
PIANO	1077-16-3	Hexylbenzene	TPHs (Aromatic High)	TRUE	0.60	**2**	0.385
PIANO	95-13-6	Indene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.116
PIANO	538-93-2	Isobutylbenzene	TPHs (Aromatic Medium)	TRUE	5.7	2	0.27
PIANO	98-82-8	Isopropylbenzene		TRUE	45	2	0.187
PIANO	3875-51-2	Isopropylcyclopentane	TPHs (Aliphatic Low)	TRUE	2.8	2	0.293
PIANO	108-87-2	Methylcyclohexane		TRUE	20.00	2	0.27
PIANO	96-37-7	Methylcyclopentane	TPHs (Aliphatic Low)	TRUE	2.8	2	0.268
PIANO	104-51-8	n-Butylbenzene		TRUE	100	2	0.197
PIANO	110-54-3	n-Hexane		TRUE	150	2	0.329
PIANO	111-84-2	Nonane (C9)		TRUE	0.53	**2**	0.311
PIANO	103-65-1	n-Propylbenzene		TRUE	66	2	0.177
PIANO	111-65-9	Octane	TPHs (Aliphatic Low)	TRUE	2.8	2	0.235
PIANO	629-62-9	Pentadecane	TPHs (Aliphatic High)	TRUE	6000	5	1.12
PIANO	135-98-8	sec-Butylbenzene		TRUE	200	2	0.259
PIANO	98-06-6	tert-Butylbenzene		TRUE	69	2	0.211
PIANO	629-59-4	Tetradecane (C14)	TPHs (Aliphatic High)	TRUE	6000	5	0.612
PIANO	108-88-3	Toluene		TRUE	110	2	0.271
PIANO	629-50-5	Tridecane	TPHs (Aliphatic High)	TRUE	6000	5	1.39
PIANO	1120-21-4	Undecane	TPHs (Aliphatic High)	TRUE	6000	2	0.222
PIANO	1330-20-7	Xylene (Total)1		TRUE	19	2	0.209
SHC	3891-98-3	2,6,10-Trimethyldodecane (1380)	TPHs (Aliphatic High)	TRUE	6000	1	0.098
SHC	3891-99-4	2,6,10-Trimethyltridecane (1470)	TPHs (Aliphatic High)	TRUE	6000	1	0.144
SHC	124-18-5	n-Decane (C10)	TPHs (Aliphatic Medium)	TRUE	10.0	2	0.271
SHC	112-40-3	n-Dodecane (C12)	TPHs (Aliphatic High)	TRUE	6000	5	0.657
SHC	629-78-7	n-Heptadecane (C17)	TPHs (Aliphatic High)	TRUE	6000	1	0.136
SHC	544-76-3	n-Hexadecane (C16)	TPHs (Aliphatic High)	TRUE	6000	1	0.149
SHC	111-84-2	n-Nonane (C9)		TRUE	0.53	**2**	0.311
SHC	593-45-3	n-Octadecane (C18)	TPHs (Aliphatic High)	TRUE	6000	1	0.08
SHC	3892-00-0	Norpristane (1650)	TPHs (Aliphatic High)	TRUE	6000	1	0.136
SHC	629-62-9	n-Pentadecane (C15)	TPHs (Aliphatic High)	TRUE	6000	5	1.12
SHC	629-59-4	n-Tetradecane (C14)	TPHs (Aliphatic High)	TRUE	6000	5	0.612
SHC	629-50-5	n-Tridecane (C13)	TPHs (Aliphatic High)	TRUE	6000	5	1.39
SHC	1120-21-4	n-Undecane (C11)	TPHs (Aliphatic High)	TRUE	6000	2	0.222
SHC	1921-70-6	Pristane	TPHs (Aliphatic High)	TRUE	6000	1	0.175

Method	CAS_NO	ANALYTE	Surrogate Analyte for Target Reporting Level (Noted, if used)	Detected in 03 July 2023 JP-5 Product Samples from Red Hill Tanks?[1]	Maximum Target Reporting Level (µg/L)[2]	MRL (µg/L)	MDL (µg/L)

Notes:

[1] These analytes were detected in 16 samples that were collected on 03 July 2023 from seven tanks at Red Hill that stored JP-5 (i.e., Tank 07, Tank 08, Tank 09, Tank 10, Tank 11, Tank 12, and Tank 20).

[2] Target Reporting Level based on November 2023 Residential Tap Water Regional Screening Levels based on a cancer risk of 1E-07 and/or a hazard quotient of 0.1. Surrogate analytes identified, where used.

Bold and Blue Shaded Values exceed the Maximum Target Reporting Limit.

6. REPORTING AND MEETING SCHEDULE

6.1 REPORTING TO THE EPA AND DOH

A monthly EDWM summary report which details the status of each zone will be provided to EPA/DOH SDWB and will be posted on the https://jbphh-safewaters.org website. Data included in the monthly report will be exported from EDMS and will, at a minimum, include the following:

- Houses and buildings sampled
- Number of samples collected
- Sampling phase (e.g., EDWM Month 1, 2, 3, … through Month 12)
- Sample sites that had exceedances and required resampling
- Sample sites with detections of TPH and locations that proceeded to Tier 1 and Tier 2, with a brief summary of the findings
- GIS map of sample sites with location IDs
- QC summary report
- Challenges incurred and recommendations for improvement
- Plan for EDWM for the following month

The monthly EDWM summary report will be submitted to EPA/DOH SDWB and will typically be posted on the https://jbphh-safewaters.org website by the 30th day of the month following the month that sampling took place.[10]

A quarterly EDWM summary report which details the status of each zone will be provided to EPA/DOH SDWB and will be posted on the https://jbphh-safewaters.org website. Data included in the quarterly reports will be exported from EDMS and will, at a minimum, include the following:

- A summary of the information included in the monthly reports that are included within the quarter (see above)
- Performance benchmarks that provide data trends and the status of system-wide water quality based on sample results
- A comparison of the sampling results to MCLs in tabular form for each Zone – similar to the Stage 5 Reports included in the LTM program

6.2 REPORTING TO RESIDENT, BUILDING MANAGER, AND PUBLIC

6.2.1 Laboratory Results

With the receipt of the monthly EDWM laboratory reports, the Navy will:

- Provide access to an electronic[11] copy of validated test results to the resident or building manager where sampling occurred. The electronic test results should be easily accessible via email, download from a website, or other means.
- Ask building managers or their representatives to post a notification that the results are available electronically in a common area of the sampled facility for a period of 30 calendar days. The electronic test results should be easily accessible using the public Safe Waters website.
- Post laboratory reports on the https://jbphh-safewaters.org/ website.

[10] This applies only if there are no suspected/confirmed sampling/lab errors/artifacts in the dataset. If suspected/confirmed sampling/lab errors/artifacts are identified, then the potentially impacted data will not be posted until the issues have been resolved. The Navy will notify EPA/DOH if there are any suspected/confirmed sampling/lab errors/artifacts in the dataset.

[11] Hardcopies will be provided upon request of the resident or building manager where sampling occurred.

Once the need for EDMS is complete, https://jbphh-safewaters.org/ may be converted to a static data and public information repository. The functions and features of EDMS are necessary while data and lab reports are being uploaded and managed through the end of EDWM. However, once all data have been validated and the full dataset is complete, the management of data will no longer be necessary, and a much more cost-effective data warehouse can replace the management functionality EDMS provides.

6.2.2 Press and Public Inquiries

The System purveyor (Navy/Army, as appropriate) will be responsible for addressing inquiries/concerns from the public or press. The System must add the EPA, DOH SDWB (i.e., sdwb@doh.hawaii.gov), and DOH Communications Office (i.e., doh.pio@doh.hawaii.gov) to media release distribution lists.

Customer complaint surveillance monitors customer calls to identify unusual trends in water quality complaints. Calls associated with an unusual trend are further investigated to determine if they are similar in nature and spatially clustered. Customers may often be the first to report loss of pressure, degraded water quality, waterline leaks, and much more.

The System will track complaints and develop a tool to spatially evaluate clusters. These trends will be identified by the System.

6.2.3 Public Notices

Should the System be required to issue a public notice as required by HAR §11-20-18, they will disseminate the notice upon consultation with EPA/DOH. It is the System's responsibility to ensure all affected consumers are notified. For each System, the appropriate method for issuing the public notice must be approved of or suggested by the EPA/DOH SDWB. A copy of the draft public notice must be sent to the EPA/DOH SDWB for approval.

The area affected by the public notice is determined by the System and the EPA/DOH SDWB based on the location of the sampling points and the results of the routine and repeat sampling.

6.3 EDWM Meeting Schedule

The Navy will coordinate all EDWM meetings with EPA, DOH, and Army representatives. Meetings to discuss EDWM will be held quarterly in July and October in 2024 and January and May in 2025, corresponding to the 12-Month EDWM Sampling Schedule presented on Figure 4-1.

The purpose of these meetings will be to:

- Review schedules, data, and deliverables, and
- Discuss issues and possible modifications to EDWM.

Meetings will be held at the DOH's office located at Uluakupu Bldg. 4, 2385 Waimano Home Road, Pearl City, Hawaii, 96782 (or other designated location determined by the attendees), and will include remote attendance via Microsoft Teams (or similar remote meeting platform).

7. REFERENCES

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Appendix A: SOPs

Drinking Water Sample Collection SOP, Part A - Headspace, Sheen Observation and Free Chlorine

Scope – The purpose of this SOP is to ensure the sample collection and observation process is performed in a manner consistent with requests made by both EPA and Hawaii State Department of Health.

