HRSD SWIFT Research Center (SRC) Quarterly Report on SWIFT Water Quality Targets

This report documents SWIFT Water Quality results for recharge operations from April 1 – June 30, 2022. Recharge operations ceased in early November to accommodate activities associated with installation of the new recharge well as described later in this report. The compliance requirements are documented in HRSD's SWIFT Underground Injection Control Inventory Information Package (UIC-IIP) submitted to EPA Region III in January 2018. These requirements are noted in Tables 1-4 and reflect an update to the monitoring and compliance evaluation for Total coliform.

Figures 1 and 2 and Table 6 provide a summary of the data from the referenced quarter of operations relative to the SWIFT Water Quality Targets. Table 6 represents a summary of all analytes that were present above the laboratory reporting limit. A detailed table identifying the parameters monitored for the purpose of evaluating compliance with the SWIFT Water Quality Targets can be found as an Appendix to this report.

Parameter	Proposed Regulatory Limit	Non-Regulatory Action/Goal
EPA Drinking Water Primary Maximum Contaminant Levels (MCLs)	Meet all primary MCLs	N/A
Total Nitrogen	5 mg/L Monthly Average; 8 mg/L Max Daily	Secondary Effluent Critical Control Point (CCP) Action Limit for Total Inorganic Nitrogen (TIN) = 5 mg/L-N; CCP Action Limit for SWIFT Water Total Nitrogen (TN) = 5 mg/L-N
Turbidity	Individual Filter Effluent (IFE) < 0.15 NTU 95% of time and never >0.3 NTU in two consecutive 15 min measurements	CCP Action Limit IFE of 0.15 NTU to initiate backwash or place a filter in standby
Total Organic Carbon (TOC)[1]	4 mg/L Monthly Average; 6 mg/L Maximum Daily	Critical Operating Point (COP) Action Limit to Initiate GAC Regeneration
Total Coliform[2]	<2 CFU/100 mL for 95% of calendar month observations, applied as the 95th percentile	N/A
E.coli	Non-detect	N/A
TDS[3]	N/A	Monitor PAS Compatibility

Table 1: SRC Regulatory and Monitoring Limits for SWIFT Water

[1] Regulatory limit applies to the TOC laboratory analysis which is collected at a minimum frequency of 3 times per week.

[2] The Total Coliform (TC) monitoring and compliance evaluation reflects an update effective in January 2020 following consultation with the Virginia Department of Health and EPA Region III UIC staff.

[3] No limit for Total Dissolved Solids (TDS) proposed as the primary driver is aquifer compatibility. The concentration of TDS in SWIFT Water at the SRC generally ranges from 500-850 mg/L.

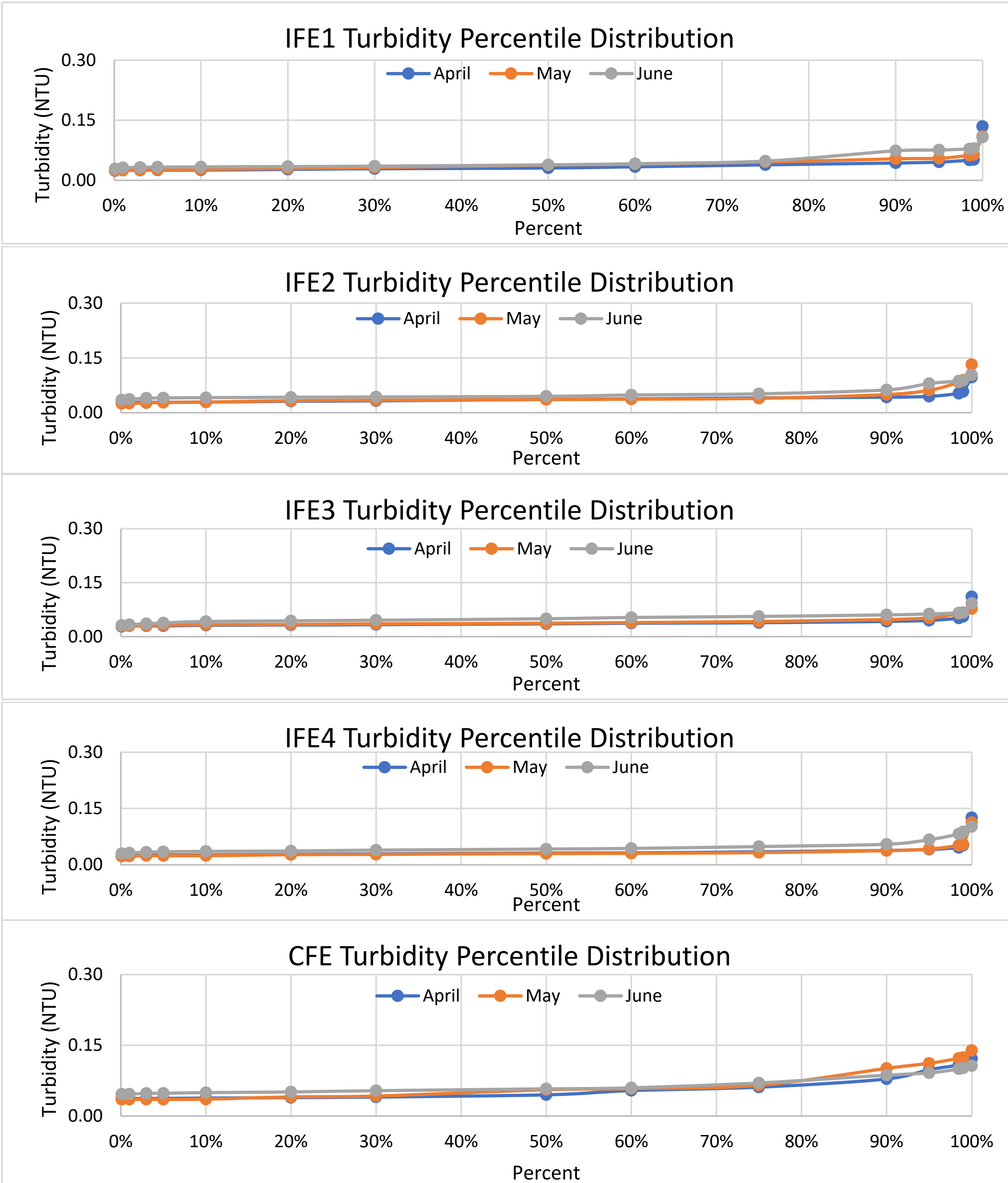

Figure 1: Percentile distribution of 15-minute average Individual Filter Effluent (IFE) Turbidities for Biofilters 1-4 (IFE1-4) and Biofilter Combined Filter Effluent (CFE). There were no 15-minute periods in this quarter with biofilter effluent turbidity values greater than 0.3 NTU. The 95% measured value for each biofilter IFE and the CFE was less than 0.15 NTU for each month in this quarter.

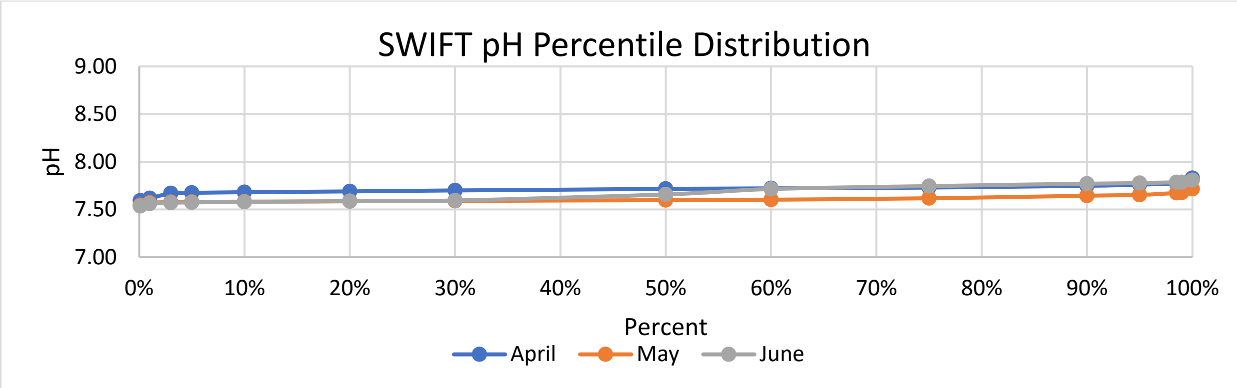

Figure 2: Distribution of Monthly SWIFT Water pH values.

