# North Carolina Collective Study Report

## Collective Study of PFAS and 1,4-Dioxane in Landfill Leachate and Estimated Influence on Wastewater Treatment Plant Facility Influent

# National Waste & Recycling Association - Carolinas Chapter

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#### North Carolina Collective Study Report National Waste & Recycling Association - Carolinas Chapter H&H Job No. NWA-001

#### 1.0 Introduction

Hart & Hickman, PC (H&H) has prepared this North Carolina Collective Study Report on behalf of the Carolinas Chapter of the National Waste & Recycling Association (NWRA) and certain member companies. This report documents the results of a study of perfluoroalkyl and polyfluoroalkyl substances (PFAS) and 1,4-dioxane in municipal solid waste landfill (MSWLF) leachate and its possible influence on wastewater treatment plant (WWTP) facility influent.

In February 2019, the North Carolina Department of Environmental Quality (NCDEQ) met with representatives of the landfill industry to discuss the potential presence of PFAS and 1,4-dioxane in leachate as part of a statewide effort to better understand the presence of these emerging chemicals in the environment. During the meeting, NCDEQ inquired about sampling landfill leachate to begin to understand PFAS and 1,4-dioxane content and its influence on leachate treatment/disposal practices, including publicly owned WWTPs that receive leachate for treatment. Rather than participating landfills sampling and reporting individually, representatives of the landfill industry agreed to participate in a collective study involving active MSWLFs in North Carolina. From these discussions with NCDEQ, the Carolinas Chapter of the NWRA committed to collect leachate samples from nine privately-owned or operated MSWLFs, including four landfills that transport leachate to WWTPs located within the Cape Fear River Basin and five landfills that transport leachate to WWTPs located across the remainder of the State. This report documents the scope and results of the sampling program. Where available, the results of the sampling were evaluated in conjunction with WWTP influent volumes and published sampling data in order to estimate the relative contribution of landfill leachate to overall WWTP influent mass of PFAS and 1,4-dioxane. The goals and objectives of the sampling program were presented to NCDEQ in a Scoping Document, dated August 8, 2019. NCDEQ issued a letter, dated August 14, 2019, concurring with the plan outlined in the Scoping Document.



This North Carolina Collective Study Report is organized into sections to include the following:

- General overview of PFAS and 1,4-dioxane in landfill leachate, including background information, waste management system considerations, a summary of previous studies, and North Carolina regulatory status;
- Description of sampling activities and results; and
- Discussion of the WWTPs receiving the landfill leachate and calculations related to estimating the contribution of landfill leachate to overall WWTP influent mass.

#### 2.0 General Overview

#### 2.1 Background Information

PFAS are a group of man-made chemicals that have been manufactured and used in a variety of industries worldwide since the 1940s. The most extensively produced and studied PFAS compounds are perfluorooctanoic acid (PFOA) and perfluorooctanesulfonate (PFOS). Another notable PFAS compound is 2,3,3,3-tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid (PFPrOPrA), which has the trade name GenX and is used in manufacturing nonstick coatings (United States Environmental Protection Agency [EPA], 2019a).

PFAS have been used to make a variety of consumer products that are resistant to water, grease, or stains. PFAS have also been used in firefighting foams and various industrial processes (Interstate Technology and Regulatory Council [ITRC], 2017). PFAS do not occur naturally, but are widespread in the environment and have been found in people, wildlife, and fish all over the world. Certain PFAS can accumulate in the human body for long periods of time and do not break down easily in the environment (Agency for Toxic Substances and Disease Registry [ATSDR], 2020).

PFOS and PFOA have been largely phased out by industry in the United States, with this phase-out beginning in the early 2000s. However, PFOS and PFOA are still being produced internationally and imported into the United States in consumer goods. Landfills receive a large variety of residential and industrial waste containing PFAS compounds (see inset) (ITRC, 2017).