- **Procedure** – Prior to the collection of drinking water samples, a headspace, sheen observation, free chlorine test, and water quality parameters test (that includes temperature, pH, conductivity, and turbidity) must be taken.
    - Sink choice –
        - Choose the sink that is highest and farthest from the water distribution source (ex: an upstairs sink). If that sink is too shallow, check for other sinks that are far and high from the source. If those are also too shallow, use a lower-level sink (such as the kitchen sink). If all sinks in the house/building are too shallow, go back to the highest and farthest sink and use a 250 mL unpreserved bottle to transfer water from the sink to the large bottles. The 250 mL unpreserved should have never been used for any other sample and should not be used after for any other sample. If the house/building is single story, use any kitchen or bathroom sink. Document the reason behind deviation from the highest and farthest sink in your logbook if applicable.

    - Check for fixture filters as well as inline filters and water heaters –
        - First, check the sample point water fixture for any filters and remove if present.
        - Then, trace the water lines below the sink to ensure the cold-water source is directly connected to the tap, i.e., there is no inline filter or water heater.
        - If filter cannot be removed or bypassed, choose another sink

    - Isolate cold water –
        - Isolate the cold-water source by closing off the hot water valve. If the sink is not a mixer, the cold-water is already isolated.
        - If unable to isolate the cold-water source, move to a new sample location.
        - If no other sample location is viable, monitor water temperature while taking the sample. Note this in the logbook as “cold water monitored”. If water is not cold and cannot be isolated, contact team support for next steps.

    - If sampling from a kitchen sink, check that the dishwasher is not running. If it is running, ask the resident to turn it off for the sample collection.

    - Pre-sampling preparation –

- Clear sampling area of any potential volatile sources (hand soaps, dishwashing soap, air fresheners, etc.) within the immediate vicinity of the tap/spigot and sample bottle staging area. Don a new pair of gloves if they become contaminated.
- Place several sheets of paper towels or an absorbent pad on a suitable flat surface such as a counter-top or the floor.
- Place the sample containers on the paper towels/absorbent pad.

- Remove aerator and achieve laminar flow –
  - To achieve the most representative sample and laminar flow, remove any aerator, spray nozzle, or detachable parts from the sample faucet. Inspect the faucet to determine if the aerator can be twisted to remove, requires a key, or is attached to a sprayer.
  - To remove simple screen aerators from faucets, begin by twisting off by hand. If the aerator is lodged, protect the aerator from damage by covering it with a paper towel or glove, and use the sample kit pipe wrench to twist off aerator.
  - If a key is required, use the removal tool in the sampling kit. Invert the tool to face the aerator, align the notches, and twist while applying upwards pressure.
  - If the faucet has a sprayer or removable head, pull the hose from the sink and tie a glove around the hose or use a clamp to prevent it from retracting back into the sink. Twist off the head or sprayer.
  - Ensure there are no rubber gaskets or pieces left behind. **Note**: The rubber gasket will sometimes stick to the faucet. Remove this before turning water on to prevent it falling down the drain.
  - Adjust the flow rate to approximately 500 mL/minute (approximately 1/8th inch diameter stream or the width of a pencil). Adjust the faucet stream until the flow is smooth and uniform, with a glassy appearance. The flow should be laminar, not appear agitated or white with air bubbles.

- Headspace observation –
  - Using a calibrated PID, take a PID reading in the vicinity of the drinking water sampling point (within 2 feet) and record the results in the logbook. Record any presence of odor and note any potential sources of the odor. **Consult with a project manager prior to sampling if ambient room reading is ≥ 2.0 ppm.**
  - Proceed to Sheen analysis.

- Sheen observation –
  - Rinse unpreserved 40-milliliter (mL) VOA vial with water from the drinking water sampling point 3 times.
  - After rinsing, fill the VOA vial half-way, avoiding agitating the water inside the vial, and close the vial tightly.

- Lay the VOA vial horizontally on a paper towel and observe the surface of the water. Record sheen and odor observations under "I*nitial Observations*" in the logbook—take pictures of the vial if a sheen is present.
- Let the VOA vial rest undisturbed for at least 1 minute before re-observing. Look to see if the surface of the water has any kind of sheen or rainbow type of coloration is present and record your observations in the logbook under "*Final Observations*". If a sheen or film is observed, photograph observations and notify the project manager and field manager. Also, in the *"Final Observations"* section, note whether there was an odor or not after letting the vial rest.
- Once the analysis is concluded, the water can be discarded into the sink. If no sheen is observed, the empty VOA vial can be reused at the next location. If a sheen is observed, dispose of the VOA vial with the discarded PPE.

- Quality control for Headspace and Sheen – In order to have consistency in the headspace and sheen analysis, it is critically important to let the sheen VOA vial rest for a minimum of 1 minute. This gives time for any chemicals dissolved in the water to migrate out and float to the surface.

- Free Chlorine Analysis –
  - Review the Safety Data Sheet for the DPD Free Chlorine Reagent Powder Pillows and ensure the proper PPE is in use. Review the colorimeter operator's manual.
  - Power on the colorimeter.
  - Set the instrument to low range by pressing the up arrow (triangle) button so the triangle is under **LR** on the instrument screen (Low Range).
  - Zero the colorimeter
    - Prior to collecting the Free Chlorine sample, rinse the sample cell and cap 3 times with water from the drinking water sampling point. Discard water into sink each time.
    - Fill the cell to the 10 mL mark and cap the sample cell. Clean and dry the outside of the sample cell with a lint free cloth.
    - Insert the sample into the cell holder ensuring the diamond mark on the cell is lined up with the triangle mark on the meter (facing the meter).
    - Insert the instrument cap over the cell holder.
    - Push **ZERO** (Blue button on the left of the meter), the display should show 0.00.
  - Take the chlorine measurement
    - Remove the sample cell from the meter and place on a flat surface. Remove the cap. Carefully open the DPD Free Chlorine Reagent Powder Pillow and add the entire contents to the sample and close the sample cell with the cap.

- Invert the sample cell several times for 20 seconds to mix, a pink color will develop if chlorine is present.
- Take a reading within 1 minute.
- While timing the mixture, clean the cell with a lint free cloth and place the cell in the meter making sure the diamond on the cell is lined up with the triangle on the meter.
- Press the green button with the check mark on the righthand side of the meter and record the results in the logbook in mg/L.

- If the chlorine measurement is less than 0.02 mg/L, repeat free chlorine analysis after sample collection.
  - If the chlorine measurement is less then 0.02 mg/L, post sample collection, flush for 5 minutes and repeat chlorine measurement.
- If the screen on the meter is blinking, that is an indication the Free Chlorine concentration is greater than 2.0 mg/L and a dilution of the sample is required.
  - Immediately decant the contents of the sample cell and rinse the sample cell and cap 3 times with the water to be analyzed and 2 times with deionized water.
  - Prepare a 1:1 dilution of the sample by decanting 50 mL of sample into a 100 mL beaker and add 50 mL of distilled water, swirl the mixture and decant into the 10 mL cell to the 10 mL mark and repeat the analysis.
  - Take the reading from the meter and multiply the result by 2 and record on the field form.
  - If the analysis is still over range, prepare a 1:4 dilution by adding 25 mL of sample to the beaker and 75 mL of distilled water. Multiply the results by 4 and record on the field form.

- After taking the Free Chlorine Analysis, dispose of solution in sink. Be sure to rinse the bottom of the sink to avoid pink staining. Rinse the sample cell 3 times before stowing as residue can discolor the sample cells.

- Water Quality Parameters Test -
  - Ensure the proper PPE is in use and review the Aqua TROLL 600 Multiparameter Sonde operator's manual.
  - Decontamination
    - Prior to collecting Water Quality Parameters, rinse a 250 ml amber transfer bottle 3 times using tap water from the sample point
    - Unscrew the black cap from the AT600 and remove the sponge, or dump out left over calibration water, from sample cell.
    - Rinse the sample cell 3 times using the 250 ml bottle that was decontaminated in the first step discarding water from cell into the sink after each rinse.

  - After rinsing, double check no debris is present (ex. sponge particles).
- Power on and Pair the AT600
  - Power on the AT600 either by slightly unscrewing the black portion of the body from the center or by turning it upside down with metal hanger facing up.
  - The screen will turn blue when the device is on, and it is ready to be paired to a smart phone via Bluetooth using the Vu-Situ App.
  - Select the appropriate AT600 serial number prompted in the Vu-Situ App for pairing.
- Take the Water Quality Parameters Measurement
  - In the Vu-Situ app select the "*Live Readings*" option.
  - Once on the *"Live Readings"* page, change the recording mode by selecting the camera image in the bottom left corner—the yellow toggle button on the bottom right corner should read *"Save Single Reading"*.
  - Above the parameters, click on "*Change Location"* and input the sample ID as the name.
  - Set "*Refresh Rate"* to 1 second
  - On the parameter screen, check the following measurements and adjust units as needed such that parameters reflect the following:
    - PH
      - Range: 6.5-8.5
    - Specific Conductivity (µS/cm)
      - Range: 50-50,000 µS/cm
    - Turbidity (NTU)
      - Range: <0.5NTU
    - Temperature (°C)
  - On a resident requested sample or exceedance sample, leave all parameters checked.
  - Fill the sample cell until the brush is fully submerged.
  - After filling the sample cell, let 30 seconds elapse before collecting "stabilized parameters"
  - Once parameters have stabilized, click on the "*Save Single Reading"* button on the bottom right corner. If measurements are outside of the expected range, note this in your logbook.
  - Double check parameters have been recorded by clicking on the upper left 3 bars and selecting data files. Parameters should be saved in the Snapshot file associate with the sample date (ex. TeamA_Snapshot – 04/12/2024)

    - At the end of the day, you will save this file and send it to the QC/Intake team. The title will include your team name and date (ex. Team A_20240412)
- In addition to the generated reports, record the temperature and pH manually in the logbook and on FQLabs chain-of-custody forms as needed
- You are now prepared for sample collecton. Refer to Drinking Water Sample Collection SOP, Part B – Sample Collection

Drinking Water Sample Collection SOP, Part B – Sample Collection

Scope – The purpose of this SOP is to ensure the sample collection process is performed in a manner consistent with requests made by both EPA and Hawaii State Department of Health.

