Brookhaven National Laboratory

Groundwater Treatment Systems Discharge Compliance Plan

December 20, 2024 – Final

This Treatment System Discharge Compliance Plan was prepared to document the results of the quarterly treatment system sampling for per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane from active groundwater treatment systems, show these results compared to the newly established New York State (NYS) effluent discharge limitations, and presents the recommended actions to attain compliance, where necessary, with the new discharge limits on a system by systems basis.

1.0 NYS Discharge Standards

In February 2023, the New York State Department of Environmental Conservation (NYSDEC) issued Final Ambient Water Quality Guidance Values (AWQGVs) to regulate perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA) and 1,4-dioxane. These guidance values are lower than the State drinking water standards that were established in 2020. The guidance values are applied as discharge effluent limits to industrial discharges that require State Pollutant Discharge Elimination System (SPDES) permits, which include groundwater remediation systems with SPDES equivalency permits managed by the Division of Environmental Remediation (DER). The discharge effluent limit values are 2.7 nanograms per liter (ng/L) for PFOS, 6.7 ng/L for PFOA, and 0.35 micrograms per liter (µg/L) for 1,4-dioxane. Based upon Brookhaven National Laboratory's (BNL's) initial monitoring of groundwater treatment systems for these chemicals during 2017-2020, it became apparent that the treatment system effluent for several of the on-site and off-site systems exceeded the guidance values for 1,4-dioxane and PFOS (**Table 1**).

BNL's groundwater treatment systems utilize air stripping and granular activated carbon (GAC) to remediate volatile organic compounds (VOCs), and ion exchange filtration for strontium-90 (Sr-90). Although GAC filters and certain ion exchange resins can effectively remove PFAS, these treatment methods are ineffective for 1,4-dioxane. Furthermore, air stripping treatment systems are ineffective for PFAS and 1,4-dioxane.

In May and July 2023, meetings were held with the United States Department of Energy (DOE), NYSDEC, the United States Environmental Protection Agency (EPA), and the Suffolk County Department of Health Services (SCDHS), regarding the currently operating groundwater treatment systems and the potential for exceeding the new discharge guidance values at several of the systems. Because of the limited PFOS, PFOA and 1,4-dioxane data that was available for these systems, in July 2023, the NYSDEC approved BNL's plan to monitor active treatment systems that had detectable levels of PFOS, PFOA, and/or 1,4-dioxane on a quarterly frequency for one year (June 2023 through April 2024). The goal of the monitoring program was to provide sufficient baseline data needed to support decision making related to compliance with the new discharge guidance values and with the expectation that a compliance plan would be submitted to the regulatory agencies in August 2024.

2.0 Active Groundwater Treatment System Effluent Monitoring

The 2023-2024 groundwater treatment system monitoring plan called for quarterly sampling of five operational treatment systems:

1) Combined Operable Unit (OU) III Western South Boundary, Middle Road, and South Boundary (WSB/MR/SB) on-site system (treatment for VOCs using air stripping),
2) OU III LIPA/Airport off-site system (treatment for VOCs using GAC),
3) OU III North Street East (NSE) off-site system (treatment for VOCs using GAC),

4) OU VI Ethylene dibromide (EDB) off-site system (treatment for EDB using GAC), and
5) OU III Brookhaven Graphite Research Reactor/Waste Concentration Facility (BGRR/WCF) Sr-90 on-site system (treatment for Sr-90 using ion exchange, and for low level VOCs using GAC).

The locations of these treatment systems are shown on **Figure 1**. Samples from treatment system influent, effluent, and individual extraction wells, were collected during the June-July 2023 and January 2024 sampling events, and treatment system influent and effluent samples were collected during the October 2023 and April 2024 sampling events (**Table 1**). Each of the systems were analyzed for PFAS by EPA Method 1633 and 1,4-dioxane by EPA Method 8270 Select Ion Monitoring (SIM), with the exception of the OU VI EDB system which was analyzed for 1,4-dioxane only.