Monitoring at the SRC also includes monitoring for performance indicators as documented in Table 2.

Constituent	Category	Trigger Value	Unit	Notes
1,4-Dioxane	Public Health	1	µg/L	CCL4; CA Notification Limit
17-β-Estradiol	Public Health	0.9[1]	ng/L	CCL4
DEET	Public Health	200	µg/L	MN Health Guidance Value
Ethinyl Estradiol	Public Health	280[1]	ng/L	CCL4
NDMA	Public Health	10	ng/L	CCL4; CA Notification Limit
Perchlorate	Public Health	6	µg/L	CA Notification Limit
PFOA+PFOS	Public Health	70	ng/L	CCL4; EPA Health Advisory
TCEP	Public Health	5	µg/L	MN Health Guidance Value
Cotinine	Treatment Effectiveness	1	µg/L	Surrogate for low molecular weight, partially charged cyclics
Primidone	Treatment Effectiveness	10	µg/L	
Phenytoin	Treatment Effectiveness	2	µg/L	
Meprobamate	Treatment Effectiveness	200	µg/L	High occurrence in wastewater treatment plant effluent
Atenolol	Treatment Effectiveness	4	µg/L	
Carbamazepine	Treatment Effectiveness	10	µg/L	Unique structure
Estrone	Treatment Effectiveness	320	ng/L	Surrogate for steroids
Sucralose	Treatment Effectiveness	150	mg/L	Surrogate for water soluble, uncharged chemicals with moderate molecular weight
Triclosan	Treatment Effectiveness	2,100	µg/L	Chemical of interest

[1] Identified as “To Be Determined” in the UIC-IIP. Since that time, threshold values were identified in *Monitoring Strategies for Constituents of Emerging Concern (CECs) in Recycled Water, Recommendations of a Science Advisory Panel, 2018; SCCWRP Technical Report 1032.*

Table 2: SRC Non-Regulatory Performance Indicators

Pathogen Log Removal Value (LRV) is not strictly regulated but the SRC has been designed and is operated to achieve at least 12 LRV for viruses and 10 LRV for *Cryptosporidium* and *Giardia* through a combination of advanced treatment processes and soil aquifer treatment. Table 3 provides a treatment process pathogen LRV summary for recharge conditions. Table 4 provides additional monitoring that is being completed to document compliance with the LRVs for ozone and UV.

Parameter	Floc/Sed (+BAC)	Ozone	BAC+GAC	UV	Cl2	SAT	Total
Enteric Viruses	2	0-3 (TBD)	0	4	0-4	6	12-19
Cryptosporidium	4	0	0	6	0	6	16
Giardia	2.5	0-1.5 (TBD)	0	6	0	6	14.5-16

Table 3: SRC Pathogen LRV for Potomac Aquifer System (PAS) Recharge.

Ozone LRV
Ozone Influent Temperature
Ozone Influent Flow
Liquid Phase Ozone Concentration[1]
Contact Time
CT
UV LRV
UV Intensity, each reactor
UVT, GAC Combined Effluent
Reactor Flow, each
Calculated Dose, each Lamp
Status, each

1 The ozone liquid phase probe is verified with lab grab samples performed at least once per week.

Table 4: Additional Monitoring to Support Ozone and UV LRV. All data are collected as continuous measurements. The 15-minute LRV data is submitted in Table 6.

Critical Control Points

The SRC incorporates Critical Control Points (CCP) throughout the treatment process, per Attachment G of UIC-IIP, to verify that treatment goals are being met at each of the individual processes. A violation of any CCP means that the SRC may not be producing water that meets the treatment goals and will trigger a diversion of the SWIFT Water so that it is not directed to the recharge well. In most instances, the SRC will continue to operate through the CCP violation, but the SWIFT Water will be diverted back to the Nansemond Plant chlorine contact tanks (CCT).

CCPs have alert values at which point the operator is expected to take action to correct the performance as well as the alarm values at which point an automated response will trigger action and prevent flow from going to the recharge well. Both the alert and alarm values will be measured consistently for a specified duration before action is taken so that blips in online analyzers do not trigger action. The specific values for the alert and alarm levels will be configured as adjustable set points in the Distributed Control System (DCS) and optimized as needed to meet the water quality requirements.

Table 5 shows the current CCPs in effect at the SRC. Modifications have been made to the CCPs since startup as compared to the original design documents in order to optimize their performance. No modifications to the CCPs were made this quarter. Each of the modifications from previous quarters was discussed in the relevant quarterly report for the period.

Parameter	Alert Value	Alarm Value	Unit	Action
Critical Control Points (CCPs)				
Influent Pump Station Conductivity	1,400	1,600	microSiemens per centimeter	Place Biofilters in Filter To Waste
Influent Pump Station Total Inorganic Nitrogen	4.0	5.0	mg/L-N	Place Biofilters in Filter To Waste
Influent Pump Station Turbidity	3.5	5.0	NTU	Place Biofilters in Filter To Waste
Preformed Chloramine Failure on Injection	N/A	Failure	mg/L	Divert SWIFT Water
Total Chlorine Post Injection upstream of ozone	2.0	1.0	mg/L	Divert SWIFT Water
Chloramine injection upstream of ozone	2.0	1.0	mg/L	Divert SWIFT Water
Ozone Feed	N/A	Failure	N/A	Open Biofilter Backwash Waste Valve
Ozone Contactor Calculated LRV – Virus	<120% LRV Goal	<110% LRV Goal	%	Open Biofilter Backwash Waste Valve
Biofilter Individual Effluent Turbidity	0.1	0.15	NTU	Place That Biofilter in Filter To Waste
Biofilter Combined Filter Effluent Turbidity	0.1	0.15	NTU	Place Biofilters in Filter To Waste
GAC Combined Effluent TOC, instantaneous online analyzer	4.0	5.0	mg/L	Divert SWIFT Water
UV Reactor Dose	<120% of Dose Setpoint	<105% of Dose Setpoint	%	Divert SWIFT Water
GAC Combined Effluent Nitrite	0.25	0.50	mg/L-N	Divert SWIFT Water
SWIFT Water TN	4.5	5.0	mg/L-N	Divert SWIFT Water
Ozone dose	70	80	lbs/day	Place Biofilters in Filter To Waste
Tasting System Free Chlorine CT	<110% of Required CT	<100% of Required CT	mg-min/L	Shut Down Tasting System
Tasting System Total Ammonia	0.1	0.3	mg/L-N	Shut Down Tasting System