### Products/Wastes with Potential PFAS

Consumer products Paper and packaging Clothing and carpets Outdoor textiles and sporting equipment Ski and snowboard waxes Non-stick cookware Cleaning agents and fabric softeners Polishes and waxes Pesticides and herbicides Hydraulic fluids Windshield wipers Paints, varnishes, dyes, and inks Adhesives Medical products Personal care products (for example, shampoo, hair conditioners, sunscreen, cosmetics, toothpaste, dental floss) Sewage sludge

Industrial wastes
Auto shredder residue
Debris from fire cleanup
Discarded AFFF
Other sources



PFAS are considered to be contaminants of emerging concern (CECs). CECs are chemicals that present known or potential human health effects or environmental risks, but either do not have regulatory cleanup standards or regulatory standards are evolving due to new science, detection capabilities or pathways, or both (ITRC, 2017). PFAS were the primary focus of the North Carolina Collective Study; however, at the request of the NCDEQ, another CEC, 1,4-dioxane, was also included in the sampling and analytical program. 1,4-Dioxane has been used as a solvent in the manufacture of other chemicals, as a stabilizer for chlorinated solvents, and as a laboratory reagent. It can also be found as a byproduct in many consumer and industrial products (EPA, 2017a, ATSDR, 2011, and ATSDR, 2012) (see inset). Disposal of these products in landfills can result in 1,4-dioxane in landfill leachate (Maine Department of Environmental Protection [MDEP], 2020).

### Products/Wastes with Potential 1.4-Dioxane

Consumer products

Household cleaners Detergents Shampoos Deodorants Cosmetics Food supplements Paint Paint strippers Dyes Greases Antifreeze Aircraft deicing fluids Adhesives Pesticides Industrial wastes Laboratory wastes

#### 2.2 Waste Management System Considerations

Landfills and WWTPs play an important role in managing wastes for our communities. It is important to note that landfills and WWTPs are receivers of PFAS and 1,4-dioxane and are not the producers or original sources. Rather, consumer products and other wastes disposed of in these facilities represent the source. Modern landfills are well-engineered and managed facilities designed to protect the environment from contaminants that may be present in the waste stream. MSWLFs must meet stringent regulatory requirements (see inset) (EPA, 2017b). North Carolina Administrative Code (NCAC) Title 15A Subchapter 13B requires that MSWLF liner systems include either 1) a geomembrane liner installed above and in direct and uniform contact with a compacted clay liner with a minimum thickness of 24 inches and a permeability

#### MSWLF Regulatory Requirements

Location restrictions
Composite liner requirements
Leachate collection and
removal systems
Operating practices
Federal, state, and local
environmental monitoring
requirements (groundwater,
surface water, stormwater, air,
leachate)
Closure and post-closure care
requirements
Corrective action provisions
Financial assurance
Others



of no more than 1.0 x 10<sup>-7</sup> cm/sec or 2) a geomembrane liner installed above and in direct and uniform contact with a geosynthetic clay liner (GCL) overlying a compacted clay liner with a minimum thickness of 18 inches and a permeability of no more than 1.0 x 10<sup>-5</sup> cm/sec. Landfill leachate is generated from rainfall travelling through landfill waste or liquids within the waste itself. The leachate is effectively captured through liner and leachate collection systems. A common method of leachate disposal is discharge to a local publicly-owned WWTP where it is handled with other household, commercial, and various industrial wastewaters. Management of leachate in this way provides for a closed system where there is no direct exposure to the public (NTH Consultants, Ltd. [NTH], 2019).

Because PFAS and 1,4-dioxane are so ubiquitous, publicly-owned WWTPs receive wastewater from multiple sources that may contain PFAS and 1,4-dioxane. In addition to landfill leachate, other potential sources containing PFAS and/or 1,4-dioxane include wastewater from industrial, commercial, and agricultural operations and domestic sewage generated from homes, workplaces, and other public and private facilities. Biosolids (sewage sludge) from WWTPs may contain PFAS compounds (EPA, 2018; MDEP, 2020a; Michigan Department of Environment, Great Lakes, and Energy, 2020). Biosolids are commonly disposed of via land application, incineration, or landfilling. Because MSWLFs are strictly regulated and include liners and leachate collection systems engineered to prevent releases of pollutants to the environment, disposal of biosolids in MSWLFs may represent the preferred management option.