The monitoring results indicated that:

- **OU III WSB/MR/SB:** 1,4-Dioxane and PFOS exceeded the guidance values in the system effluent in each of the quarterly sampling rounds. The maximum concentration of 1,4-dioxane in system effluent was 2.8 µg/L in October 2023 and the maximum concentration of PFOS was 7.53 ng/L in January 2024. PFOA did not exceed the guidance value and was detected at a maximum concentration of 5.63 ng/L in January 2024. In general, 1,4-dioxane and PFOS were detected in most of the system's active and inactive (off/standby) extraction wells above the guidance values. PFOA was detected in most extraction wells but below its guidance value with two exceptions in January 2024. The maximum concentration of PFOA in extraction wells was 7.86 ng/L in SB extraction well EW-8, currently in standby. The highest concentrations of 1,4-dioxane were detected in the WSB system. 1,4-dioxane was detected above its guidance value in each of the WSB wells and the highest concentration was 6.5 µg/L in the active extraction well WSB-6 in January 2024. Effluent from the OU III WSB/MR/SB treatment system is directed to the OU III recharge basin located in the central portion of the site. A portion of this discharge is pumped to the RA V basin to balance groundwater mounding and flow characteristics. The locations of these basins are shown on **Figure 1**.
- **OU III LIPA/Airport:** 1,4-Dioxane exceeded its guidance value in the system effluent in each of the quarterly sampling rounds. The maximum concentration of 1,4-dioxane was 1.3 µg/L during the June-July 2023 sampling event. PFOS and PFOA were not detected in the system effluent. 1,4-Dioxane was detected in each of the Airport extraction wells above its guidance value. PFOS and PFOA were not detected above their guidance values in the Airport extraction wells. 1,4-Dioxane and PFOS were detected above their guidance values in LIPA extraction wells; however, each of the LIPA extraction wells are currently off and in standby mode, and a Petition for Shutdown of the LIPA portion of the treatment system has been submitted for regulatory agency approval. Effluent from these treatment systems was historically split, with a portion recharged to recirculation wells, and the remainder being recharged to a series of reinjection wells on the airport property. Starting in 2008, all of the treated effluent was being discharged to the reinjection wells.
- **OU III NSE:** 1,4-Dioxane exceeded its guidance value in the system effluent in each of the quarterly sampling rounds with a maximum concentration of 0.92 µg/L in June-July 2023. PFOA and PFOS were not detected above the guidance values in the system effluent. 1,4-Dioxane was detected in the system's extraction wells above its guidance value. PFOS and PFOA were not detected above their guidance values in the system's extraction wells. The effluent from the OU III NSE system is directed to four injection wells located downgradient (southwest) of the extraction wells.
- **OU VI EDB:** 1,4-Dioxane was not detected above its guidance value in the system effluent and was not detected in the two shallow extraction wells (EW-1E and EW-2E) that are currently off and in standby mode. The highest concentration of 1,4-dioxane detected in the system effluent was 0.27 µg/L in January 2024 following the startup of the new deep extraction wells. 1,4-dioxane was

detected slightly above (0.36 µg/L) the guidance value in the new deep extraction well (EW-3E) during January 2024. PFAS was not detected in EW-1E and EW-2E during the 2017-2020 characterization effort. The two new deep extraction wells (EW-3E and EW-4E) were tested for PFAS following their startup in January 2024. Consistent with historic data, PFOS and PFOA were not detected in these extraction wells. The effluent from the OU VI EDB treatment system is directed to two injection wells located immediately downgradient of the extraction wells.

- **OU III BGRR/WCF:** Although trace levels of 1,4-dioxane were detected in several extraction wells during 2017-2020, 1,4-dioxane was not detected in the treatment system's extraction wells during the quarterly sampling. However, 1,4-dioxane was detected in the system effluent at 0.13J µg/L (estimated) during one sampling round (October 2023). Both PFOS and PFOA were routinely detected in each of the systems extraction wells, with maximum concentrations of 12.9 ng/L (SR-1, active) and 6.48 ng/L (SR-7, standby) in January 2024, respectively. Although the Sr-90 treatment system has a GAC filter for final treatment of the water prior to discharge, on several occasions PFOS concentrations in the discharge exceeded the guidance value, with a maximum concentration of 5.22 ng/L in April 2024. Due to low VOC concentrations in the treatment system influent, the GAC has not been changed for several years. Effluent from this system is directed to a series of on-site drywells located in the central portion of the site, west of the treatment system building.

As required by their existing SPDES equivalency permits, the effluent from the OU X Current Firehouse and Former Firehouse PFAS treatment systems are routinely monitored for PFOS, PFOA, and 1,4-dioxane, and the Building 96 treatment system is monitored for PFOS and PFOA. Since the start of the Current Firehouse and Former Firehouse PFAS treatment system operations in October 2022 and January 2023, respectively, the effluent for each system has complied with the effluent limits. Effluent from the Current Firehouse system is directed to the HP recharge basins proximate to the OU III basin and effluent from the Former Firehouse system is directed to the RA V basin (**Figure 1)**.