Table 5. Critical Control Points for the SRC

Table 6. SWIFT Water Quality Monitoring

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	April 2022			May 2022			June 2022		
					Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples
Regulatory Parameters													
Total Nitrogen (TN)	mg/L	NA	0.50	Daily[3]	3.65	5.54	23	3.00	3.93	29	3.41	5.08	24
NO_3	mg/L	10	0.20	Daily[3]	3.14	4.53	21	2.91	3.93	29	3.11	4.53	24
NO_2	mg/L	1	0.01	Daily[3]	<0.01	<0.01	21	<0.01	<0.01	30	<0.01	<0.01	24
Turbidity	NTU	NA	0.01	Continuous				Figure 1					
Total Organic Carbon (TOC)	mg/L	NA	1.00	3x/Wk[3]	3.34	3.68	16	3.36	3.74	21	3.57	3.86	17
pH		NA	NA	Continuous				Figure 2					
TDS[4]	mg/L	Potomac Aquifer System Range: 694-8,720	2.5	Monthly		568	1		736	1		576	1
Microorganisms													
Total Coliform	MPN/100 mL	MCLG = 0	1	Daily[3]	<1	<1	21	<1	<1	29	<1	<1	24
E. coli	MPN/100 mL	NA	1	Weekly	<1	<1	21	<1	<1	29	<1	<1	24
Disinfection Byproducts													
Bromate	µg/L	10	0.15	Monthly		2.35	1		5.95	1		2.79	1
Trihalomethanes													
Bromodichloromethane	µg/L		1.00	Monthly		1.31	1		2.03	1		2.28	1
Bromoform	µg/L		1.00	Monthly		3.59	1		8.61	1		6.40	1
Chloroform	µg/L		1.00	Monthly		<1.00	1		<1.00	1		1.02	1
Dibromochloromethane	µg/L		1.00	Monthly		3.94	1		7.38	1		6.69	1
Total Trihalomethanes	µg/L	80				8.84	1		18.0	1		16.4	1
HAAs													
Dichloroacetic acid	µg/L		0.60	Monthly		2.17	1		1.4	1		2.14	1
Trichloroacetic acid	µg/L		0.20	Monthly		0.20, OR6	1		<0.20	1		0.59	1
Monochloroacetic acid	µg/L		0.60	Monthly		<0.60	1		<0.60	1		<0.60	1
Bromoacetic acid	µg/L		0.40	Monthly		0.98, OR6	1		1.25	1		1.16	1
Dibromoacetic acid	µg/L		0.20	Monthly		5.10	1		8.73	1		8.51	1
Total Haloacetic Acids	µg/L	60				8.45	1		11.4	1		12.4	1
Disinfectants[5]													
Monochloramine (as Cl_2)	mg/L	4		Continuous	0.02	0.04		0.01	0.02		0.01	0.01	
Chlorine (as Cl_2)	mg/L	4		Continuous	2.67	3.07		2.43	3.13		2.41	2.97	
Inorganic Chemical													
Barium	mg/L	2	0.005	Monthly	0.007	0.007	2		0.006	1		0.007	1
Fluoride	mg/L	4.0	0.050	Monthly	0.787	0.917	23	0.803	0.885	29	0.855	1.07	24
Mercury	µg/L	2	0.10	Monthly	<0.10	<0.10	2		<0.10	1		0.19	1
Radionuclides													
Beta particles and photon emitters	pCi/L	4 mrem/yr[6]	4	Monthly		9.7	1		6.7	1		14.7	1

Table 6. SWIFT Water Quality Monitoring

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	April 2022			May 2022			June 2022		
					Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples
Non-regulatory Performance Indicators													
Public Health Indicators		**Trigger Limits**											
1,4-dioxane	µg/L	1	0.06	Weekly	0.31	0.34	4	0.33	0.39	5	0.29	0.33	3
s(2-carboxyethyl)phosphine (TCEP)	ng/L	5,000	10	Quarterly		12	1						
Perfluorooctanoic Acid (PFOA)	ng/L	70 (PFOA+PFOS)	2.0	Quarterly		8.4	1						
Treatment Efficacy Indicators		**Trigger Limits**											
Cotinine	ng/L	1,000	10	Quarterly		19	1						
Primidone	ng/L	10,000	5.0	Quarterly		6.0	1						
Sucralose	ng/L	150,000,000	1000	Monthly		4300	1		2800	1		20000	1
Additional Monitoring (Ozone & UV LRV)						**Minimum**			**Minimum**			**Minimum**	
Ozone Virus LRV				Continuous	4.51	3.67		4.59	3.71		4.50	3.49	
Ozone Giardia LRV				Continuous	2.32	1.93		2.30	1.70		2.11	1.63	
UV Dose Reactor 1	mJ/cm^2			Continuous	>186	>186		>186	>186		>186	>186	
UV Virus LRV Reactor 1				Continuous	>4	>4		>4	>4		>4	>4	
UV Dose Reactor 2	mJ/cm^2			Continuous	>186	>186		>186	>186		>186	>186	
UV Virus LRV Reactor 2				Continuous	>4	>4		>4	>4		>4	>4	

[1] When minimum reporting limits varied during the quarter, the highest minumum reporting limit used is identified.
[2] Analytical results less than the reporting limit were treated as zero for the purposes of the averaging calculation.
[3] Daily samples are typically not collected on days in which there is no or limited recharge. TOC sample collection occurs routinely on Monday through Friday when recharging. Limited or inconsistent recharge impacts the collection of daily samples, particularly for the microbiological samples collected for total coliform and E coli which have limited holding time requirements. In April, limited or no recharge impacted nine days of sampling. In May, limited or no recharge impacted one day of sampling. An improperly preserved sample on May 13 resulted in the loss of total nitrogen and nitrate for the day. In June, limited or no recharge impacted six days of sampling.
[4] TDS of the Potomac Aquifer System is based on the averages within the upper, middle and lower Potomac Aquifer as determined during baseline montioring.
[5] The maximum residual disinfectant level (or MRDL) MCL for monochloramine and chlorine are based on annual averages.
[6] The measurement unit for beta particles and photon emitters is pCi/L while the MCL is expressed as mrem/yr. Per EPA's Implementation Guidance for Radionuclides (EPA 816-F-00-002, March 2002), the screening threshold for beta particles and photon emitters is 50 pCi/L. If sample concentrations exceed 50 pCi/L, each individual beta particle and photon emitter is converted from pCi/L to mrem using the EPA designated conversion tables, currently available in the referenced document.

Contract Laboratory Flags
OR6: >50% difference between analytical and confirmation GC columns. Lower value is reported.
U: Results less than the sample detection limit.
G: The sample Minimum Detectable Concentration (MDC) is greater than the requested RL.

Recharge Statistics

The total volume recharged during this operational period was 35.0 million gallons. The backflushed volume was 6.3 million gallons for a net recharge of 28.7 million gallons (Figure 3). Brief backflushing periods occur as part of routine well maintenance on an approximate daily basis. From the start of operation through the end of this reporting period, the SRC has recharged a total volume of 595.5 million gallons.

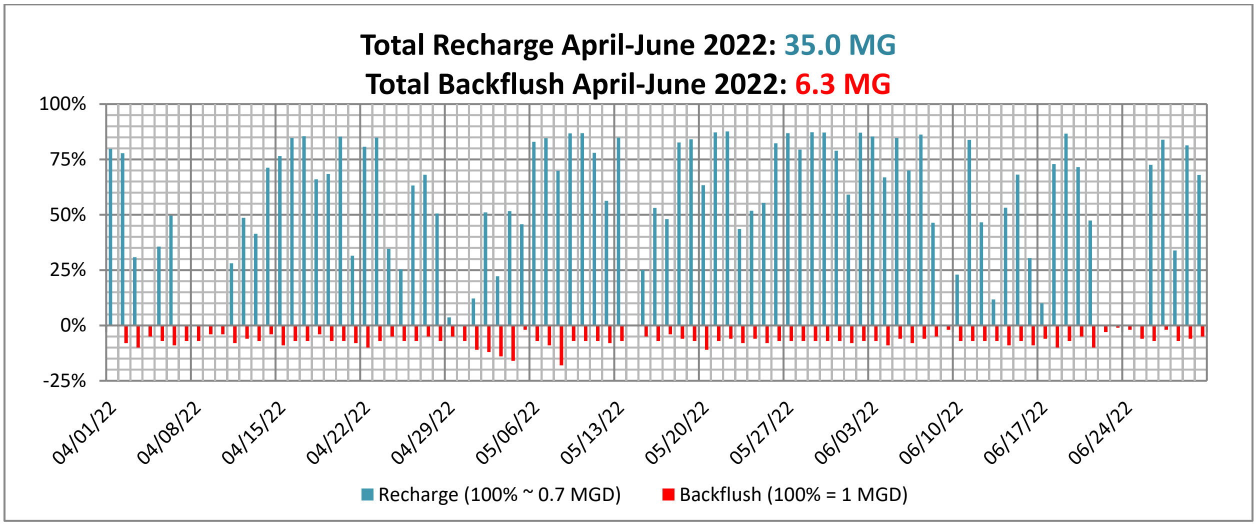

Figure 3: Recharge and Backflush Volumes, April 1 – June 30, 2022

HRSD has developed an internal target to recharge 75% of a SWIFT facility's operational capacity. This is a particularly relevant planning target for full-scale operations and HRSD is striving to meet this target at the SRC. Operational redundancies will exist at full-scale facilities (e.g., multiple recharge wells) which will likely result in a higher rate of recharge at full-scale.