#### 2.3 Other Related Studies

NTH, on behalf of the Michigan Waste & Recycling Association (MWRA), recently performed a statewide study of landfill leachate PFAS impacts on WWTP influent in the State of Michigan (herein referred to as the Michigan Study). This effort represented one of the largest studies conducted on active landfill leachate to date. The results of the study were documented in a Technical Report dated March 1, 2019 (NTH, 2019). Testing performed as part of the Michigan Study included collection of leachate samples from 32 active MSWLFs located in the State of Michigan and analysis of the samples for PFOS and PFOA. Data related to leachate disposal methods and volumes were gathered for each of the MSWLFs tested. The results were evaluated



with respect to publicly available sampling data for WWTPs located across the State of Michigan. The North Carolina Collective Study presented in this report was performed using an approach similar to the Michigan Study. The results of the Michigan Study are discussed in conjunction with the results of the North Carolina Collective Study in Sections 3.4 and 4.0 of this report.

The Michigan Study also included a review of literature related to PFAS in landfill leachate. The literature review identified two key publications: National Estimate of Per- and Polyfluoroalkyl Substances (PFAS) Release to U.S. Municipal Landfill Leachate (Lang et al, 2017) and Review of the Fate and Transformation of Per- and Polyfluoroalkyl Substances (PFASs) in Landfills (Hamid et al, 2018). Lang et al (2017) evaluated the concentrations of PFAS compounds in 95 samples of leachate from landfills of varying climates and waste ages in the United States. According to the summary presented in the Michigan Study report, Lang et al demonstrated that PFOA and PFOS concentrations in leachate generally have been decreasing over time, with greater rates of decline in humid regions. Hamid et al (2018) compiled data from 11 literature sources that document PFAS leachate concentrations from dozens of landfills and more than 162 leachate samples from across the globe. The data show that PFOS and PFOA concentrations vary widely in different regions of the world, and are likely reflective of the consumer products and industrial materials used, produced, and disposed in each country. Reported concentrations for landfills in China were notably higher than elsewhere, which is likely due to the continued production of consumer goods containing PFAS and associated industrial waste from the manufacturing processes. Note that PFAS-containing products manufactured in China and other countries are often imported into the United States for purchase and eventually disposed of in United States landfills. PFOS and PFOA concentration data based on the literature review performed during the Michigan Study are summarized in Table 1 and depicted in Figure 1.

Additional studies of PFAS in landfill leachate are underway since the date of the Michigan Study. Locally, the North Carolina Policy Collaboratory (NC Collaboratory) has funded research being performed by the NC PFAS Testing (PFAST) Network. The NC Collaboratory was established by the North Carolina General Assembly in 2016 to facilitate and fund research and make recommendations to the General Assembly. The PFAST Network consists of investigators from



various NC universities performing multiple studies related to PFAS. One of these studies is being led by Dr. Morton Barlaz at North Carolina State University and focuses on PFAS in landfill leachate. The purpose of the study is to assess the relative importance of MSWLFs and domestic wastewater as contributors of PFAS to WWTPs and potentially to surface water (PFAST Network, 2019). The results of the PFAST Network study have not yet been published and therefore could not be incorporated into the North Carolina Collective Study documented in this report.

No comprehensive studies have been identified regarding 1,4-dioxane concentrations in landfill leachate. More data are available regarding 1,4-dioxane concentrations in public water systems (PWS). Monitoring of 1,4-dioxane in PWS was required by the EPA Third Unregulated Contaminant Monitoring Rule (UCMR 3). Adamson et al (2017) documents an evaluation of 1,4-dioxane concentrations in PWS located across the United States based on data collected under the UCMR 3. The results of the study identified detectable concentrations of 1,4-dioxane in 21% of 4,864 PWS. The study concluded that the data indicated a decreasing trend in concentrations and detection frequency over time. The study also concluded that detections of 1,4-dioxane were highly associated with detections of other chlorinated solvent compounds, which is attributed to the use of 1,4-dioxane as a solvent stabilizer.