Monitoring results for 2023 through early 2024 for the Building 96 treatment system indicated that PFOS concentrations routinely exceeded the 2.7 ng/L discharge guidance value, with a maximum concentration of 9.7 ng/L. During this period, PFOA concentrations were routinely less than the 6.7 ng/L guidance value, with a maximum concentration of 6.6 ng/L. The SPDES equivalency permit for the Building 96 system does not establish effluent limits for PFOS and PFOA; however, it requires that the system effluent is monitored quarterly for them. Effluent from the Building 96 system is directed to an open channel that ultimately discharges to the HS recharge basin, located downgradient of the Building 96 extraction wells.

The on-site recharge basins mentioned above generally "take water" well and will percolate through the unsaturated zone to the water table interface at a rate that meets or exceeds what is required by the treatment system discharge. While the treatment systems are operating, the basins may have several inches to a foot of standing water in their base.

There are several shallow monitoring wells downgradient of the RA V recharge basin and the OU III/HP recharge basins. No shallow monitoring wells are located downgradient of the HS basin. The monitoring wells that exist downgradient of these recharge basins are not currently part of a routine monitoring program. These monitoring wells were sampled during the 2017-2020 PFAS and 1,4-dioxane characterization effort and showed detectable concentrations of 1,4-dioxane greater than 1 µg/L.

3.0 Compliance Plan

Based upon the monitoring results, treatment system modifications are needed to bring several of the active groundwater treatment systems into compliance with the NYS discharge guidance values. To support the evaluation of system modification, BNL explored several possibilities and met with several commercial providers of established or emerging treatment technologies for both PFAS and 1,4-dioxane. Because PFAS can be readably treated using GAC filtration, the focus was on commercially available treatment systems for 1,4-dioxane. Each of the evaluated treatment technologies for 1,4-dioxane were some variation of an advanced oxidation process (AOP).

BNL considered the following issues when evaluating need for and availability of these treatment technologies:

- Remaining operating duration of the treatment systems based upon estimated time needed to achieve the existing OU III Record of Decision (ROD) cleanup goals,
- Effectiveness of available treatment technologies,
- Availability of engineering and materials to design and install the treatment technology,
- Time required to make modifications,
- Cost benefit analysis,
- Capital, operating and maintenance costs,
- Funding, and
- Community and regulatory agency acceptance.

Several options were evaluated and based on the results; the following compliance actions are proposed for the affected treatment systems:

1) **OU III WSB/MR/SB:** This system uses air stripping to treat VOC contaminated groundwater that is affected by PFAS and 1,4-Dioxane. It is currently anticipated to remain in operation for another six to ten years (~2030 – 2034) to achieve ROD cleanup goals. To comply with the effluent discharge limits for PFOS, PFOA, and 1,4-dioxane, there will be a need to add an AOP system to the existing air stripping system. AOP systems are commercially available, have undergone rigorous testing and have received NYSDEC approval for the removal of 1,4-dioxane from potable water supplies on Long Island. AOP systems use hydrogen peroxide and UV light or hydrogen peroxide and ozone to treat 1,4-dioxane and some VOCs (e.g., TCE and PCE). Because AOP systems typically have GAC filters at the end of the treatment process to remove chemical degradation products, these systems can also treat PFAS and other VOCs that may not be destroyed during the oxidation process.

   BNL will continue to monitor the system effluent for PFOS, PFOA, and 1,4-dioxane and initiate a full engineering design of the system. This design will develop an accurate cost estimate for construction, startup testing, and routine operations and maintenance.

2) **OU III LIPA/Airport:** This system uses GAC filtration to treat VOC contaminated groundwater that is affected by PFAS and 1,4-dioxane. However, because the LIPA system is currently in standby mode as its ROD cleanup goals have been achieved, only 1,4-dioxane has been adversely affecting the treatment system effluent. The Airport portion of the treatment system is anticipated to remain in operation for another six to ten years (~2030 – 2034) to achieve its ROD cleanup goals. Therefore, to comply with the effluent discharge limits for 1,4-dioxane, there will be a need to add an AOP system to the existing GAC filtration system.

   Similar to the OU III WSB/MR/SB recommended compliance action, BNL will continue to monitor the system effluent for PFOS, PFOA, and 1,4-dioxane and initiate a full engineering design of the system. This design will develop an accurate cost estimate for construction, startup testing, and routine operations and maintenance.

3) **OU III North Street East:** The North Street East treatment system is expected to achieve its ROD cleanup goal for EDB by 2025. Therefore, no modifications (e.g., 1,4-dioxane treatment) to this system are proposed at this time. However, BNL will continue to monitor for 1,4-dioxane.