The recharge capacity of TW-1 has slowly diminished since the well rehabilitation completed in Quarter 1 of 2021. To compensate for the reduced injectivity and preserve capacity until NP_MAR_01 is operational the recharge flow to TW-1 has been reduced. The well recharge target was initially adjusted to 600 gallons per minute (gpm, equivalent to 0.864 MGD), down from 700 gpm (~1 MGD) and more recently adjusted to 500 gpm (0.72 MGD). Recharge well capacity will continue to be monitored and the recharge flow will be adjusted as necessary; the SRC 75% target will be evaluated against the adjusted flow. The new well, NP_MAR_01 is anticipated to undergo commissioning in mid to late August and should be in routine operation in September.

Figure 4 depicts the operational activity for this monitoring period identifying the percentage of operational time spent in recharge as well as the general factors precluding recharge.

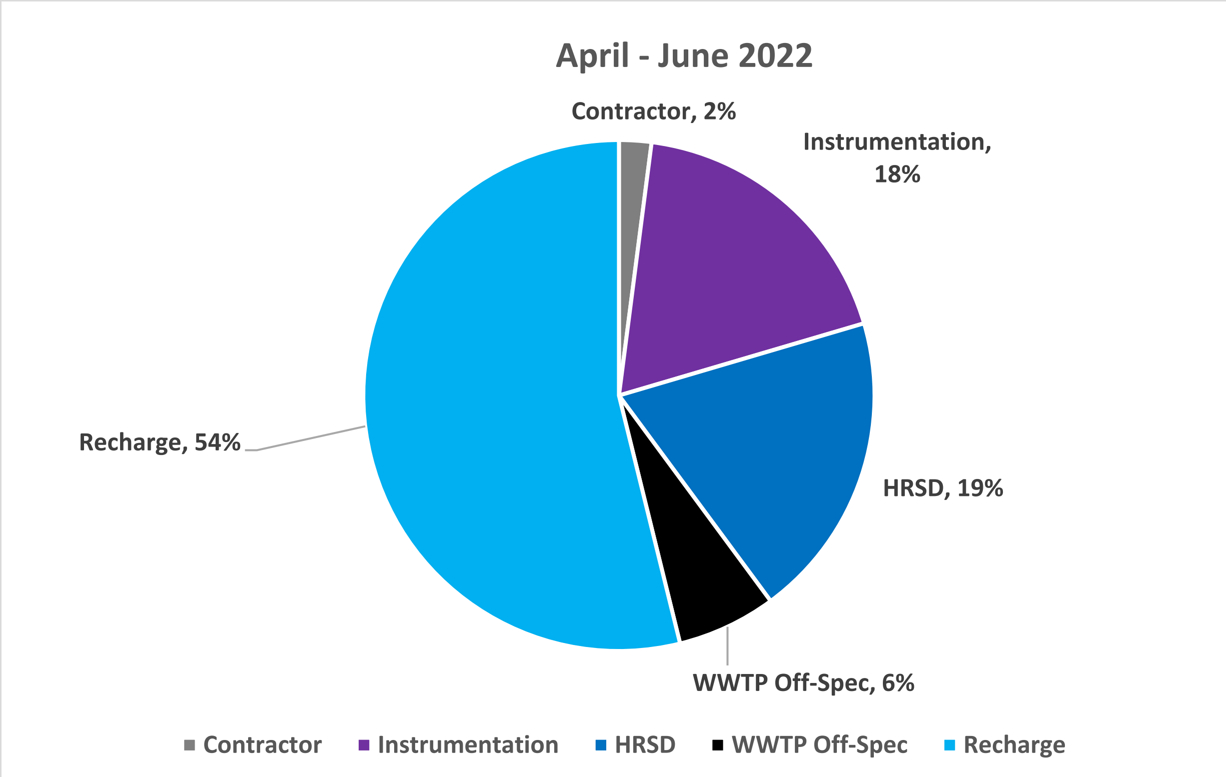

Figure 4: Operational activity for monitoring period. Notes: *Recharge***:** Recharge of SWIFT Water; *WWTP Off-Spec*: Influent to the SWIFT facility (wastewater facility secondary clarifier effluent) does not meet influent quality requirements (e.g. elevated TOC or TN, or WWTP repairs; *HRSD***:** Broad category covering activity within SWIFT facility that may lead to shut-down (e.g. maintenance and repairs, operational problems); *Contractor:* Recharge suspended to accommodate contractor activity at the AWT and/or recharge well. *Instrumentation*: On-line analyzer and/or instrumentation maintenance and repair.

Conventional Monitoring Wells

The conventional monitoring well for the upper zone of the Potomac Aquifer (MW-UPA), located approximately 400 ft from the recharge well, has been routinely monitored to detect the arrival of the recharge front. The recharge front arrived at MW-UPA in the fall of 2019 as evidenced by increasing Total Organic Carbon (TOC) concentrations. Travel time to MW-UPA was further confirmed through a bromide tracer study initiated in July of 2020. Bromide from this tracer study was identified in MW-UPA beginning in April 2022, a period in which approximately 230 million gallons of SWIFT Water was recharged.

TOC observations in the monitoring wells located in the middle and lower zones of the Potomac Aquifer (MW-MPA, MW-LPA) remain < 1.0 mg/L. However, a gradual increase in TOC was observed in MW-MPA in 2021 and 1,4 dioxane has been detected near the reporting limit consistently since late December of 2020 in MW-MPA (Figures 5 and 6). This indicates that the recharge front has reached the MW-MPA.

In this monitoring period, three indicator compounds were observed in the conventional monitoring well, MW-UPA: 1, 4-dioxane, sucralose and PFOA. 1,4 dioxane and sucralose have been observed frequently since November 2019 and this current reporting quarter was the first time PFOA has been observed. Trend data associated with sucralose and 1,4 dioxane is presented in Figures 6 and 7. PFOA is discussed in greater detail in an independent section below. All reported values for 1,4 dioxane and sucralose are less than the action thresholds ("trigger values") identified in Table 2 of this report. Further, results for all regulatory parameters are less than the PMCL and all regulated organics were non-detect. Arsenic observations are described in further detail in a subsequent section.

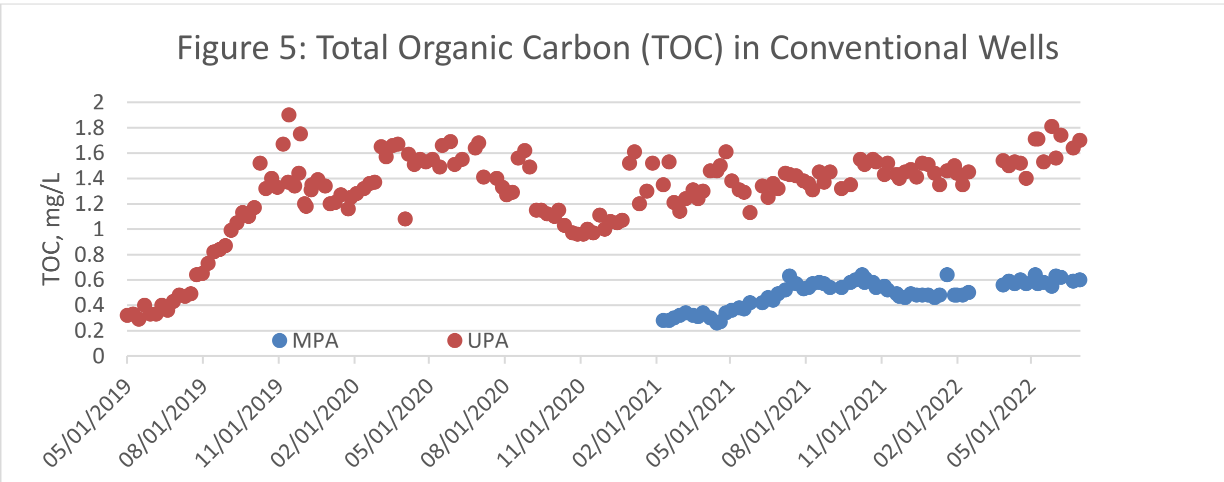

Figure 5: TOC concentration in the Upper and Middle Potomac conventional monitoring wells, MW-UPA and MW-MPA. Based on travel time studies using a conservative tracer, SWIFT Water recharged in July 2020 reached the MW-UPA in April 2022. The SWIFT Water average TOC concentration for July – September 2020 was 3.74 mg/L, with a maximum of 4.22 mg/L.