#### 2.4 Regulatory Status

The regulatory status of PFAS and 1,4-dioxane are currently evolving as additional studies are completed regarding human health risks and ecological effects. No regulatory standards or screening levels have been developed by EPA or the State of North Carolina that are applicable to landfill leachate. Levels that have been established for drinking water are summarized below, but it should be noted that these levels do not apply to landfill leachate.

#### **PFAS**

EPA has not adopted Federal regulatory standards or Maximum Contaminant Levels (MCLs) for PFAS compounds to date. EPA has established a Health Advisory Level for combined or individual PFOS and PFOA of 70 nanograms per liter (ng/L, equivalent to parts per trillion). EPA's



health advisories are non-enforceable and non-regulatory but provide technical information to state agencies and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination (EPA, 2019b).

North Carolina also has not adopted regulatory standards for PFAS compounds to date. North Carolina has established a Drinking Water Health Goal for PFPrOPrA (GenX) of 140 ng/L. According to the North Carolina Department of Health and Human Services (NCDHHS), the PFPrOPrA Drinking Water Health Goal is not a regulatory level and is not a boundary line between a "safe" or "dangerous" level, but can be used to provide information to affected communities and residents about potential risks from exposure to GenX through drinking water (NCDHHS, 2020).

#### 1,4-Dioxane

EPA has not adopted Federal regulatory standards or MCLs for 1,4-dioxane to date. EPA has established a Drinking Water Health Advisory Level of 35 micrograms per liter (μg/L, equivalent to parts per billion). As referenced above, EPA's health advisories are non-enforceable and non-regulatory but provide technical information to state agencies and other public health officials (EPA, 2019b).

North Carolina has established a 2L Groundwater Standard under Title 15A NCAC 2L .0202 of 3  $\mu$ g/L for 1,4-dioxane. The 2L Standards are the maximum allowable concentrations resulting from any discharge of contaminants that may be tolerated without creating a threat to human health or would otherwise render the groundwater unsuitable for it intended best usage. Although a 2L Groundwater Standard has been established, NCDEQ has relied on the EPA Drinking Water Health Advisory Level of 35  $\mu$ g/L when evaluating the potential for impacts to public water supplies (NCDEQ, 2020).



#### 3.0 Sampling Activities

#### 3.1 Locations Sampled

In accordance with the August 2019 Scoping Document, leachate samples were collected from the following nine active MSWLF facilities located across the State of North Carolina:

- 1. Great Oak Landfill (7607-MSWLF-2015)
- 2. Sampson County Disposal, LLC (8202-MSWLF-2000)
- 3. South Wake MSW Landfill (9222-MSWLF-2008)
- 4. Upper Piedmont Regional Landfill (7304-MSWLF-1997)
- 5. BFI-Charlotte Motor Speedway Landfill V (1304-MSWLF-1992)
- 6. Uwharrie Environmental Regional Landfill (6204-MSWLF-1995)
- 7. East Carolina Regional Landfill (0803-MSWLF-1993)
- 8. Chambers Development MSW Landfill (0403-MSWLF-2010)
- 9. Foothills Environmental Landfill (1403-MSWLF-1998)

Prior to sampling, H&H contacted each landfill and requested information regarding site contacts, leachate collection and disposal systems, access limitations, typical leachate sampling locations, leachate volumes, and leachate disposal methods. This information is summarized in **Table 2**. The landfill locations are shown on **Figure 2**.

#### 3.2 Sampling Methodology

Sampling was performed by H&H staff with experience sampling for PFAS and other constituents of concern. Sampling procedures were in accordance with the guidance document "PFC Sampling Procedures, January 2019" issued by the NCDEQ Division of Waste Management (DWM) Solid Waste Section (herein referred to as NC DWM Sampling Guidance). Prior to sampling, a Health & Safety Plan was prepared to cover safety concerns associated with the proposed field activities. Sampling bottles, bottle coolers, and PFAS-free water for blanks and decontamination were



obtained from the laboratory, GEL Laboratories, LLC (GEL) located in Charleston, South Carolina.