4) **OU III Building 96:** With the anticipated effectiveness of the 2024 source area remedial actions (injection of liquid carbon and zero valent iron), the Building 96 treatment system is expected to achieve its ROD cleanup goal for VOCs by 2025. Therefore, no modifications (e.g., add GAC filters for PFAS remediation) to this system are proposed at this time. BNL will continue to monitor for PFOS and PFOA as specified in the existing SPDES equivalency permit.

5) **OU III BGRR/WCF:** Because PFOS is being detected in the BGRR/WCF Sr-90 treatment system discharge at concentrations above the guidance value, BNL will perform more frequent changeouts of the system's existing GAC filter and continue to monitor for PFOS and PFOA.

6) Recharge basins that have received treatment system effluent with concentrations of PFOA, PFOS, and/or 1,4-dioxane exceeding the ambient water quality guidance values will be investigated for both PFAS and 1,4-dioxane. These recharge basins include the OU III basin, HP basin, RA V, and HS basin. These recharge basin investigations will be conducted in accordance with the scope of work specified in the March 2023 Draft Operable Unit X Remedial Investigation/Feasibility Study (RI/FS) Work Plan.

7) Routine groundwater monitoring downgradient of recharge basins that have received treatment system effluent with concentrations of PFOA, PFOS, and/or 1,4-dioxane exceeding the ambient water quality guidance values (OU III, HP, RA V, and HS) will be added to their groundwater monitoring programs. This will include existing viable monitoring wells for this purpose and the installation of new monitoring wells where necessary.

8) Groundwater treatment infrastructure that is currently in-use and/or in an operationally ready state will be kept intact and ready to use pending the completion of the OU X RI/FS and their need is determined.

3.1 Compliance Action Schedule

The following compliance schedule is estimated based on professional experience, judgement, and current available funding/budget. The schedule will be updated following regulatory approval of the proposed compliance actions and availability of funds.

Action	Target Dates
Submit the Draft Compliance Plan to the Regulators for review and approval.	August 2024
Provide a briefing of the Draft Compliance Plan and discuss with the NYSDEC during the upcoming Annual Groundwater Status Report Briefing.	August 22, 2024
Receive regulator comments, prepare responses and a revised Compliance Plan, and receive regulatory approval.	September – November 2024
Continue to monitor the active treatment systems for PFOS, PFOA, and 1,4-dioxane, as documented in Section 3.0.	Begin October 2024 (Semi-Annual)
Perform recharge basin investigation.	April – June 2025

Action	Target Dates
Begin routine groundwater monitoring downgradient of recharge basins including installation of new monitoring wells.	April – June 2025
Complete engineering design and cost estimates for the OU III WSB/MR/SB and OU III LIPA/Airport 1,4-dioxane treatment systems.	December 2024 – June 2025

NOTE: *Procurement, construction, and startup of additional treatment systems is subject to appropriated funds.*