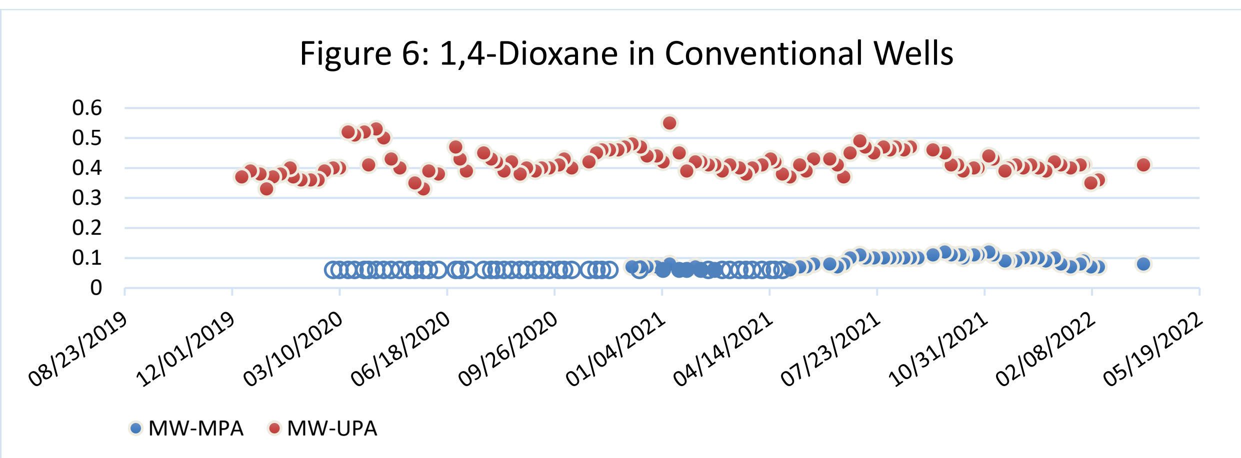

Figure 6: 1,4 dioxane trending in MW-UPA and MW-MPA. Open circles represent data that is less than the reporting limit. Based on travel time studies using a conservative tracer, SWIFT Water recharged in July 2020 reached the MW-UPA in April 2022. The SWIFT Water average 1,4-dioxane concentration for July – September 2020 was 0.33 µg/L, with a maximum value of 0.38 µg/L.

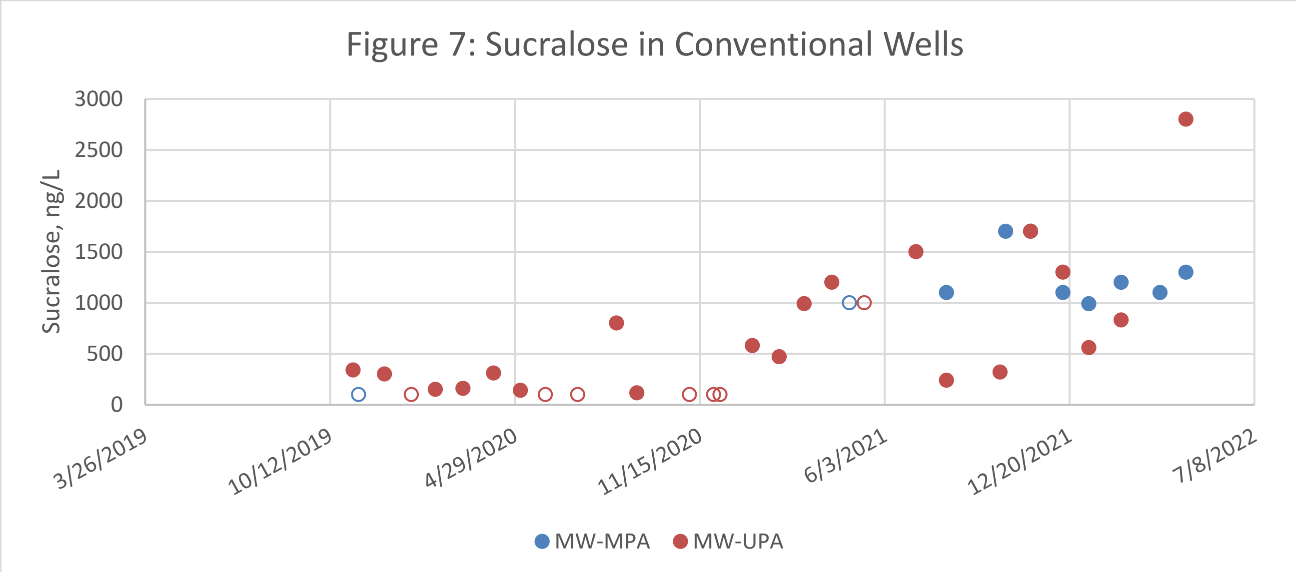

Figure 7: Sucralose trending in MW-UPA and MW-MPA. Open circles represent data that is less than the reporting limit. Based on travel time studies using a conservative tracer, SWIFT Water recharged in July 2020 reached the MW-UPA in April 2022. The SWIFT Water average sucralose concentration for July – September 2020 was 6,180 ng/L, with a maximum value of 13,000 ng/L.

PFOA and PFOS

EPA recently released of interim health advisory levels for PFOA and PFOS and health advisory levels for PFBS and Gen-X, reflecting commendable progress on advancing its efforts to understand and eventually comprehensively regulate per- and polyfluoroalkyl substances (PFAS), which HRSD supports. The SWIFT Water produced at the SRC is below the Gen-X and PFBS HALs of 10 ng/L and 2,000 ng/L, respectively. (Gen-X has not been observed in SWIFT Water and the maximum PFBS concentration observed is 12 ng/L). PFOA and PFOS have been observed in SWIFT Water and control approaches for these compounds are discussed in further detail below.

Since its inception, the SWIFT Advanced Water Treatment process has included advanced treatment for PFAS (i.e., granular activated carbon) in conjunction with significant other management and treatment measures. The IHALs for PFOA and PFOS of 0.004 ng/L and 0.02 ng/L, respectively, are several orders of magnitude below the Minimum Reporting Level (MRL) of the available laboratory analytical methodology. Both PFOA and PFOS have been observed in SWIFT Water (Table 7), with a maximum PFOA concentration of 9.3 ng/L and a maximum PFOS concentration of 4.3 ng/L.

HRSD's SWIFT program is intentionally layered with multiple barriers of control to ensure protection of public health while addressing the current depletion and contamination of the PAS. These multiple barriers provide protections for organic and inorganic contaminants as well as pathogens. The barriers of control most relevant for PFOA and PFOS at the SRC and other future SWIFT facilities are described below.

- **Source Control** – Source control refers to HRSD's efforts to control the source of contaminants before they even enter the wastewater system. HRSD's regulatory authority allows it to limit the discharge of contaminants of concern from its permitted industrial dischargers. This authority includes the control of PFAS in addition to other contaminants. HRSD's pretreatment program has long implemented stringent controls on industrial users in order to protect its sensitive wastewater treatment processes. Beginning in 2017, HRSD included SWIFT Water protection as a driver in industrial monitoring, working to identify and control contaminant sources, including PFAS. HRSD is also engaged in collaborative research to further aid the investigation and tracking of PFAS sources into its system.

- **ENR Treatment Process** – The HRSD wastewater treatment facilities that will provide the source water for the SWIFT Advanced Water Treatment process are all advanced wastewater treatment facilities. These facilities provide enhanced nutrient removal (ENR), which is known to provide the collateral benefit of effectively removing organic contaminants.

- **AWT Treatment Process** – The SWIFT Advance Water Treatment (AWT) Process planned at James River SWIFT includes multiple treatment approaches for organic contaminants: coagulation, flocculation and sedimentation, ozonation which acts as an advanced oxidation step in secondary effluent, biofiltration, and granular activated carbon adsorption. Each of these processes is individually responsible for a level of organic contaminant removal.