Procedure – Once the headspace/sheen observations and free chlorine tests have been performed and recorded according to Part A, samples can be collected for shipment to the designated analytical laboratory. Samples should be collected in the order listed below referencing the required bottleware chart on the last page.

- Pre-sampling preparation – Place the sample containers to be filled on the towel used in Part A. Check to ensure all required sample preservatives are available for each container. See Bottle Container Checklist (Part B). The 250 ml plastic bottle for metals contains the 1:1 nitric acid preservative, handle with caution. Do not rinse any of the bottles.

- Collect the samples for EPA Methods **524.2 VOCs** and **524.2 Total Trihalomethanes**
  - Remove cap and tilt the vial so the flow falls on the interior surface of the vial, do not shake or agitate. Fill to the neck of the vial.
  - Add 3 drops of HCl. Place cap on the vial, tighten, and gently invert several times to dissolve the preservative.
  - Remove the cap. Add more sample until a convex meniscus is formed, but do not overfill. Cap the vial. Do not use the cap to add additional water to the vial.
  - Once the vial has been sealed, turn the vial upside down and look for the presence of bubbles. If any bubbles are present greater than half the size on a pea, re-collect the sample. DO NOT add additional sample. If there are no bubbles, repeat the process until all the vials have been filled.

- Collect the sample for EPA Method **504.1 Ethylene Dibromide**
  - Remove cap and tilt the bottle so the flow falls on the interior surface of the bottle, do not shake or agitate.
  - Fill the bottle to the neck of the bottle. Replace the cap and tilt the bottle several times to mix the preservative.

- Collect the samples for EPA Methods **8260 TPH-g**
  - Remove cap and tilt the vial so the flow falls on the interior surface of the vial, do not shake or agitate.
  - Fill the vial until a convex meniscus is formed, but do not overfill. Place cap on the vial, tighten, and gently invert the vial several times to mix the preservative.

  - Once the vial has been sealed, turn the vial upside down and look for the presence of bubbles, if any bubbles are present greater than half the size on a pea, re-collect the sample. DO NOT add additional sample. If there are no bubbles repeat the process until all the vials have been filled.

- Collect the samples for EPA Method **SM 5310B TOC**
  - Remove cap and tilt the bottle so the flow falls on the interior surface of the bottle, do not shake or agitate.
  - Fill to the neck of the bottle. Place cap on the bottle, tighten, and gently invert several times to mix the preservative.

- Collect the samples for EPA Method **8015 TPH-d/o**
  - Remove cap and tilt the vial so the flow falls on the interior surface of the bottle, do not shake or agitate.
  - Fill the vial to the bottle lip, but do not overfill. Place cap on the vial and tighten.
  - Zero headspace is not required due to the hard plastic cap.

- Collect the samples for EPA Method **525.2 SOCs**
  - Remove cap and tilt the bottle so the flow falls on the interior surface of the bottle, do not shake or agitate.
  - Fill the bottle within 1 or 2 inches of the top (just below the neck of the bottle). Add 5 mL of 1:1 HCL, place the cap on the bottle, tighten and gently tip the bottle to mix the preservative.
  - Fill the bottle to the neck of the bottle. Replace the cap and tilt the bottle several times to mix the preservative.

- Collect the sample for EPA Method **8270SIM 2-(2-Methoxyethoxy)- Ethanol**
  - Remove cap and tilt the bottle so the flow falls on the interior surface of the bottle, do not shake or agitate.
  - Fill the bottle to the neck of the bottle. Replace the cap.

- Collect the sample for EPA Method **SM 2320B Total Alkalinity**
  - Remove cap and tilt the bottle so the flow falls on the interior surface of the bottle, do not shake or agitate.
  - Fill the bottle to the neck of the bottle. Replace the cap.

- Collect the sample for EPA Method **300.1 Anions**
  - Remove cap and tilt the bottle so the flow falls on the interior surface of the bottle, do not shake or agitate.
  - Fill the bottle to the neck of the bottle. Replace the cap.

- Collect the sample for EPA Method **200.8/245.1 Metals/Mercury** and **200.7 Cations & Silica**
    - This bottle contains 1:1 HNO3, a corrosive acid that can cause serious injury, therefore when filling the bottle point the opening away from you prior to and during sampling.
    - Remove the cap pointing the open end away from you. Place the bottle under the sample point so the sample runs down the inside the wall of the bottle.
    - Fill the bottle to the neck of the bottle. Replace the cap and tilt the bottle several times to mix the preservative.

- Collect the sample for EPA Methods **SM 9223B Total Coliform** and **SM 9215B Heterotrophic Plate Count**
    - Put on a new pair of gloves prior to handling bottleware.
    - Purge the sample location for at least 5 minutes by increasing the flow rate to a maximum flow
    - After the 5 minute purge, reduce the flow rate to 500 mL/minute (approximately 1/8th inch diameter stream or the width of a pencil)
    - Remove cap and tilt the bottle so leaving at least 2.5cm of headspace the flow falls on the interior surface of the bottle, do not shake or agitate.
    - Fill the bottle leaving at least 2.5cm of headspace. Replace the cap and tilt the bottle several times to mix the preservative. Do not place the cap down while filling the bottle.
    - Besure to record the temperature and pH (from the AT600 readings you took prior to the sample) manually in the logbook and on the FQLabs chain-of-custody forms.

- Collect the sample for EPA Methods **SM 9215 Heterotrophic Plate Count (HOT)**
    - Close the cold water valve and open the hot water valve.
    - Purge the sample location for at least 5 minutes by increasing the flow rate to a maximum flow
    - After the 5 minute purge, reduce the flow rate to 500 mL/minute (approximately 1/8th inch diameter stream or the width of a pencil)
    - Take a **hot** free chlorine analysis and water quality parameter measurements following steps from Drinking Water Field SOP Part A recording only for temperature and pH. In addition to the snapshot of the parameters, please manually record the pH and temperature in the logbook and FQLabs chain-of-custody form.
    - Put on a new pair of gloves prior to handling bottleware.
    - Remove cap and tilt the bottle so the flow falls on the interior surface of the bottle, do not shake or agitate.

- Fill the bottle leaving at least 2.5cm of headspace. Replace the cap and tilt the bottle several times to mix the preservative.

Take note of any color or odor associated with the sample and document. Complete the COC. Record the date as MM/DD/YYYY and time universal (military) time. Affix the sample label to the bottles/vials, affix the custody seal to the bottles/vials, place the bottles/vials in the laboratory provided bubble wrap or equivalent and then place in a zip lock bag. Place the samples into a cooler with ice.

Analysis	RE/Priority Buildings	Resident Requests	Hydrants (Monthly)	Hydrants (Quarterly)	Waiawa Shaft pre and post-chlorination (Monthly)	Waiawa Shaft pre and post-chlorination (Quarterly)	NAH Shaft pre-chlorination (Quarterly)	Red Hill Shaft pre-chlorination (Quarterly)
VOC's (EPA 524.2) + 15 mL HCL Dropper	x	x	x	x	x/x	x/x		
Collected In VOC's Bottle - Total Trihalomethanes (EPA 524.2)	x				/x	/x		
Ethylene Dibromide (EPA 504.1)				x		x		
TPH-G (EPA 8260)	x	x	x	x	x/x	x/x		
TOC (SM 5310B)	x	x	x	x	x/x	x/x		
TPH d/o (EPA 8015)	x	x	x	x	x/x	x/x		
SOC's (EPA 525.2) + 5 mL HCL Vial	x	x	x	x	x/x	x/x		
2-(2-Methoxyethoxy)-Ethanol (EPA 8270SIM)				x		x		
2-(2-Methoxyethoxy)-Ethanol (EPA 8270SIM)				x		x		
Total Alkalinity (SM 2320B)	x	x	x	x	x/x	x/x	x	x
Total Coliform (SM 9223B) / Heterotrophic Plate Count (SM 9215B)	x	x	x	x	x/x	x/x	x	x
Hot Sample Heterotrophic Plate Count (SM 9215B)		x						
Anions (EPA 300.1)					x/x	x/x	x	x
Metals (EPA 200.8 & EPA 245.1)	x	x						
Collected In Metals Bottle - Cations & Silica (EPA 200.7)					x/x	x/x	x	x

Drinking Water Sample Collection SOP, Part C – Hydrant Sampling

Scope – The purpose of this SOP is to ensure the sample collection process is performed in a manner consistent with requests made by both EPA and Hawaii State Department of Health. The option to collect a sample from the first flush of water from a tap is a deviation of typical State and Federal requirements for the collection of drinking water samples for the generation of definitive-level analytical data.

Procedure –

- Decontaminate the hydrant spigot fitting using isopropyl alcohol. Take special care to rinse the grooves of the fitting. Use distilled water to thoroughly rinse the fitting.

- Approach hydrant and ensure safe parking is available near hydrant. If not, park in a safe area away from traffic and walk equipment to the hydrant. When working along the street, place cones to demarcate the work zone and use the vehicle as a barrier between traffic and staff.