Figure

BGRR
WCF
Sr-90
Current
Firehouse
and Bldg 170
(PFAS)
Bldg 452
Freon-11
Carbon
Tetrachloride
Bldg
96
HFBR
Tritium
OU IV
AOC 6
Former
Firehouse
(PFAS)
Chem
Holes
Sr-90
Waste
Management
Area - AOC 1
OU V
Middle Road
OU I South
Boundary
OU III South Boundary
Western South
Boundary
Industrial
Park
East
Industrial Park
North
Street
East EDB
North
Street
East
OU VI
EDB
LIPA
North
Street
Brookhaven Airport
SR-1
SR-2
SR-3
SR-4
SR-5
SR-6
SR-7
SR-8
SR-9
CF-RW-A
CF-RW-B
CF-RW-C
CF-RW-D
CF-RW-E
CF-RW-F
CF-RW-G
CF-RW-H
CF-RW-I
FF-RW-A
FF-RW-B
FF-RW-C
EW-18
RTW-1
RTW-2
RTW-3
RTW-4
EW-9
EW-10
EW-11
EW-16
SR90 EW-1
SR90 EW-2
SR90 EW-3
RW-1
RW-2
RW-3
RW-4
RW-5
RW-6
RW-7
WSB-1
WSB-2
WSB-3
WSB-4
WSB-5
WSB-6
EW-3
EW-4
EW-5
EW-6
EW-7
EW-8
EW-12
EW-17
EW-1
EW-2
UVB-1
UVB-2
UVB-3
UVB-4
UVB-5
UVB-6
UVB-7
IP-EW-8
IP-EW-9
NSE-EDB-EW-4
NSE-EDB-EW-3
NSE-1
NSE-2
EW-1E
EW-2E
EW-4L
EW-3L
EW-2L
EW-1L
NS-1
NS-2
RW-6A
RTW-1A
RTW-2A
RTW-3A
RTW-4A
RTW-5A
SCALE
0
500
1000
FEET
LEGEND
32
BNL GRID NUMBER
EW-12
BNL REMEDIATION WELL
BNL-12
BNL SUPPLY / PROCESS WELL
OPERATING REMEDIATION SYSTEMS
REMEDIATION SYSTEM PLACED IN SHUTDOWN MODE
DECOMMISSIONED REMEDIATION SYSTEM
REMEDIATION WELL STATUS
RTW-4A
ON-FULL TIME
SR-9
PULSED PUMPING
RTW-5A
STAND BY-OFF
2023 TVOC PLUME UNLESS SPECIFIED. CONCENTRATION AS INDICATED. (DASHED WHERE INFERRED)
2023 TRITIUM PLUME. OUTLINE IS 20,000 pCi/L.
2023 STRONTIUM 90 PLUME. OUTLINE IS 8 pCi/L.
2023 NORTH STREET EAST AND OU VI EDB PLUMES. OUTLINE IS 0.05 µg/L.
EXTENT OF PFOS PLUME OUTLINES BASED UPON 2023 MONITORING RESULTS. OUTLINE IS 10 ng/L.
04/19/24 FIGURE: 1
GROUNDWATER REMEDIATION SYSTEMS
Brookhaven
National Laboratory
ENVIRONMENTAL PROTECTION DIVISION
2023 BNL GROUNDWATER STATUS REPORT

Table

TABLE 1
Brookhaven National Laboratory
Groundwater Treatment System Monitoring for PFAS and 1,4-Dioxane
June 2023 - April 2024