- **Granular Activated Carbon (GAC) –** Importantly for PFAS, the treatment train includes GAC, which is recognized as an effective treatment barrier for PFOA and PFOS and the leading treatment technology choice for public water suppliers providing finished drinking water to consumers. HRSD has been engaged in collaborative research to further optimize the treatment of PFAS, recently publishing Granular activated carbon-based treatment and mobility of per- and polyfluoroalkyl substances in potable reuse for aquifer recharge in the journal AWWA Water Science (Gonzalez, D., et al., 2021; article linked). Based upon the recently released IHALS, HRSD is adjusting its operation of GAC at the SWIFT Research Center to achieve better removal of PFOA.

- **Critical Control Points –** Throughout the wastewater and SWIFT treatment processes, critical control points have been established which include continuous real-time monitoring to alert operators of atypical process performance or source water characteristics. If an established alarm threshold is exceeded, SWIFT Water is prevented from entering the aquifer and is diverted to HRSD's permitted surface water outfall.

- **Soil Aquifer Treatment** – The aquifer itself provides an environmental buffer before the water reaches drinking water utilities, taps in homes, and industries. Within this buffer, the sediments of the aquifer provide further treatment of SWIFT Water. HRSD monitoring at the SWIFT Research Center documents the benefit of this additional soil aquifer treatment provided for total organic carbon (TOC), nitrate, bromate, and PFOA and PFOS, among others. As described earlier, based on tracer monitoring, SWIFT Water recharged from May 2018 through July 2020 has reached the conventional monitoring well characterizing the upper zone of the PAS. During that monitoring period, the maximum observed SWIFT Water PFOA concentration was 6 ng/L. PFOA and PFOS concentrations in MW-UPA have been < 2 ng/L except for the most recent result from May 2022. The PFOA concentration in MW-UPA for this monitoring event was 2.8 ng/L, very near the analytical reporting limit of 2 ng/L. Continued monitoring of PFAS will allow us to evaluate the presence of these constituents in groundwater and identify if this May 2022 PFOA result is a single occurrence, reflecting possible sample contamination, or if it is associated with PFOA present in SWIFT Water. Regardless, the lower concentration of PFOA in MW-UPA relative to SWIFT Water indicates the availability of additional removal through soil aquifer treatment.

- **Limited Movement of SWIFT Water** – Based on the tracer study at the SWIFT Research Center, travel time for the recharged SWIFT Water is estimated at 10 years to travel 2,000 ft. The rate of travel beyond 2,000 ft is even slower as the velocity of the water movement continues to decrease with increased distance from the recharge well. In fact, analytical and numerical modeling have estimated that it will take well over 150 years for the water to travel a radial distance of three miles from the wellfield. It is important to note that there are no well users withdrawing from the Potomac Aquifer System within a three-mile radius of either the HRSD James River or Nansemond treatment facilities (other facilities to be studied with project permitting activities).

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	SWIFT Water		Groundwater MW-UPA		Notes
Quarterly Report	**PFOA (ng/L)**	**PFOS (ng/L)**	**PFOA (ng/L)**	**PFOS (ng/L)**	
May – August 2018	< 20	< 40	NM	NM	NM: Not monitored. Monitoring for PFOA and PFOS not initiated until SWIFT Water recharge front reached conventional well.
September - November 2018	< 20	< 40	NM	NM	
April - June 2019	< 2	< 2	NM	NM	
July – September 2019	< 2	< 2	NM	NM	
October – December 2019	< 2	< 2	<2	<2	Monthly monitoring of PFOA/PFOS initiated in MW-UPA
January – March 2020	5.3	< 2	<2	<2	
April – June 2020	5.7	< 2	<2	<2	
July – September 2020	6	< 2	<2	<2	Bromide introduced to the recharge well as part of a tracer study
October – December 2020	4.5	< 2	<2	<2	
April – June 2021	9.3	4.3	<2	<2	
July – September 2021	8.5	3.1	<2	<2	
October – November 2021	< 2	< 2	<2	<2	
January – March 2022	4	< 2	<2	<2	
April – June 2022	8.4	< 2	2.8	<2	Bromide from tracer study identified in MW-UPA in April 2022

Table 7. PFOA and PFOS monitoring in SWIFT Water and Conventional Monitoring Wells

Arsenic in MW-SAT Update

HRSD continues to closely track arsenic (As) concentrations in MW-SAT. During the previous quarter As concentrations in screen interval 9, continued to have the highest observable arsenic concentration, but were relatively stable, ranging between 2.85 and 3.14 µg/L. These concentrations represent typical conditions for screen interval 9. Monitoring was therefore reduced to monthly sampling for this quarter, focusing on representative screen intervals 1, 2, 4, 9, 10 and 11. Other than screen interval 9, arsenic concentration in the remaining monitored screens was < 1.5 µg/L.

HRSD will continue monitoring during recharge in the most transmissive screens of MW-SAT and in the conventional wells.

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	April 2022			May 2022			June 2022		
					Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples
Regulatory Parameters													
Total Nitrogen (TN)	mg/L	NA	0.50	Daily[3]	3.65	5.54	23	3.00	3.93	29	3.41	5.08	24
NO_3	mg/L	10	0.20	Daily[3]	3.14	4.53	21	2.91	3.93	29	3.11	4.53	24
NO_2	mg/L	1	0.01	Daily[3]	<0.01	<0.01	21	<0.01	<0.01	30	<0.01	<0.01	24
Turbidity	NTU	NA	0.01	Continuous					**Figure 1**				
Total Organic Carbon (TOC)	mg/L	NA	1.00	3x/Wk[3]	3.34	3.68	16	3.36	3.74	21	3.57	3.86	17
pH		NA	NA	Continuous					**Figure 2**				
TDS[4]	mg/L	Potomac Aquifer System Range: 694-8,720	2.5	Monthly		568	1		736	1		576	1
Microorganisms													
Total Coliform	MPN/100 mL	MCLG = 0	1	Daily[3]	<1	<1	21	<1	<1	29	<1	<1	24
E. coli	MPN/100 mL	NA	1	Weekly	<1	<1	21	<1	<1	29	<1	<1	24
Cryptosporidium	oocysts/L	Treatment Technique, MCLG = 0	0.103	Quarterly		<0.103	1						
Giardia lamblia	oocysts/L	Treatment Technique, MCLG = 0	0.103	Quarterly		<0.103	1						
Legionella	MPN/100 mL	Treatment Technique, MCLG = 0	1	Quarterly		<1	1						
Disinfection Byproducts													
Bromate	µg/L	10	0.15	Monthly		2.35	1		5.95	1		2.79	1
Chlorite	mg/L	1.0	0.100	Monthly		<0.100	1		<0.100	1		<0.100	1
Trihalomethanes													
Bromodichloromethane	µg/L		1.00	Monthly		1.31	1		2.03	1		2.28	1
Bromoform	µg/L		1.00	Monthly		3.59	1		8.61	1		6.40	1
Chloroform	µg/L		1.00	Monthly		<1.00	1		<1.00	1		1.02	1
Dibromochloromethane	µg/L		1.00	Monthly		3.94	1		7.38	1		6.69	1
Total Trihalomethanes	µg/L	80				8.84	1		18.0	1		16.4	1