- Prepare for hydrant purge by staging two five-gallon buckets underneath the top hydrant outlet port, where water is discharged from. One bucket is needed to measure flow volume and to capture any water discharged during sampling. The purge requirements are 30 gallons over a 10-minute period. This means that a flow rate of roughly 3 gal/min is optimal to achieve the required purge.

- After buckets are positioned correctly, use the hydrant wrench to remove the cover fitting over the top discharge port. Screw the hydrant spigot fitting onto the discharge port. This fitting allows for the flow to be controlled.

- Use the hydrant wrench to slowly open the valve that is opposite the top discharge port. Turning the wrench counterclockwise will open the valve allowing the flow of water to begin. Adjust the flow at either the hydrant valve or the valve on the attached hydrant spigot fitting to achieve roughly 3 gal/min for the purge. Wait until the 5-gallon bucket is full and then switch out the second empty bucket to begin filling. While the second bucket is filling, the first can be dumped onto the ground. Repeat this process until 30 gallons is achieved. Make sure water is not discharged into a storm drain or sewer manhole. Discharge water onto a grassy area.

- Perform and record headspace/sheen observations and free chlorine tests according to **Part A – Headspace, Sheen Observation and Free Chlorine**.

- Collect samples according to **Part B – Sample Collection**.

1. Upon sampling completion, affix the hydrant wrench to the valve opposite of the top discharge port, and turn clockwise to tighten the valve, stopping the flow of water. Remove the hydrant spigot fitting and place in the hydrant kit along with the hydrant wrench and decontamination supplies. Affix the cover fitting over the discharge port and tighten until snug.

Appendix B:
TPH Risk Evaluation Protocol

Memo

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To: Red Hill Tier 2 TPH Risk Evaluation Tiger Team

From: Chris Waldron, PE

Date: May 3, 2024

Subject: Red Hill Extended Drinking Water Monitoring (EDWM) Plan
Risk Evaluation Protocol for Tier 2 Quantitative Evaluation of Petroleum Hydrocarbons

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PREFACE: There are practical/technical challenges associated with collecting/performing Tier 2 analysis on drinking water samples. These challenges can be overcome but they are not insignificant. This is especially important because in order to perform a human health risk evaluation of the resulting data – we need to have representative, reproducible, and quality assured data (see Attachment 1 for more information). The Tier 2 analysis being proposed in Extended Drinking Water Monitoring (EDWM; i.e., Total Petroleum Hydrocarbon [TPH] Fingerprinting) is typically performed on pure product samples (i.e., fuel samples from refineries) or highly contaminated environmental samples (e.g., fuel-saturated soil, groundwater with free product) with very, very high (i.e., %) concentrations. Very few laboratories perform this type of fingerprinting analysis; laboratories that do perform this analysis are familiar with analyzing highly contaminated samples. This is a very important point because under Tier 2 of EDWM we will be asking them to analyze drinking water samples with extremely low-levels (sub parts per billion) of soluble phase, TPH. This is like analyzing Apples and Oranges. In order to obtain the data quality required by the human health risk evaluation, the laboratory will need to provide reliable Tier 2 data in the sub-part per billion range to part per trillion range – not very high (% concentrations) they are accustomed to.

Consequently, the Navy is currently (April/May 2024) performing a PILOT Study of the Feasibility of Performing Tier 2 Quantitative Evaluation of Petroleum Hydrocarbons. The PILOT Study will used to determine if Tier 2 will be included in the EDWM. Multiple factors will be included in the assessment; however, the primary focus of the PILOT is determining whether or not the laboratory can achieve the Data Quality Objectives (DQOs) required by Tier 2, including but not limited to:

1. Demonstrating accurate and precise identification/quantification of Tier 2 analytes.
2. Achieving low-level, risk-based Method Detection Limits (MDLs) and Method Reporting Limits (MRLs).
3. Ensuring that blank (e.g., method blanks, field blanks, blind blanks) contamination is not present (i.e., is non-detect) or if it is present that concentrations are below risk-based goals.

If the laboratory demonstrates that it can reliably/consistently achieve the DQOs required by Tier 2, then Tier 2 will be included in EDWM. Otherwise, Tier 2 will not be included in the EDWM.

Purpose

The purpose of this technical memorandum (memo) is to document the steps and assumptions that will be used to conduct a risk evaluation as part of Course of Action (COA) 3 – Detection of Total Petroleum Hydrocarbon (TPH) via Method 8015/8260 of the Extended Drinking Water Monitoring (EDWM) Program. The risk evaluation will be performed using the results of the following:

1. EPA Method 8260D: Paraffins, Isoparaffins, Aromatics, Naphthenes, and Olefin (PIANO)
2. EPA Method 8270E-SIM: Polycyclic Aromatic Hydrocarbons (PAHs)/Alkylated PAHs (Alkyl-PAHs), and
3. EPA Method 8015D: Saturated Hydrocarbons.

The purpose of this evaluation is to estimate the risk to human health to support the Tier 2 Quantitative Evaluation of Petroleum Hydrocarbons.

The steps described in this protocol are based on well-established, scientific methods recommend by the EPA to evaluate the potential for impacts to human health associated with exposure to constituents in contaminated media (e.g., tap water). Risk Assessment is a management decision tool; it does not evaluate nor does it provide information about actual health effects. Risk assessments focus on hypothetical (but realistic) upper-bound exposures to constituents and complete exposure pathways for a Site (in this case, the JBPHH Drinking Water System). Risk managers use the results of the risk evaluation to determine if further investigation or action is needed.

Human Health Risk Evaluation Process

The human health risk evaluation will be conducted in accordance with the United States Environmental Protection Agency (EPA) Risk Assessment Guidance for Superfund (RAGS)[1] and the United States Navy Human Health Navy Risk Assessment Guidance.[2] The primary steps of this risk evaluation include:

- Step 1: Hazard Identification and Data Evaluation and Reduction
- Step 2: Exposure Assessment
- Step 3: Toxicity Assessment
- Step 4: Risk Characterization and Uncertainty Analysis
- Step 5: Results, Decision Criteria, and Documentation

[1] EPA, 1989. Risk Assessment Guidance for Superfund: (1) Part A: Human Health Evaluation Manual, Part B: Development of Risk-based Preliminary Remediation Goals, , Part E: Supplemental Guidance for Dermal Risk Assessment, and Part F: Supplemental Guidance for Inhalation Risk Assessment. https://www.epa.gov/risk/risk-assessment-guidance-superfund-rags-part.

[2] Navy, 2008. U.S. Navy Human Health Risk Assessment Guidance. Naval Facilities Engineering Command and Navy Marine Corps Public Health Center. December 2008. https://www.med.navy.mil/Navy-and-Marine-Corps-Force-Health-Protection-Command/Environmental-Health/Environmental-Programs/Risk-Assessment/.

Step 1: Hazard Identification and Data Evaluation and Reduction

The purpose of the Hazard Identification and Data Evaluation and Reduction step is to identify the data that will be included in the risk evaluation, establish a control group for comparing drinking water results, and identify constituents of potential concern (COPCs) that will be retained for further evaluation in the risk assessment.

Key Decision Criteria in Step 1:

- Identify a control group to establish "background" water quality conditions in the JBPHH System. Drinking water results from target locations (i.e., locations where TPH has been detected during EDWM and Tier 2 analysis was performed) will be compared to the control group. If concentrations from target locations are within the typical range of concentrations observed in the control group, these concentrations will be identified as "background" (i.e., concentrations that are unrelated to the JP-5/Fuel release from Red Hill) and will not be retained for further evaluation in the risk assessment. This risk evaluation estimates the incremental risk (i.e., risk above background and potentially associated with the JP-5/Fuel release from Red Hill).
- Identification of chemicals to include in the risk evaluation. This protocol assumes the 225 chemicals tested for in the PIANO, PAH/Alkyl-PAH, and Saturated Hydrocarbon analyses will potentially be included in the risk evaluation.

Step 1 includes:

- <u>Establishing a Control Group</u>
  - The purpose of the control group is to establish "background" drinking water quality conditions in the JBPHH System to compare drinking water results at target locations. TPH results from Zones not included in the control group (i.e., Zones that were potentially impacted by the JP-5 fuel release) will be compared to concentrations in the control group. The control group will be comprised of Zones that are supplied drinking water via the JBPHH System but were not impacted by the November 2021 JP-5 fuel release from the Red Hill Bulk Storage Facility.
  - Control Group:
    - Zones not provided drinking water via the Red Hill Shaft. Therefore, the JP-5 release from Red Hill Bulk Storage Facility did not impact drinking water at these Zones.
      - Manana Housing, Zone A1 (Pearl City Housing), Zone A2 (Ford Island), Zone B1 (McGrew/Halawa), Zone C1 (Sub Base), and Zone G1 (Camp Smith)
    - Zones with inline Granular Activated Carbon (GAC) treatment units (which remove TPH, if present, in drinking water) that treat drinking water before distribution to residences.
      - Zones H1, H2, and H3 (Aliamanu Military Reservation) and Zone I1 (Red Hill)
  - Descriptive statistics (e.g., minimum, maximum, median, average, standard deviation) will be calculated for locations included in the control group in order to facilitate evaluating Tier 2 results from a target location.