Well/Sample ID	Screen Interval (ft. bls.)	Aquifer Seqment	Treatment System Extraction Well/Influent/Effluent	2017-2020			June - July 2023			October 2023			January 2024			April 2024		
				1,4-Dioxane 0.35 µg/L	PFOS 2.7 ng/L	PFOA 6.7 ng/L	1,4-Dioxane 0.35 ug/L	PFOS 2.7 ng/L	PFOA 6.7 ng/L	1,4-Dioxane 0.35 ug/L	PFOS 2.7 ng/L	PFOA 6.7 ng/L	1,4-Dioxane 0.35 ug/L	PFOS 2.7 ng/L	PFOA 6.7 ng/L	1,4-Dioxane 0.35 ug/L	PFOS 2.7 ng/L	PFOA 6.7 ng/L
OU III Western South Boundary, Middle Road, and South Boundary Treatment Systems (Status: Active)																		
Western South Boundary																		
126-12	140-160	DG	WSB-1	2.99	5.66	3.17	3.9	3.58	2.64	NS	NS	NS	3.3	3.84	3.5	NS	NS	NS
127-05	150-170	DG	WSB-2	5.38	1.53J	1.76U	3.9	2.37	2.07	NS	NS	NS	4	2.46	1.99	NS	NS	NS
111-17	168-188	DG	WSB-3	3.81	1.1J	1.48	2	8.7	3.57	NS	NS	NS	2.2	9.91	3.88	NS	NS	NS
119-13	170-190	DG	WSB-4	7.64	1.80U	1.80U	3.9	3.9	2.7	NS	NS	NS	2.3	8.57	3.75	NS	NS	NS
130-12	160-190	DG	WSB-5	6.04	1.77U	1.77U	3.4	3.38	2.53	NS	NS	NS	4.4	3.33	2.94	NS	NS	NS
130-13	196-216	DG	WSB-6	4.05	1.80U	1.80U	5.9	1.79U	1.93U	NS	NS	NS	6.5	3.71U	4	NS	NS	NS
121-55	---	---	WSB Influent to System	NA	NA	NA	4.4	2.27	1.63J	4.4	4.38	1.74J	3	5.4	3.43	6.3B	1.83U	1.98U
Middle Road																		
113-23	90-130	MG	Middle Road RW-1	NA	10.3	9.6	0.2U	10.2	4.47	NS	NS	NS	0.21U	10.3	3.53	NS	NS	NS
113-24	170-200	DG	Middle Road RW-2	NA	11.2	10.9	0.6B J+	11.6	6.68	NS	NS	NS	0.52	13.5	7.11	NS	NS	NS
113-25	228-268	MAG	Middle Road RW-3	NA	3	5.82	1.4B J+	2.18	2.67	NS	NS	NS	1.3	1.87	2.33	NS	NS	NS
113-26	150-180	DG	Middle Road RW-4	NA	7.14	8.79	2.2B J+	4.89	4.49	NS	NS	NS	1.8	4.33	5.35	NS	NS	NS
113-27	150-180	DG	Middle Road RW-5	NA	7.19	5.83	1.4B J+	4.43	3.14J	NS	NS	NS	2.1	2.56	1.44J	NS	NS	NS
106-66	188-218	DG	Middle Road RW-6	NA	4.48	1.65J	3.3B J+	4.51	2.29	NS	NS	NS	2.8	6.87	2.48	NS	NS	NS
113-33	202-222	DG	Middle Road RW-7	NA	2.15	5.35	2B J+	3.27	4.36	NS	NS	NS	1.6	7.16	5.16	NS	NS	NS
113-34	---	---	Middle Road Influent to System	NA	5.93	7.01	1.2B J+	5.82	4.54	1.7	2.55	4.35	1	6.74	5	1.1B	8.43	6.1
South Boundary																		
121-17	150-190	DG	OU III South Boundary EW-3	NA	3.51	2.46	0.59	2.8	2.6	NS	NS	NS	0.54	2.93	2.6	NS	NS	NS
121-16	160-200	DG	OU III South Boundary EW-4	NA	17.6	10.9	0.35	13	6.5	NS	NS	NS	0.16J	16.5	6.48	NS	NS	NS
121-15	160-200	DG	OU III South Boundary EW-5	NA	18.9	12.5	1.1	8.1	4.9	NS	NS	NS	0.9	10.1	4.82	NS	NS	NS
122-14	160-200	DG	OU III South Boundary EW-6	NA	11.7	5.37	0.6	14	5.6	NS	NS	NS	1.1	12.7	4.97	NS	NS	NS
122-13	170-210	DG	OU III South Boundary EW-7	NA	11.8	16.4	1.1	16	4.5	NS	NS	NS	0.59	14.2	4.09	NS	NS	NS
122-12	190-250	DG/MAG	OU III South Boundary EW-8	NA	3.73	3.51	0.19J	21	6.1	NS	NS	NS	0.17J	28.1	7.86	NS	NS	NS
121-46	207-237	DG	OU III South Boundary EW-17	NA	10	5.55	1.2	8.2	6.9	NS	NS	NS	1.1	8.8	6.17	NS	NS	NS
121-41	---	---	South Boundary Influent to System	NA	14.4	10.3	0.82	8.4	5.7	1.7	8.29	7.15	1.2	7.07	6.05	1.1B	8.3	6.97
WSB/MR/SB Combined System Effluent*																		
095-270	---	---	OUIII Combined System Effluent	NA	NA	NA	2.1B J+	5.24	4.11	2.8	2.76	2.13	1.9	7.53	5.63	1.6B	6.2	4.68
095-126	---	---	OUIII Combined System Effluent	4.33	4.83	5.82	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
OU III LIPA/Airport VOC Treatment System (Status: LIPA in Standby, AP Active)																		
000-453	217-237	DG	LIPA EW-1L	3.27	4.78	2.31	2.7	3.97	1.64J	NS	NS	NS	3.3	4.68	1.26J	NS	NS	NS
000-455	224-244	DG	LIPA EW-2L	2.7	6.32	3.74	0.36	2.4	0.898J	NS	NS	NS	0.17J	4.15	2.01U	NS	NS	NS
000-457	216-236	DG	LIPA EW-3L	0.43	9.43	9.45	0.2U	3.48	1.03J	NS	NS	NS	0.2U	2.04	1.9U	NS	NS	NS
000-461	304-324	MAG	LIPA EW-4L	0.26	1.82U	1.3J	0.18J	2.1	1.81J	NS	NS	NS	0.14J	1.64J	1.2J	NS	NS	NS
800-109	188-208	DG	AP RTW-1A	0.28	1.59J	3.59	0.36	1.30J	2.8	NS	NS	NS	0.41	1.65U	1.21J	NS	NS	NS
800-110	188-208	DG	AP RTW-2A	0.51	1.80U	1.80U	0.89	1.64U	1.77U	NS	NS	NS	1	1.8U	1.94U	NS	NS	NS
800-111	210-230	MAG	AP RTW-3A	0.12J	1.98	3.79	0.45	0.872J	2.43	NS	NS	NS	0.59	1.08J	2.58	NS	NS	NS
800-112	268-288	MAG	AP RTW-4A	2.12	1.81U	0.7J	2.4	1.72U	0.641J	NS	NS	NS	2.1	1.71U	0.937J	NS	NS	NS
800-113	220-240	MAG	AP RTW-5A	3.15	1.80U	1.80U	3	1.86U	2.01U	NS	NS	NS	2.7	1.72U	1.86U	NS	NS	NS
800-132	165-185	DG	AP RTW-6A	0.82	1.47	3.24	0.85	1.84	3.36	NS	NS	NS	0.65	1.91	4.68	NS	NS	NS
800-122	---	---	LIPA/AP System Influent	1.39	1.79U	1.47J	0.62	1.61J	3.3	1.2	1.28J	2.47	1.2	1.32J	3.04	1	1.86U	3.5
800-124	---	---	LIPA/AP System Effluent	1.61	NA	NA	1.3D	1.68U	1.81U	1.2	1.69U	1.82U	1.2	1.7U	1.84U	1.1	1.69U	1.82U
OU III North Street East VOC/EDB Treatment System (Status: Active)																		
000-561	195-215	DG	NSE-EDB-EW3	3.88	1.84U	4.32	1.2	0.615J	1.88J	NS	NS	NS	0.77	1.85U	1.38J	NS	NS	NS
000-562	182-202	DG	NSE-EDB-EW4	0.86	0.681J	7.56	0.52	1.34J	2.13	NS	NS	NS	0.39	1.8J	1.73J	NS	NS	NS
000-441	---	---	NSE System Influent	2.52	1.71U	4.71	0.81	0.967J	1.84J	0.76 HJ	1.04J	1.84J	0.57	0.75J	1.5J	0.52	1.72U	2.02
000-444	---	---	NSE System Effluent	0.2U	1.78U	1.78U	0.92	1.73U	1.87U	0.68 HJ	1.87U	2.02U	0.59	1.8U	1.93U	0.51	1.73U	1.86