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	April 2022			May 2022			June 2022		
					Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples
HAAs													
Dichloroacetic acid	µg/L		0.60	Monthly		2.17	1		1.4	1		2.14	1
Trichloroacetic acid	µg/L		0.20	Monthly		0.20, OR6	1		<0.20	1		0.59	1
Monochloroacetic acid	µg/L		0.60	Monthly		<0.60	1		<0.60	1		<0.60	1
Bromoacetic acid	µg/L		0.40	Monthly		0.98, OR6	1		1.25	1		1.16	1
Dibromoacetic acid	µg/L		0.20	Monthly		5.10	1		8.73	1		8.51	1
Total Haloacetic Acids	µg/L	60				8.45	1		11.4	1		12.4	1
Disinfectants[5]													
Monochloramine (as Cl_2)	mg/L	4		Continuous	0.02	0.04		0.01	0.02		0.01	0.01	
Chlorine (as Cl_2)	mg/L	4		Continuous	2.67	3.07		2.43	3.13		2.41	2.97	
Inorganic Chemical													
Antimony	µg/L	6	2.00	Monthly	<2.00	<2.00	2		<2.00	1		<2.00	1
Arsenic	µg/L	10	1.00	Monthly	<0.50	<0.50	2		<0.50	1		<0.50	1
Asbestos	MFL	7	0.20	Monthly		<0.20	1		<0.20, QG	1		<0.20	1
Barium	mg/L	2	0.005	Monthly	0.007	0.007	2		0.006	1		0.007	1
Beryllium	µg/L	4	0.10	Monthly	<0.10	<0.10	2		<0.10	1		<0.10	1
Cadmium	µg/L	5	0.10	Monthly	<0.10	<0.10	2		<0.10	1		<0.10	1
Chromium (total)	µg/L	100	2.50	Monthly	<1.00	<1.00	2		<1.00	1		<1.00	1
Copper	mg/L	1.3 (action level)	0.005	Monthly	<0.005	<0.005	2		<0.005	1		<0.005	1
Cyanide (total)	µg/L	200	20	Monthly		<10	1		<10	1		<20	1
Fluoride	mg/L	4.0	0.050	Monthly	0.787	0.917	23	0.803	0.885	29	0.855	1.07	24
Lead	µg/L	15 (action level)	0.10	Monthly	<0.10	<0.10	2		<0.10	1		<0.10	1
Mercury	µg/L	2	0.10	Monthly	<0.10	<0.10	2		<0.10	1		0.19	1
Selenium	µg/L	50	5.00	Monthly	<5.00	<5.00	2		<5.00	1		<5.00	1
Thallium	µg/L	2	0.20	Monthly	<0.20	<0.20	2		<0.20	1		<0.20	1
Organic Chemicals													
Acrylamide	µg/L	Treatment Technique, MCLG = 0	1.00	Monthly		<0.10	1		<0.10	1		<1.0, DB	1
Alachlor	µg/L	2	0.098	Monthly		<0.098	1		<0.050	1		<0.049	1
Atrazine	µg/L	3	0.098	Monthly		<0.098	1		<0.050	1		<0.049	1
Benzo(a)pyrene (PAHs)	µg/L	0.2	0.02	Monthly		<0.02	1		<0.020	1		<0.020	1
Di(2-ethylhexyl) adipate	µg/L	400	0.60	Monthly		<0.59	1		<0.60	1		<0.59 *+ ^3+	1
Di(2-ethylhexyl) phthalate	µg/L	6	0.60	Monthly		<0.59	1		<0.60	1		<0.59	1

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	April 2022			May 2022			June 2022		
					Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples
Hexachlorocyclopentadiene	µg/L	50	0.098	Monthly		<0.098	1		<0.050	1		<0.049	1
Hexachlorobenzene	µg/L	1	0.098	Monthly		<0.098	1		<0.050	1		<0.049	1
Simazine	µg/L	4	0.069	Monthly		<0.069	1		<0.050	1		<0.049	1
Carbofuran	µg/L	40	0.50	Monthly		<0.10	1		<0.50	1		<0.50	1
Oxamyl (Vydate)	µg/L	200	0.50	Monthly		<0.10	1		<0.50	1		<0.50	1
Chlordane	µg/L	2	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
Endrin	µg/L	2	0.010	Monthly		<0.010	1		<0.010	1		<0.01	1
Heptachlor	µg/L	0.4	0.010	Monthly		<0.010	1		<0.010	1		<0.01	1
Heptachlor Epoxide	µg/L	0.2	0.010	Monthly		<0.010	1		<0.010	1		<0.01	1
Lindane	µg/L	0.2	0.010	Monthly		<0.010	1		<0.010	1		<0.01	1
Methoxychlor	µg/L	40	0.050	Monthly		<0.050	1		<0.050	1		<0.05	1
Toxaphene	µg/L	3	0.50	Monthly		<0.50	1		<0.50	1		<0.50	1
PCB Arochlor1016	µg/L		0.08	Monthly		<0.080	1		<0.070	1		<0.08	1
PCB Arochlor1221	µg/L		0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
PCB Arochlor1232	µg/L		0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
PCB Arochlor1242	µg/L		0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
PCB Arochlor1248	µg/L		0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
PCB Arochlor1254	µg/L		0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
PCB Arochlor1260	µg/L		0.10	Monthly		<0.10	1		<0.070	1		<0.10	1
Total Polychlorinated Biphenyls (PCBs)	µg/L	0.5				<0.10	1		<0.10	1		<0.10	1
2,4-D	µg/L	70	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
Dalapon	µg/L	200	1.0	Monthly		<1.0	1		<1.0	1		<1.0	1
Picloram	µg/L	500	0.10	Monthly		<0.10	1		<0.10	1		<0.10	1
2,4,5-TP (Silvex)	µg/L	50	0.20	Monthly		<0.20	1		<0.20	1		<0.20	1
Dinoseb	µg/L	7	0.20	Monthly		<0.20	1		<0.20	1		<0.20	1
Pentachlorophenol	µg/L	1	0.040	Monthly		<0.040	1		<0.040	1		<0.040	1
Dioxin (2,3,7,8-TCDD)	pg/L	30	5.50	Monthly		<5.5	1		<5.0	1		<3.8	1
Diquat	µg/L	20	0.40	Monthly		<0.40	1		<0.39	1		<0.40	1
Endothall	µg/L	100	5.0	Monthly		<5.0	1		<5.0	1		<5.0	1
Epichlorohydrin	µg/L	Treatment Technique, MCLG = 0	4.0	Monthly		<4.0, DB	1		<4.0	1		<4.0, H	1
Glycophosphate	µg/L	700	6.0	Monthly		<6.0	1		<6.0	1		<6.0	1
Benzene	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Carbon Tetrachloride	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	April 2022			May 2022			June 2022		
					Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples
Chlorobenzene	µg/L	100	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,2-dibromo-3-chloropropane (DBCP)	µg/L	0.2	0.02	Monthly		<0.020	1		<0.020	1		<0.020	1
o-Dichlororbenzene	µg/L	600	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
p-Dichlorobenzene	µg/L	75	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,2-Dichloroethane	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,1-Dichlororethylene	µg/L	7	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
cis-1,2-Dichloroethylene	µg/L	70	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
trans-1,2-Dichloroethylene	µg/L	100	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Dichloromethane	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,2-Dichloropropane	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Ethylbenzene	µg/L	700	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Ethylene Dibromide (EDB)	µg/L	0.05	0.02	Monthly		<0.020	1		<0.020	1		<0.020	1
Styrene	µg/L	100	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Tetrachloroethylene	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Toluene	µg/L	1,000	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,2,4-Trichlorobenzene	µg/L	70	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,1,1-Trichloroethane	µg/L	200	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
1,1,2-Trichloroethane	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Trichloroethylene	µg/L	5	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Vinyl Chloride	µg/L	2	1.00	Monthly		<1.00	1		<1.00	1		<1.00	1
Total Xylene	µg/L	10,000	3.00	Monthly		<3.00	1		<3.00	1		<3.00	1
Radionuclides													
Alpha particles	pCi/L	15	3	Monthly		<3, U, G	1		<3, U	1		<3, U	1
Beta particles and photon emitters	pCi/L	4 mrem/yr[6]	4	Monthly		9.7	1		6.7	1		14.7	1
Radium 226	pCi/L	5 (226+228)	1.0	Monthly		<1.0, U	1		<1.0	1		<1.0, U	1
Radium 228	pCi/L	5 (226+228)	1.0	Monthly		<1.0, U	1		<1.0	1		<1.0, U	1
Uranium	µg/L	30	0.10	Monthly		<0.10	2		<0.10	1		<0.10	1
Strontium-90	pCi/L	NA	2.0	Monthly		<2.0, U	1		<2.0, U	1		<2.0, U	1
Tritium	pCi/L	NA	1000	Monthly		<1000, U	1		<1000, U	1		<1000, U	1