- Data Overview and Processing
  - The risk evaluation will be performed on a location-by-location basis using the results of the Tier 2 analyses conducted during EDWM. The risk evaluation will primarily focus on residence locations.
  - If the residence has one sample result:
    - Detected chemicals will be retained for further evaluation and the reported concentration will be used in the risk evaluation.
    - Non-detected chemicals will not be retained for further evaluation (i.e., the concentration for that chemical will be set to zero).
  - If the residence has two, or more, sample results:
    - Detected chemicals will be retained for further evaluation with the following modifications:
      - If multiple results are detected, the largest of the results will be used in the risk evaluation.
      - If only one result is detected and the other results are non-detect, the detected result will be used in the risk evaluation.
    - If all sample results are non-detect (i.e., chemicals are not detected in any sample), then the chemical will not be retained for further evaluation (i.e., the concentration for that chemical will be set to zero).
- Data Reduction
  - Concentrations for each chemical will be compared to the control group.
    - If the concentration for a given chemical is within the range of detected concentrations (i.e., between the minimum and maximum detected concentration) for the control group, the chemical will not be retained for further evaluation in the risk evaluation. This chemical will be considered "background."
    - If the chemical was not detected in the control group, but was detected in the location's sample, this chemical will be retained for further evaluation in the risk evaluation.
    - If the chemical was detected at a concentration that exceeds the range of detected concentrations (i.e., greater than the maximum concentration) for the control group, the chemical will be retained for further evaluation in the risk evaluation.

Step 2: Exposure Assessment

The purpose of the Exposure Assessment step is to identify potentially exposed populations (i.e., receptors), exposure scenarios, complete exposure pathways, and exposure factors/parameters.

Key Decision Criteria in Step 2:

- The risk evaluation focuses on child and adult residents that are provided tap water by the JBPHH System. Risk will be calculated for a 3-year and 6-year exposure duration (based on one or two tours with the Navy) and 26-years (EPA default for a resident).
- An exposure model will be developed using EPA-default parameters, except where otherwise noted. Complete exposure pathways included ingestion of tap water, inhalation of tap water while showering, and dermal contact with tap water while showering.

Step 2 includes:

- Developing a Conceptual Site Model and an Exposure Model
  - The conceptual site model (CSM) is provided in Figure 1. The CSM is a visual representative of how exposure to chemicals in tap water provided by the JBPHH System could occur.
  - Receptors Evaluated include: 3-Year Active-Duty Personnel (Child/Adult), 6-Year Active-Duty Personnel (Child/Adult), 26-Year Resident (Child/Adult)[3]
  - Complete Exposure Pathways include: Ingestion of Tap Water, Inhalation of Vapors in Tap Water while Showering, Dermal Contact with Tap Water
  - Exposure Factors/Parameters: Exposure Parameters were selected based on EPA's default parameters for child and adult resident exposure scenarios, except where noted.[4] Exposure Parameters are summarized in Table 1.

[3] The 3-year and 6-year exposure durations are based on one or two typical tour lengths for the Navy.
[4] EPA Default Exposure Parameters and Definitions are available at the following link: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables.

Step 3: Toxicity Assessment

The purpose of the Toxicity Assessment step is to obtain toxicity values for chemicals identified in Step 1.

Key Decision Criteria in Step 3:

- This protocol assumes the 225 chemicals tested for in the PIANO, PAH/Alkyl-PAH, and Saturated Hydrocarbons analyses will potentially be included in the risk evaluation. However, toxicity values are only available (see the sources listed below) for 65 of the 225 chemicals. As a result, methodology will need to be developed to determine if/how surrogate toxicity values can/will be developed for the remaining 160 chemicals with acceptable confidence/uncertainty. Of those, 115 chemicals that were detected in the JP-5 product samples that were collected from the Red Hill Tanks in July 2023. The development of surrogate toxicity values will be prioritized by focusing on the subset of those 115 chemicals that are water soluble (see Table 2).
- Only noncarcinogenic, surrogate toxicity values will be developed, as appropriate.

Step 3 includes:

- Toxicity Values
  - Source: All Toxicity Values were obtained from the November 2023 Regional Screening Levels (RSLs) tables.[5]
  - Table 2 presents the 225 that will potentially be included in the risk evaluation and also identifies (1) the Toxicity Values available in the November 2023 RSL table and (2) if the chemical was detected in the JP-5 product samples that were collected from the Red Hill Tanks in July 2023. Toxicity values are only available (see the sources listed below) for 65 of the 225 chemicals. As a result, the methodology will need to be developed to determine if/how surrogate toxicity values can/will be developed for the remaining 160 chemicals with acceptable confidence/uncertainty. Of those, 115 chemicals were detected in the JP-5 product samples that were collected from the Red Hill Tanks in July 2023. The development of surrogate toxicity values will be prioritized by focusing on the subset of those 115 chemicals that are water-soluble.
  - Summary statistics for the chemicals detected in the JP-5 product samples collected from the Red Hill Tanks in July 2023 are provided in Attachment 2.

[5] https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables.

Step 4: Risk Characterization and Uncertainty Analysis

The purpose of the Risk Characterization step is to calculate the cancer risk and noncancer hazards associated with exposure to TPH-related chemicals using the information developed in Steps 1 through 3.

Key Decision Criteria in Step 4:

- Prior to calculating risk, a toxicity assessment will need to be conducted to identify the target endpoint/critical effect associated with each chemical. All chemicals will not be assumed to have the same target endpoint/critical effect.
- The EPA acceptable cancer risk range is 1.0E-04 to 1.0E-06 and he EPA noncancer hazard benchmark is 1 (grouped by target organ/critical effect) will be used, in conjunction with other information (e.g., background risks from the control group), to evaluate the result of the risk evaluation.
- The Tier 2 risks for the Control Group will be presented in the section for context and used to compare/assess the risks from the target location.

Step 4 includes:

- Calculating Cancer Risk and Noncancer Hazards
  - Cancer risks and noncancer hazards will be calculated for each receptor, pathway, and chemical – based on inputs from Steps 1 through 3.
- Comparing Risks to Acceptable Cancer Risk Range and Noncancer Hazard Benchmarks
  - Cancer risks will be compared to the EPA acceptable risk range of 1.0E-04 to 1.0E-06.
  - Noncancer hazard indices will be compared to the EPA benchmark of 1 (grouped by target organ/critical effect).
- Comparing Cancer Risks and Noncancer Hazard Benchmarks to the Control Group
  - Cancer risks/noncancer hazards for the target location will be compared to the Control Group to provide risk managers with information regarding how the risks compare to background risks for Tier 2 chemicals.

Step 5: Results, Decision Criteria, and Documentation

The purpose of the Results, Decision Criteria, and Documentation step is to summarize the risk evaluation results, develop decision criteria for determining the next steps (if necessary), and outline how the results will be documented.

Key Questions/Decision Criteria in Step 5:

- The decision criteria for identifying if/when additional investigation or action is needed will depend on the location type (e.g., source water, hydrant, residence) to ensure proper action (e.g., flushing, re-sampling, bracket sampling, fixture replacement) and will include multiple factors. In general:
    - No further action is warranted if the total risk is within or below the EPA acceptable risk range of 1.0E-04 to 1.0E-06 and the noncancer hazard is below the EPA benchmark of 1 (grouped by target organ/critical effect).
    - No further action is warranted if the total risk is within the typical range of risks observed in the control group.
    - Additional action may be warranted if the total risk exceeds the EPA acceptable risk range of 1.0E-04 to 1.0E-06 and /or the noncancer hazard exceeds the EPA benchmark of 1 (grouped by target organ/critical effect and the total risk is exceeds the typical range of risks observed in the control group.

Step 5 includes:

- Results
    - No further action is warranted if the total cancer risk is below or within the EPA acceptable risk range of 1.0E-04 to 1.0E-06 and total noncancer hazard index is below the EPA benchmark of 1 (grouped by target organ/critical effect).
    - No further action is warranted if the total risk is within the typical range of risks observed in the control group.
    - Additional action (e.g., flushing, re-sampling, fixture replacement, bracket sampling, spatial distribution evaluation) may be warranted if the total cancer risk exceeds the EPA acceptable risk range of 1.0E-04 to 1.0E-06 and /or the noncancer hazard exceeds the EPA benchmark of 1 (grouped by target organ/critical effect) and the total risk is exceeds the typical range of risks observed in the control group.
    - Results will be evaluated to determine if they are a localized impact (i.e., the risk is associated with conditions at that sample location and not associated with the JBPHH System) or a distribution impact (i.e., the risk is associated with conditions in the JBPHH distribution system). This will be achieved by evaluating nearby residences and results from nearby hydrants, reviewing source water data (i.e., Waiawa Shaft), and collecting additional data (if necessary).
- Documentation
    - Results of the risk evaluation will be documented in a tech memo. The tech memo will summarize the results of each step outlined in this protocol and identify next steps for that location.
    - The tech memo will be submitted to EPA and State of Hawaii Department of Health (DOH) for review.