TABLE 1
Brookhaven National Laboratory
Groundwater Treatment System Monitoring for PFAS and 1,4-Dioxane
June 2023 - April 2024

Well/Sample ID	Screen Interval (ft. bls.)	Aquifer Segment	Treatment System Extraction Well/Influent/Effluent	2017-2020			June - July 2023			October 2023			January 2024			April 2024		
				1,4-Dioxane	PFOS	PFOA	1,4-Dioxane	PFOS	PFOA	1,4-Dioxane	PFOS	PFOA	1,4-Dioxane	PFOS	PFOA	1,4-Dioxane	PFOS	PFOA
				0.35 µg/L	2.7 ng/L	6.7 ng/L	0.35 ug/L	2.7 ng/L	6.7 ng/L	0.35 ug/L	2.7 ng/L	6.7 ng/L	0.35 ug/L	2.7 ng/L	6.7 ng/L	0.35 ug/L	2.7 ng/L	6.7 ng/L
OU VI EDB Treatment System (Status: Active)																		
000-503	115-135	DG	EW-1E	0.15J	1.84U	1.84U	0.2U	NS	NS	NS	NS	NS	0.2U	NS	NS	NS	NS	NS
000-504	115-135	DG	EW-2E	0.13J	1.82U	1.82U	0.2U	NS	NS	NS	NS	NS	0.2U	NS	NS	NS	NS	NS
000-578	174-194	DG	EW-3E	--	--	--	--	--	--	--	--	--	0.36	2.05U	2.2U	NS	NS	NS
000-579	170-190	DG	EW-4E	--	--	--	--	--	--	--	--	--	0.19J	1.94U	2.09U	NS	NS	NS
000-512	---	---	EDB System Influent	0.12J	1.75U	1.75U	0.2U	NS	NS	0.17 HJ	NS	NS	0.27	NS	NS	0.23	NS	NS
000-510	---	---	EDB System Effluent	0.17J	1.80U	1.80U	0.2U	NS	NS	0.18 HJ	NS	NS	0.27	NS	NS	0.24	NS	NS
BGRR/WCF Sr-90 Treatment System (Status: Active)																		
065-368	33-53	SG	BGRR/WCF SR-1	0.2U	5.32	5.45	0.2U	11.9	4.98	NS	NS	NS	0.2U	12.9	6.39	NS	NS	NS
065-369	33-53	SG	BGRR/WCF SR-2	0.2U	3.6	2.57	0.2U	10.1	3.12	NS	NS	NS	0.2U	10.5	3.76	NS	NS	NS
075-676	51-71	SG	BGRR/WCF SR-3**	0.2U	2.44	6.22	0.2U	5.51	3.65	NS	NS	NS	0.2U	2.48	2.7	NS	NS	NS
075-677	35-75	SG	BGRR/WCF SR-4	0.2U	8.74	5.53	0.2U	6.82	3.25	NS	NS	NS	0.2U	6.72	3.11	NS	NS	NS
075-678	35-75	SG	BGRR/WCF SR-5	0.2U	7.02	3.27	0.2U	5.45	3.17	NS	NS	NS	0.2U	5.47	3.82	NS	NS	NS
065-403	85-105	SG	BGRR/WCF SR-6	0.2U	12.3	4.12	0.2U	6.28	3.84	NS	NS	NS	0.2U	1.92	3.34	NS	NS	NS
075-702	82-102	SG	BGRR/WCF SR-7	0.21	10.8	4.33	0.2U	7.33	4.17	NS	NS	NS	0.2U	4.61	6.48	NS	NS	NS
075-703	77-97	SG	BGRR/WCF SR-8	0.12J	8.12	3.72	0.2U	5.74	3.86	NS	NS	NS	0.21U	4.98	5.56	NS	NS	NS
075-704	67-87	SG	BGRR/WCF SR-9	0.11J	7.01	3.1	0.2U	4.79	2.03	NS	NS	NS	0.2U	6.42	5.78	NS	NS	NS
066-216	---	---	BGRR/WCF System Influent	NA	6.46	3.75	0.2U	10.4	3.73	0.12J	11.9	4.12	0.21U	10.5	4.02	0.2U	13.5	4.64
Carbon Midpoint	--	--	BGRR/WCF System Midpoint	NA	NA	NA	0.2U	4.43	3.83	NS	NS	NS	NS	NS	NS	NS	NS	NS
066-219	---	---	BGRR/WCF System Effluent	NA	3.69	4.22	0.2U	0.94J	2.43	0.13J	0.815J	3.24	0.2U	2.65	3.82	0.2U	5.22	5.35