Because PFAS are present in many commonly used materials, the PFCs Sampling Checklist form included with the NC DWM Sampling Guidance was followed by field personnel to reduce the potential for cross-contamination of samples with PFAS from external sources. Each sampler washed their hands before sampling and utilized a minimum of three layers of nitrile gloves at each sampling location to maintain a "clean hands" approach after encountering various surfaces. Sampling supplies were placed on new high-density polyethylene (HDPE) sheeting in close proximity to the sampling location.

Sampling was performed September 16 through 19, 2019. Leachate collection/management systems vary by landfill facility; therefore, samples were collected under three general scenarios as described below. The sampling scenario for each facility is indicated on **Table 2**.

#### Valve at Bottom of Holding Tank/Discharge Line

• At locations where a sample port was located at the bottom of the holding tank and/or the discharge line (all locations except BFI-Charlotte Motor Speedway Landfill V and Great Oak Landfill), the valve was opened to clear any potential sediment and to adjust the flow to an appropriate rate for sample collection. Using fresh nitrile gloves, the sampler then removed the lid of the sample container and collected the sample keeping the sample container lid in the opposite hand. Upon completion of sampling, bottles were capped, placed in Zip-lock bags, and placed into laboratory-supplied coolers filled with ice. Because samples were collected directly into laboratory-supplied sampling containers and no separate sampling apparatus was used, no equipment blanks were collected for these locations.

#### Direct From Lagoon

• At the BFI-Charlotte Motor Speedway Landfill V, the sampling team mobilized to the leachate lagoon and set up a sampling station on the edge of the lagoon utilizing new HDPE sheeting. Samples were collected by submerging a new unpreserved laboratory-supplied



sample container approximately 1-foot below the surface of the lagoon, then transferring the contents into the laboratory-supplied sample containers to be submitted for analysis. Upon completion of sampling, bottles were capped, placed in Zip-lock bags, and placed into laboratory-supplied coolers filled with ice. Because samples were collected using laboratory-supplied sampling containers and no separate sampling apparatus was used, no equipment blanks were collected for this location.

#### Direct From Holding Tank

At the Great Oak Landfill, the level of leachate in the holding tank was insufficient to collect a sample from the discharge port; therefore, samples were collected directly from the manhole hatch located at the top of the leachate holding tank. On September 17, 2019, samples were collected using a new properly decontaminated HDPE bucket and cotton string for analysis of both PFAS and 1,4-dioxane. H&H returned to the site on September 30, 2019, to resample for 1,4-dioxane due to issues with damage to sample containers during transport to the laboratory. During the sampling on September 30, 2019, samples were collected using a new HDPE bailer and cotton string for analysis of 1,4-dioxane. To complete the sampling, leachate was extracted from the holding tank using the bucket or bailer and transferred into the sample containers. The sampling station at the platform on top of the holding tank was covered with new HDPE sheeting. In addition, the "windmill" technique was utilized while bailing to prevent the bailer or string from contacting potential PFAS containing surfaces. Upon completion of sampling, bottles were capped, placed in Zip-lock bags, and placed into laboratory-supplied coolers filled with ice. For quality assurance/quality control (QA/QC), an equipment blank was collected during each sampling event from the bucket or bailer using PFAS-free water provided by the laboratory.

Each sample was assigned a unique identification number beginning with the first four digits of the NCDEQ permit number. Samples collected for analysis of PFAS were placed in coolers separate from samples collected for analysis of 1,4-dioxane. The sample coolers were shipped to GEL under chain-of-custody protocol for analysis as described in Section 3.3.



#### 3.3 Laboratory Analyses

The samples from each facility were analyzed for PFAS by modified EPA Method 537.1 using Method PFAS by LCMSMS Compliant with Table B-15 of Department of Defense Quality Systems Manual (QSM) Version 5.3 and 1,4-dioxane by EPA Method 8270 Selective Ion Monitoring. The list of PFAS compounds included in the analyses was based on prior discussions between NWRA member companies and NCDEQ staff. At the request of NCDEQ, samples from Sampson County Disposal, LLC were also analyzed for PFPrOPrA by modified EPA Method 537.1.