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	April 2022			May 2022			June 2022		
					Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples
Non-regulatory Performance Indicators													
Public Health Indicators		**Trigger Limits**											
1,4-dioxane	µg/L	1	0.06	Weekly	0.31	0.34	4	0.33	0.39	5	0.29	0.33	3
17-β-estradiol	ng/L	0.9	0.40	Quarterly		<0.40	1						
DEET	ng/L	200,000	5	Quarterly		<5	1						
Ethinyl estradiol	ng/L	280	0.90	Quarterly		<0.90	1						
Tris(2-carboxyethyl)phosphine (TCEP)	ng/L	5,000	10	Quarterly		12	1						
NDMA	ng/L	10	2.00	Weekly	<2.00	<2.00	4	<2.00	<2.00	5	<2.00	<2.00	3
Perchlorate	µg/L	6	0.50	Quarterly		<0.50	1						
Perfluorooctanoic Acid (PFOA)	ng/L	70 (PFOA+PFOS)	2.0	Quarterly		8.4	1						
Perfluorooctanesulfonic Acid (PFOS)	ng/L	70 (PFOA+PFOS)	2.0	Quarterly		<2.0	1						
Treatment Efficacy Indicators		**Trigger Limits**											
Cotinine	ng/L	1,000	10	Quarterly		19	1						
Primidone	ng/L	10,000	5.0	Quarterly		6.0	1						
Phenytoin (Dilantin)	ng/L	2,000	20	Quarterly		<20	1						
Meprobamate	ng/L	200,000	5.0	Quarterly		<5.0	1						
Atenolol	ng/L	4,000	5.0	Quarterly		<5.0	1						
Carbamazepine	ng/L	10,000	5.0	Quarterly		<5.0	1						
Estrone	ng/L	320,000	2.0	Quarterly		<2.0	1						
Sucralose	ng/L	150,000,000	1000	Monthly		4300	1		2800	1		20000	1
Triclosan	ng/L	210,000	50	Monthly		<25	1		<50	1		<50	1
Additional Monitoring (Ozone & UV LRV)						**Minimum**			**Minimum**			**Minimum**	
Ozone Virus LRV				Continuous	4.51	3.67		4.59	3.71		4.50	3.49	
Ozone Giardia LRV				Continuous	2.32	1.93		2.30	1.70		2.11	1.63	
UV Dose Reactor 1	mJ/cm^2			Continuous	>186	>186		>186	>186		>186	>186	
UV Virus LRV Reactor 1				Continuous	>4	>4		>4	>4		>4	>4	
UV Dose Reactor 2	mJ/cm^2			Continuous	>186	>186		>186	>186		>186	>186	
UV Virus LRV Reactor 2				Continuous	>4	>4		>4	>4		>4	>4	

Parameter	Units	Maximum Contaminant Level (MCL) or MCL Goal (MCLG) where numerical MCL not expressed. Values noted for indicator compounds are non-regulatory screening values	Minimum Report Level[1]	Required Monitoring Frequency	April 2022			May 2022			June 2022		
					Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples	Average[2]	Maximum	Numer of Samples

[1] When minimum reporting limits varied during the quarter, the highest minumum reporting limit used is identified.

[2] Analytical results less than the reporting limit were treated as zero for the purposes of the averaging calculation.

[3] Daily samples are typically not collected on days in which there is no or limited recharge. TOC sample collection occurs routinely on Monday through Friday when recharging. Limited or inconsistent recharge impacts the collection of daily samples, particularly for the microbiological samples collected for total coliform and E coli which have limited holding time requirements. In April, limited or no recharge impacted nine days of sampling. In May, limited or no recharge impacted one day of sampling. An improperly preserved sample on May 13 resulted in the loss of total nitrogen and nitrate for the day. In June, limited or no recharge impacted six days of sampling.

[4] TDS of the Potomac Aquifer System is based on the averages within the upper, middle and lower Potomac Aquifer as determined during baseline montioring.

[5] The maximum residual disinfectant level (or MRDL) MCL for monochloramine and chlorine are based on annual averages.

[6] The measurement unit for beta particles and photon emitters is pCi/L while the MCL is expressed as mrem/yr. Per EPA's Implementation Guidance for Radionuclides (EPA 816-F-00-002, March 2002), the screening threshold for beta particles and photon emitters is 50 pCi/L. If sample concentrations exceed 50 pCi/L, each individual beta particle and photon emitter is converted from pCi/L to mrem using the EPA designated conversion tables, currently available in the referenced document.

Contract Laboratory Flags

OR6: >50% difference between analytical and confirmation GC columns. Lower value is reported.

DB: Sample required dilution due to matrix. Minimum Reporting Limit (MRL) was adjusted, Analyte was non-detect in the sample.

H: Sample was prepared and analyzed beyond the specified holding time.

U: Results less than the sample detection limit.

G: The sample Minimum Detectable Concentration (MDC) is greater than the requested RL.

QG: Sample was not filtered within 48 hours of collection. As per the method, sample was ozonated before filtration and analysis. Data is acceptable for compliance.

*+: LCS and/or LCSD is outside acceptance limits, high biased.

^3+: Reporting Limit Check Standard is outside acceptance limits, high biased.

eurofins | Eaton Analytical

July 8th, 2022

Attn: Hampton Roads Sanitation District

Eurofins Eaton Analytical Monrovia (EEA-M) will take the opportunity of this letter to explain the missed reporting deadlines for July 10th, 2022 and our current plans for future compliance for 10th of the month reporting deadlines.

It is important to clearly note that in all cases, the reason why our drinking water compliance data are missing regulatory deadlines is the sole responsibility of Eurofins Eaton Analytical in Monrovia, and not any fault of our clients.

On June 6th we moved all of our sample receipts into our new LIMS (TALS). TALS is a corporate LIMS used by all of the Eurofins network environmental laboratories, with EEA-M being one of the last laboratories to be placed in this LIMS. Although the LIMS is validated and its processes sound, it is much different in the way it functions from our previous LIMS (STARLIMS). STARLIMS was an off the shelf purchased LIMS, heavily customized for our needs and the needs of our clients. TALS has many additional features and fail-safes, which has translated into a great deal more data entry and project validation.

Our key roadblocks is not the analytical portion of our LIMS. It is the sample receipt and login of samples into the LIMS, and the connections of the login to projects. Staff attrition and corporate mandated quarantine for the COVID resurgence have also played a role in our challenges during June. Samples are analyzed according to our method based Standard Operating Procedures and data entered into TALS according to sample ID or, for short Holding Time tests (<48 hours), site IDs. The analysis portion of our work and login portion of our work for short holding time tests are independent of each other, in order to ensure that the method required holding times are met.

A project (sample or group of samples from a chain of custody) requires that login review be conducted and completed by a Project Manager before the analysis is released to operations, which was not how our previous LIMS functioned. We must have all state certifications, methods, analytes, certification programs, and lastly the site ID properly built into a project before a sample can be logged into the LIMS. As we receive a great deal of samples each day, often unknown to us what will arrive day to day, these projects often must be created on the fly, which causes delayed logins, delayed linking to analyses, and delayed reporting. As was the case in our test run of the LIMS in May, this quickly overwhelmed our sample receiving staff, which has a domino effect in every other step of the process.

We have hired 2 project management staff and 5 additional sample receiving staff in order to address the additional data entry requirements of TALS. This has doubled the size of our sample receiving group since the beginning of 2022. With staff beyond those noted being vetted to help us normalize this process, we are stabilizing the area and moving samples through the LIMS and eventually to reporting, however there is a steep learning curve with the complexity of TALS and the numerous data entry points which were formerly simply scanned documents attached to a report. It is a robust system for data defensibility and traceability, however that creates a much larger need for oversight and attention to minute detail in project setup.

We apologize for any inconvenience the lack of data for the above noted analysis has caused you. We are taking all available steps to bring our reporting back in line with regulatory expectations. This transition is challenging and we expect to work through road blocks in the future by utilizing those trained within our network on the system for support. However, we are only the second full service drinking water laboratory to use this system, and have many clients with unique needs. We are subcontracting to certified laboratories as much as possible for the limited testing available to such actions, and will continue to push through to make this a successful process.

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