Enclosures

Figure 1	Conceptual Site Model
Table 1	Exposure Parameters
Table 2	Toxicity Values for PIANO, PAH/Alkyl-PAH, and Saturated Hydrocarbons
Attachment 1	Email Regarding Practical, Technical Challenges for Collecting/Performing Tier 2 Data Analysis on Drinking Water Samples
Attachment 2	Summary Statistics for JP-5 Free Product Samples Collected from Red Hill Tanks (July 2023)

Figure 1. Conceptual Site Model

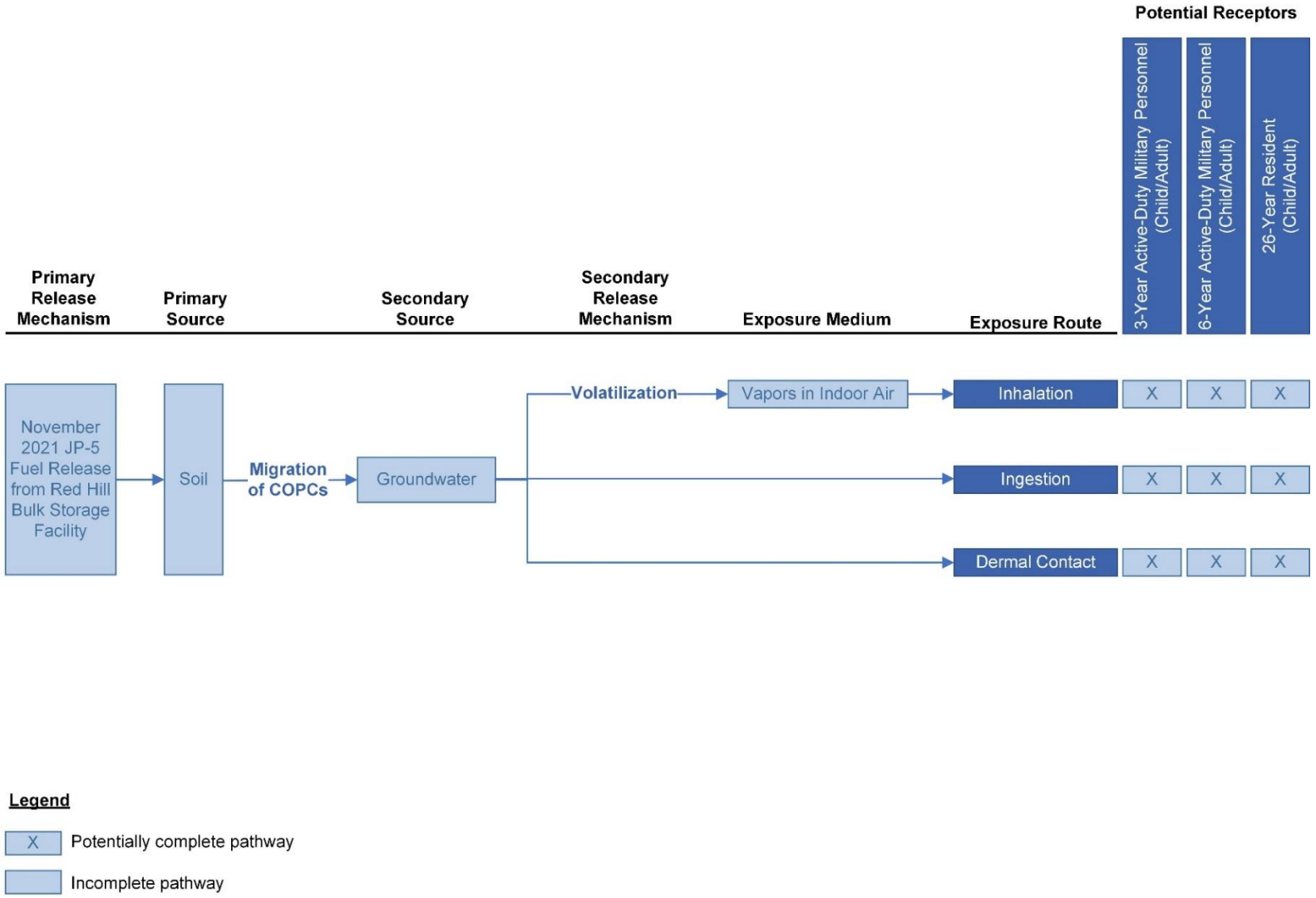

Table 1. Exposure Parameters

Ingestion of Drinking Water Exposure Parameters				
Exposure Parameter	for Non-carcinogens (Child 0 - 6)		for Carcinogens (Child + Adults)	
Average Body Weight	15	kg	80	kg
Unit Conversion Factor	0.001	mg/ug	0.001	mg/ug
Drinking Water Ingestion Rate	0.78	L/day	2.5	L/day
Drinking Water Fraction	1	unitless	1	unitless
Exposure Frequency	350	day/year	350	day/year
Exposure Duration	6	years	26	years
Averaging Time	2,190	days	25,550	days

Inhalation via Showering Exposure Parameters				
Exposure Parameter	for Non-carcinogens (Child 0 - 6)		for Carcinogens (Child + Adults)	
Exposure Time	1.08	hours/day	1.42	hours/day
Unit Conversion Factor	0.001	mg/ug	1	ug/ug
Exposure Frequency	200	days/year	350	days/year
Exposure Duration	6	years	26	years
Volatilization factor of Andelman (K)	0.5	L/m3	0.5	L/m3
Averaging Time	52,560	hours	613,200	hours

Dermal Contact with Water Exposure Parameters (Bathing/Showering)				
Exposure Parameter	Bathing for Non-carcinogens (Child 0 - 6)		Showering for Carcinogens (Adults)	
Average Body Weight	15	kg	80	kg
Unit Conversion Factor	0.001	mg/ug	0.001	mg/ug
Skin Surface Area	6,365	cm^2	4,193	cm^2
Event Frequency	1	event/day	1	event/day
Exposure Frequency	200	day/year	350	day/year
Exposure Duration	6	years	26	years
Averaging Time	2,190	days	25,550	days

Notes:

1.) All Exposure Parameters are from the USEPA Regional Screening Level Table (March 2, 2022), except as noted.

2.) Exposure Time for Inhalation via Showering was assumed to be 2 events/day: 1.08 hours/day (i.e., 2 * 0.54 hr/event) for the child and 1.42 hours/day (i.e., 2 * 0.71 hr/event) for the adult.

3.) The Exposure Frequency for Showering/Bathing for the child was assumed to be 4 day/week for 50 weeks (i.e., 200 days/year), assuming 2 weeks of vacation.

4.) Adults are assumed to Shower and not Bathe. Twenty-five (25%) of the Adult Skin Surface Area was assumed to be in contact with water during Showering (i.e., 19,652 cm^2 * 0.25 = 4,913 cm^2) during the showering event.

5.) EPA defaults to a 26-year exposure duration for a residential exposure scenario. In addition to the default scenario recommended by EPA, risk will be calculated for a 3- and 6-year residential exposure scenario. This is representative of one to two tours of active-duty personnel serving in the U.S. Navy who are stationed at JBPHH.

Notes: Other Dermal Factors Used to Calculate DAD-event for Child and DAD-Event for Adult

Event Time (Child)	0.54	hr/event
Event Time (Adult)	0.71	hr/event
Skin Thickness	0.001	cm

Table 2. Toxicity Values for PIANO, PAH/Alkyl-PAH, and Saturated Hydrocarbons

CASRN	Analyte	Detected in JP-5 Sample?	Oral Slope Factor mg/kg-day^{-1}	Inhalation Unit Risk ug/m$^{3(-1)}$	Oral Reference Dose mg/kg-day	Inhalation Reference Concentration mg/m^3
7094-27-1	1,1,4-Trimethylcyclohexane	No	--	--	--	--
1638-26-2	1,1-Dimethylcyclopentane	No	--	--	--	--
877-44-1	1,2,4-Triethylbenzene	No	--	--	--	--
106-93-4	1,2-Dibromoethane	No	2.0	0.00060	0.0090	0.0090
107-06-2	1,2-Dichloroethane	No	0.091	0.000026	0.0060	0.0070
102-25-0	1,3,5-Triethylbenzene	No	--	--	--	--
98-19-1	1,3-Dimethyl-5-tert-Butylbenzene	No	--	--	--	--
872-05-9	1-Decene	No	--	--	--	--
592-41-6	1-Hexene	No	--	--	--	--
124-11-8	1-Nonene	No	--	--	--	--
111-66-0	1-Octene	No	--	--	--	--
109-67-1	1-Pentene	No	--	--	--	--
464-06-2	2,2,3-Trimethylbutane	No	--	--	--	--
564-02-3	2,2,3-Trimethylpentane	No	--	--	--	--
75-83-2	2,2-Dimethylbutane	No	--	--	--	--
590-73-8	2,2-Dimethylhexane	No	--	--	--	--
590-35-2	2,2-Dimethylpentane	No	--	--	--	--
560-21-4	2,3,3-Trimethylpentane	No	--	--	--	--
565-75-3	2,3,4-Trimethylpentane	No	--	--	--	--
79-29-8	2,3-Dimethylbutane	No	--	--	--	--
584-94-1	2,3-Dimethylhexane	No	--	--	--	--
565-59-3	2,3-Dimethylpentane	No	--	--	--	--
108-08-7	2,4-Dimethylpentane	No	--	--	--	--
592-13-2	2,5-Dimethylhexane	No	--	--	--	--
872-55-9	2-Ethylthiophene	No	--	--	--	--
563-46-2	2-Methyl-1-Butene	No	--	--	--	--
625-27-4	2-Methyl-2-pentene	No	--	--	--	--
107-83-5	2-Methylpentane	No	--	--	--	--
554-14-3	2-Methylthiophene	No	--	--	--	--
2216-38-8	2-Nonene	No	--	--	--	--
1067-20-5	3,3-Diethylpentane	No	--	--	--	--
562-49-2	3,3-Dimethylpentane	No	--	--	--	--
619-99-8	3-Ethylhexane	No	--	--	--	--
617-78-7	3-Ethylpentane	No	--	--	--	--
563-45-1	3-Methyl-1-butene	No	--	--	--	--
96-14-0	3-Methylpentane	No	--	--	--	--
616-44-4	3-Methylthiophene	No	--	--	--	--
691-37-2	4-Methyl-1-pentene	No	--	--	--	--
56-55-3	Benz(a)anthracene	No	0.10	0.000060	--	--
71-43-2	Benzene	No	0.055	0.0000078	0.0040	0.030
50-32-8	Benzo(a)pyrene	No	1.0	0.00060	0.00030	0.0000020
205-99-2	Benzo(b)fluoranthene	No	0.10	0.000060	--	--
192-97-2	Benzo(e)pyrene	No	--	--	0.000090	0.0000020
191-24-2	Benzo(g,h,i)perylene	No	--	--	--	--