Notes:

Active extraction well
Standby/Off extraction well
System Influent/Midpoint (sampled during current operation)
System Effluent (sampled during current operation)
Denotes 1,4-dioxane result exceeds NYSDEC AWQGV
Denotes PFOS/PFOA result exceeds NYSDEC AWQGV

PFOS and PFOA analyzed by EPA Method 1633. The results are reported in ng/L.
1,4-dioxane analyzed by EPA Method 8270 SIM. The results are reported in µg/L.

U - Analyte not detected above the method detection limit (MDL).
J - Analyte detected above MDL but below reporting limit, result estimated.
+ - Denotes an estimated result is biased high.
B - Analyte detected in laboratory QA/QC blank sample.
D - Results are reported from a sample that required a dilution.
H - Sample analyzed outside of method holding time.
BNL review qualifers, where present, are separated by a space.

NA - Not Analyzed
NS - Not Sampled
* - OUIII running on Bldg 517 air stripper only, effluent sample point 095-270.
** - BGRR/WCF SR-3 operated as needed
SG=Shallow Upper Glacial, MG=Middle Upper Glacial, DG=Deep Upper Glacial
Mag=Magothy
The EPA Risk Based Screening Levels (RSLs) are included below to provide perspective to the values presented in Table 1.

EPA RSL Summary Table (TR=1E-06, HQ=1) November 2024 - 1,4-Dioxane, PFOS, and PFOA

Key: I = IRIS; P = PPRTV; O = OPP; A = ATSDR; T = ATSDR DRAFT; C = Cal EPA; X = PPRTV Screening Level; H = HEAST; D = OW; R = ORD; N = WI; W = TEF applied; E = RPF applied; G = see user's guide; c = cancer; n = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL; SSL values are based on DAF=1; m = ceiling limit exceeded; s = Csat exceeded; V = volatile; M = mutagen.

Contaminant		Screening Levels											Protection of Groundwater SSLs		
Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tap Water (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
Dioxane, 1,4-	123-91-1	5.3E+00	c	2.4E+01	c	5.6E-01	c*	2.5E+00	c*	4.6E-01	c		9.4E-05	c	
~Perfluorooctanesulfonic acid (PFOS)	1763-23-1	6.3E-03	n	5.8E-02	c**					2.0E-03	c**	4.0E-03	1.5E-05	c**	3.0E-05
~Perfluorooctanoic acid (PFOA)	335-67-1	1.9E-05	c	7.8E-05	c					2.7E-06	c	4.0E-03	4.0E-08	c	6.1E-05

Source: https://www.epa.gov/risk/regional-screening-levels-rsls