Table 2. Toxicity Values for PIANO, PAH/Alkyl-PAH, and Saturated Hydrocarbons

CASRN	Analyte	Detected in JP-5 Sample?	Oral Slope Factor mg/kg-day^{-1}	Inhalation Unit Risk ug/m$^{3(-1)}$	Oral Reference Dose mg/kg-day	Inhalation Reference Concentration mg/m^3
205-82-3, 207-08-9	Benzo(j)+(k)fluoranthene	No	--	--	--	--
95-15-8	Benzothiophene	No	--	--	--	--
218-01-9-C1	C1-Chrysenes	No	--	--	--	--
218-01-9-C2	C2-Chrysenes BS	No	--	--	--	--
206-44-0,129-00-0-C2	C2-Fluoranthenes/Pyrenes	No	--	--	--	--
218-01-9-C3	C3-Chrysenes	No	--	--	--	--
206-44-0,129-00-0-C3	C3-Fluoranthenes/Pyrenes	No	--	--	--	--
85-01-8,120-12-7-C3	C3-Phenanthrenes/Anthracenes	No	--	--	--	--
218-01-9-C4	C4-Chrysenes	No	--	--	--	--
132-65-0-C4	C4-Dibenzothiophenes	No	--	--	--	--
206-44-0,129-00-0-C4	C4-Fluoranthenes/Pyrenes	No	--	--	--	--
85-01-8,120-12-7-C4	C4-Phenanthrenes/Anthracenes	No	--	--	--	--
218-01-9,Triph	Chrysene/Triphenylene	No	--	--	--	--
6443-92-1	cis-2-Heptene	No	--	--	--	--
7688-21-3	cis-2-Hexene	No	--	--	--	--
7642-04-8	cis-2-Octene	No	--	--	--	--
627-20-3	cis-2-Pentene	No	--	--	--	--
20237-46-1	cis-3-Nonene	No	--	--	--	--
287-92-3	Cyclopentane	No	--	--	--	--
53-70-3 , 218-58-7	Dibenz(a,h)+(a,c)anthracene	No	--	--	--	--
637-92-3	Ethyl-Tert-Butyl-Ether	No	--	0.000000080	1.0	40
206-44-0	Fluoranthene	No	--	--	0.040	--
193-39-5	Indeno(1,2,3-cd)pyrene	No	0.10	0.000060	--	--
1678-98-4	Isobutylcyclohexane	No	--	--	--	--
540-84-1	Isooctane	No	--	--	--	--
78-78-4	Isopentane	No	--	--	--	--
78-79-5	Isoprene	No	--	--	--	--
108-20-3	Isopropyl Ether	No	--	--	--	0.70
696-29-7	Isopropylcyclohexane	No	--	--	--	--
1634-04-4	Methyl tert butyl ether	No	0.0018	0.00000026	--	3.0
12108-13-3	MMT	No	--	--	--	--
629-97-0	n-Docosane (C22)	No	--	--	--	--
544-85-4	n-Dotriacontane (C32)	No	--	--	--	--
112-95-8	n-Eicosane (C20)	No	--	--	--	--
629-94-7	n-Heneicosane (C21)	No	--	--	--	--
630-04-6	n-Hentriacontane (C31)	No	--	--	--	--
593-49-7	n-Heptacosane (C27)	No	--	--	--	--
7194-84-5	n-Heptatriacontane (C37)	No	--	--	--	--
630-01-3	n-Hexacosane (C26)	No	--	--	--	--
630-06-8	n-Hexatriacontane (C36)	No	--	--	--	--
630-03-5	n-Nonacosane (C29)	No	--	--	--	--
629-92-5	n-Nonadecane (C19)	No	--	--	--	--
7194-86-7	n-Nonatriacontane (C39)	No	--	--	--	--
7194-85-6	n-Octatriacontane (C38)	No	--	--	--	--

Table 2. Toxicity Values for PIANO, PAH/Alkyl-PAH, and Saturated Hydrocarbons

CASRN	Analyte	Detected in JP-5 Sample?	Oral Slope Factor mg/kg-day^{-1}	Inhalation Unit Risk ug/m$^{3(-1)}$	Oral Reference Dose mg/kg-day	Inhalation Reference Concentration mg/m^3
630-07-9	n-Pentatriacontane (C35)	No	--	--	--	--
4181-95-7	n-Tetracontane (C40)	No	--	--	--	--
646-31-1	n-Tetracosane (C24)	No	--	--	--	--
14167-59-0	n-Tetratriacontane (C34)	No	--	--	--	--
638-68-6	n-Triacontane (C30)	No	--	--	--	--
638-67-5	n-Tricosane (C23)	No	--	--	--	--
630-05-7	n-Tritriacontane (C33)	No	--	--	--	--
109-66-0	Pentane	No	--	--	--	1.0
198-55-0	Perylene	No	--	--	0.000090	0.0000020
108-95-2	Phenol	No	--	--	0.30	0.20
638-36-8	Phytane	No	--	--	--	--
129-00-0	Pyrene	No	--	--	0.030	--
483-65-8	Retene	No	--	--	--	--
100-42-5	Styrene	No	--	--	0.20	1.0
75-65-0	Tertiary Butanol	No	0.00050	--	0.40	5.0
994-05-8	Tertiary-Amyl Methyl Ether	No	--	--	--	--
110-02-1	Thiophene	No	--	--	--	--
14686-13-6	trans-2-Heptene	No	--	--	--	--
4050-45-7	trans-2-Hexene	No	--	--	--	--
646-04-8	trans-2-Pentene	No	--	--	--	--
14686-14-7	trans-3-Heptene	No	--	--	--	--
20063-92-7	trans-3-Nonene	No	--	--	--	--
2532-58-3	1,3-Dimethylcyclopentane (cis)	Yes	--	--	--	--
120-12-7	Anthracene	Yes	--	--	0.30	--
132-65-0-C3	C3-Dibenzothiophenes	Yes	--	--	--	--
86-73-7-C3	C3-Fluorenes	Yes	--	--	--	--
630-02-4	n-Octacosane (C28)	No	--	--	--	--
1-Heptene/1,2-DMCP(trans)	1-Heptene/1,2-DMCP (trans)	No	--	--	--	--
591-76-4	2-Methylhexane	No	--	--	--	--
589-53-7	4-Methylheptane	Yes	--	--	--	--
3875-51-2	Isopropylcyclopentane	Yes	--	--	--	--
110-54-3	n-Hexane	Yes	--	--	--	0.70
98-06-6	tert-Butylbenzene	Yes	--	--	0.10	--
85-01-8,120-12-7-C2	C2-Phenanthrenes/Anthr BS	No	--	--	--	--
589-43-5	2,4-Dimethylhexane	Yes	--	--	--	--
4032-86-4	3,3-Dimethylheptane	Yes	--	--	--	--
589-34-4	3-Methylhexane	Yes	--	--	--	--
1640-89-7	Ethylcyclopentane	Yes	--	--	--	--
96-37-7	Methylcyclopentane	Yes	--	--	--	--
629-99-2	n-Pentacosane (C25)	No	--	--	--	--
110-82-7	Cyclohexane	Yes	--	--	--	6.0
3892-00-0	Norpristane (1650)	Yes	--	--	--	--
593-45-3	n-Octadecane (C18)	Yes	--	--	--	--

Table 2. Toxicity Values for PIANO, PAH/Alkyl-PAH, and Saturated Hydrocarbons

CASRN	Analyte	Detected in JP-5 Sample?	Oral Slope Factor mg/kg-day^{-1}	Inhalation Unit Risk ug/m$^{3(-1)}$	Oral Reference Dose mg/kg-day	Inhalation Reference Concentration mg/m^3
206-44-0,129-00-0-C1	C1-Fluoranthenes/Pyrenes	No	--	--	--	--
2207-01-4	1,2-Dimethylcyclohexane (cis)	No	--	--	--	--
926-82-9	3,5-Dimethylheptane	Yes	--	--	--	--
629-78-7	n-Heptadecane (C17)	Yes	--	--	--	--
1921-70-6	Pristane	Yes	--	--	--	--
85-01-8,120-12-7-C1	C1-Phenanthrenes/Anthracenes	No	--	--	--	--
488-23-3	1,2,3,4-Tetramethylbenzene	Yes	--	--	--	--
527-53-7	1,2,3,5-Tetramethylbenzene	Yes	--	--	--	--
526-73-8	1,2,3-Trimethylbenzene	Yes	--	--	0.010	0.060
95-93-2	1,2,4,5-Tetramethylbenzene	Yes	--	--	--	--
95-63-6	1,2,4-Trimethylbenzene	Yes	--	--	0.010	0.060
135-01-3	1,2-Diethylbenzene	Yes	--	--	--	--
933-98-2	1,2-Dimethyl-3-Ethylbenzene	Yes	--	--	--	--
934-80-5	1,2-Dimethyl-4-Ethylbenzene	Yes	--	--	--	--
6876-23-9	1,2-Dimethylcyclohexane (trans)	Yes	--	--	--	--
108-67-8	1,3,5-Trimethylbenzene	Yes	--	--	0.010	0.060
141-93-5	1,3-Diethylbenzene	Yes	--	--	--	--
2870-04-4	1,3-Dimethyl-2-Ethylbenzene	Yes	--	--	--	--
874-41-9	1,3-Dimethyl-4-Ethylbenzene	Yes	--	--	--	--
934-74-7	1,3-Dimethyl-5-Ethylbenzene	Yes	--	--	--	--
1758-88-9	1,4-Dimethyl-2-Ethylbenzene	Yes	--	--	--	--
2207-04-7	1,4-Dimethylcyclohexane (trans)	Yes	--	--	--	--
611-14-3	1-Methyl-2-Ethylbenzene	Yes	--	--	--	--
527-84-4	1-Methyl-2-Isopropylbenzene	Yes	--	--	--	--
1074-17-5	1-Methyl-2-N-Propylbenzene	Yes	--	--	--	--
620-14-4	1-Methyl-3-Ethylbenzene	Yes	--	--	--	--
535-77-3	1-Methyl-3-Isopropylbenzene	Yes	--	--	--	--
1074-43-7	1-Methyl-3-N-Propylbenzene	Yes	--	--	--	--
622-96-8	1-Methyl-4-Ethylbenzene	No	--	--	--	--
99-87-6	1-Methyl-4-Isopropylbenzene	Yes	--	--	--	--
1074-55-1	1-Methyl-4-N-Propylbenzene	Yes	--	--	--	--
90-12-0	1-Methylnaphthalene	Yes	0.029	--	0.070	--
2245-38-7	2,3,5-Trimethylnaphthalene	No	--	--	--	--
3074-71-3	2,3-Dimethylheptane	Yes	--	--	--	--
2216-30-0	2,5-Dimethylheptane	Yes	--	--	--	--
3891-98-3	2,6,10-Trimethyldodecane (1380)	Yes	--	--	--	--
3891-99-4	2,6,10-Trimethyltridecane (1470)	Yes	--	--	--	--
581-42-0	2,6-Dimethylnaphthalene	No	--	--	--	--
592-27-8	2-Methylheptane	No	--	--	--	--
91-57-6	2-Methylnaphthalene	Yes	--	--	0.0040	--
871-83-0	2-Methylnonane	Yes	--	--	--	--
3221-61-2	2-Methyloctane	Yes	--	--	--	--
4110-44-5	3,3-Dimethyloctane	Yes	--	--	--	--
922-28-1	3,4-Dimethylheptane	Yes	--	--	--	--

Table 2. Toxicity Values for PIANO, PAH/Alkyl-PAH, and Saturated Hydrocarbons

CASRN	Analyte	Detected in JP-5 Sample?	Oral Slope Factor mg/kg-day^{-1}	Inhalation Unit Risk ug/m$^{3(-1)}$	Oral Reference Dose mg/kg-day	Inhalation Reference Concentration mg/m^3
589-81-1	3-Methylheptane	Yes	--	--	--	--
5911-04-6	3-Methylnonane	Yes	--	--	--	--
2216-33-3	3-Methyloctane	Yes	--	--	--	--
2216-34-4	4-Methyloctane	Yes	--	--	--	--
83-32-9	Acenaphthene	Yes	--	--	0.060	--
208-96-8	Acenaphthylene	Yes	--	--	--	--
92-52-4	Biphenyl	Yes	0.0080	--	0.50	0.00040
132-65-0-C1	C1-Dibenzothiophenes BS	Yes	--	--	--	--
86-73-7-C1	C1-Fluorenes	Yes	--	--	--	--
91-20-3-C1	C1-Naphthalenes	Yes	--	--	--	--
132-65-0-C2	C2-Dibenzothiophenes	Yes	--	--	--	--
86-73-7-C2	C2-Fluorenes	Yes	--	--	--	--
91-20-3-C2	C2-Naphthalenes	Yes	--	--	--	--
91-20-3-C3	C3-Naphthalenes	Yes	--	--	--	--
91-20-3-C4	C4-Naphthalenes	Yes	--	--	--	--
124-18-5	Decane (C10)	Yes	--	--	--	--
132-64-9	Dibenzofuran	No	--	--	0.0010	--
132-65-0	Dibenzothiophene	Yes	--	--	--	--
112-40-3	Dodecane (C12)	Yes	--	--	--	--
100-41-4	Ethylbenzene	Yes	0.011	0.0000025	0.050	1.0
86-73-7	Fluorene	Yes	--	--	0.040	--
142-82-5	Heptane	Yes	--	--	0.00030	0.40
1077-16-3	Hexylbenzene	Yes	--	--	--	--
496-11-7	Indane	No	--	--	--	--
95-13-6	Indene	Yes	--	--	--	--
538-93-2	Isobutylbenzene	Yes	--	--	--	--
98-82-8	Isopropylbenzene	Yes	--	--	0.10	0.40
108-87-2	Methylcyclohexane	Yes	--	--	--	0.095
91-20-3	Naphthalene	Yes	0.12	0.000034	0.020	0.0030
104-51-8	n-Butylbenzene	Yes	--	--	0.050	--
124-18-5	n-Decane (C10)	Yes	--	--	--	--
112-40-3	n-Dodecane (C12)	Yes	--	--	--	--
544-76-3	n-Hexadecane (C16)	Yes	--	--	--	--
111-84-2	n-Nonane (C9)	Yes	--	--	0.00030	0.020
629-62-9	n-Pentadecane (C15)	Yes	--	--	--	--
538-68-1	N-Pentylbenzene	No	--	--	--	--
103-65-1	n-Propylbenzene	Yes	--	--	0.10	1.0
629-59-4	n-Tetradecane (C14)	Yes	--	--	--	--
629-50-5	n-Tridecane (C13)	Yes	--	--	--	--
1120-21-4	n-Undecane (C11)	Yes	--	--	--	--
111-65-9	Octane	Yes	--	--	--	--
629-62-9	Pentadecane	Yes	--	--	--	--
85-01-8	Phenanthrene	Yes	--	--	--	--
135-98-8	sec-Butylbenzene	Yes	--	--	0.10	--

Table 2. Toxicity Values for PIANO, PAH/Alkyl-PAH, and Saturated Hydrocarbons

CASRN	Analyte	Detected in JP-5 Sample?	Oral Slope Factor mg/kg-day^{-1}	Inhalation Unit Risk ug/m$^{3(-1)}$	Oral Reference Dose mg/kg-day	Inhalation Reference Concentration mg/m^3
629-59-4	Tetradecane (C14)	Yes	--	--	--	--
108-88-3	Toluene	Yes	--	--	0.080	5.0
629-50-5	Tridecane	Yes	--	--	--	--
1120-21-4	Undecane	Yes	--	--	--	--
1330-20-7	Xylene (Total)	Yes	--	--	0.20	0.10

Notes:

-- No toxicity value available in the November 2023 EPA RSL Table. https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables.

Chemical was detected in JP-5 product sample collected from Red Hill.

Chemical was not detected inJP-5 product sample collected from Red Hill.

Attachment 1 – Email Regarding Practical, Technical Challenges for Collecting/Performing Tier 2 Data Analysis on Drinking Water Samples

From: Chris Waldron
Sent: Tuesday, March 26, 2024 11:04 AM
To: 'Li.Corine@epa.gov' <Li.Corine@epa.gov>
Cc: 'Hopeman.Bob@epa.gov' <Hopeman.Bob@epa.gov>
Subject: JBPHH - PIANO/Alkyl PAH Lab Discussion

Hi Corine,

Are you and Bob Hopeman available today to discuss PIANO/Alkyl PAH Analysis and Labs/Lab protocols? It is feasible to collect Tier 2 data for use in a human health risk assessment. I want to discuss the idea of developing a protocol for Tier 2 that the Navy's Lab and the EPA's Lab will both follow to ensure that we have confidence in the data that are returned. If not, we (Navy and EPA) could be very different results from split samples which are due to laboratory issues and not due to the actual field samples.

This would just be the 3 of us, unless you need additional folks. The purpose to discuss some practical concerns that I have regarding the labs that perform PIANO/Alkyl PAH analysis and start the process for developing an approach to ensure consistency with how the Lab EPA selects to perform PIANO/Alkyl PAH analysis and the Navy's lab.

Here's a list of challenges (this is not a complete list) we'll need to overcome:

- Our field teams need to be uber meticulous when collecting samples. We should consider developing SOPs for sampling that are similar to those used when collecting PFAS samples.
- These labs typically analyze product samples (e.g., refinery samples) with very high concentrations – this may create very real, practical challenges to obtaining reliable data from these labs at the sub-part-per billion concentrations required by human health risk assessment.
- Lab contamination/cross contamination. This becomes a bigger issue as we push the lab to lower and lower detection limits. This will be even more significant if the lab routinely analyzes highly contaminated samples because they won't be experienced applying SOPs required, at all levels, to prevent low-level lab contamination in Method Blanks et cetera to the parts per trillion levels (or less).
- These labs do not routinely (and likely never have) run drinking water samples. So, they are not experienced with potential chlorine interactions that may occur during preparation/analysis. We will quench the samples prior to analysis, which should minimize the impact of residual chlorine, but we need to keep this in mind.
- Labs typically combine samples from multiple customers in Sample Delivery Groups of 20 samples and then run those as a batch. This could significantly impact our results if our batch includes samples with higher contamination – due to "Bleed Over" from the previous contaminated sample. THINK the NOAA Lab results.
- May need to consider requiring dedicated equipment (glassware, consumables, analytical equipment [GC/MS]) for performing this analysis.
- We will need to perform Level 4 Data Validation on all PIANO data.
- These specialty labs are typically small and routinely take a month (or more) to perform/report the results of PIANO Analysis. This does not include Data Validation. This will take time…

-Thank you,

-Chris Waldron

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

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)
584-94-1	2,3-Dimethylhexane	16	0	0.0	187	484	0.0	0.0	176	216	97	62
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

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)
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
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

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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
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

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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
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

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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
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

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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
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

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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
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