Three items were identified during review of the laboratory QA/QC data which are discussed below:

- For sample 0403-1 (Chambers Development MSWLF), the surrogate recovery for the 1,4-dioxane sample analysis was below acceptable limits. The analytical results indicated 60% surrogate recovery with an estimated sample concentration of 9.22 μg/L. If this concentration is adjusted upward based on 100% recovery instead of 60%, the estimated 1,4-dioxane concentration in the sample would be 15.4 μg/L ([9.22 μg/L x 100%] / 60% = 15.4 μg/L). Following the initial analysis, GEL re-analyzed a second portion of the sample. However, the re-analysis was performed outside the method-recommended holding time. The results of the second analysis indicated a concentration of 14.8 μg/L. Based on the adjusted initial sample analysis result and the re-analysis result, H&H concludes that there is sufficient data to conclude the concentration in the sample is reasonably on the order of approximately 15 μg/L.
- For sample 1304-1 (BFI-Charlotte Motor Speedway Landfill V), GEL inadvertently did not analyze the 1,4-dioxane sample collected on September 16, 2019. A second sample (ID 1,1A,2,2A) was collected by landfill facility personnel on December 4, 2019 and analyzed for 1,4-dioxane.



• The equipment blank sample collected from Great Oak Landfill (sample 7607-EB) contained perfluorobutyric acid (PFBA) at a laboratory estimated concentration of 1.12 ng/L. The concentration detected was J-flagged, which means the concentration is estimated above the laboratory method detection limit but below the quantification/reporting limit. PFBA was also detected in the primary leachate sample collected from Great Oak Landfill (sample 7607). Based on these data, there is less confidence in PFBA concentrations reported for the Great Oak Landfill.

Laboratory analytical reports are included in **Appendix A**.

#### 3.4 Discussion of Sampling Results and Comparison to Other Studies

The results of the laboratory analyses indicated detectable concentrations of PFOS, PFOA, and other PFAS compounds in each of the collected samples. 1,4-Dioxane was also detected in each of the samples. A summary of laboratory analytical data for the full set of constituents of concern is provided in **Table 3**.

Concentrations of PFOS and PFOA detected in the samples were compared to concentrations detected in leachate samples collected during the Michigan Study. The comparison data are summarized in **Table 4**. The results of the comparison indicated mean concentrations detected during the North Carolina Collective Study were generally similar to those detected during the Michigan Study (see inset). Variations in minimum and maximum

PFOS and PFOA Concentrations in Leachate						
Parameter Min Max Mea						
PFOS	NC	82	402	199		
(ng/L)	MI	9	960	222		
PFOA	NC	108	3,690	1,005		
(ng/L)	MI	16	3,200	881		

concentrations between the North Carolina and Michigan studies are likely a result of differing sample sizes. Comparison to published literature references (as referenced in Section 2.2) indicates that concentrations detected during the North Carolina Collective Study are also within



the range of values reported during other studies in the United States and other Western world regions, but more than an order of magnitude lower than maximum values reported for China.

Similar to the procedure followed during the Michigan Study, the analytical data and estimated

annual leachate volumes provided by each MSWLF facility were used to calculate the daily mass of PFOS and PFOA contained within landfill leachate for each facility. The calculations based on the North

PFOS and PFOA Daily Mass in Leachate							
Paramete	Min	Max	Mean				
PFOS Daily	NC	0.00001	0.00014	0.00004			
Mass (lbs/day)	MI	0.00001	0.00040	0.00005			
PFOA Daily Mass (lbs/day)	NC	0.00001	0.00098	0.00013			
	MI	0.00002	0.00260	0.00022			

Carolina Collective Study data indicate a mean daily mass of less than 0.001 lbs/day of PFOS or PFOA (see inset). Comparison of estimated daily mass values for the North Carolina Collective Study to those calculated during the Michigan Study indicate generally similar values. Daily mass calculations for PFOS and PFOA are summarized in **Table 4** and depicted on **Figure 3**.

Daily mass calculations were also performed for 1,4-dioxane based on data collected during the North Carolina Collective Study. The results of the calculations indicated a mean daily mass of less than 0.1 lbs/day of 1,4-dioxane (see inset). The Michigan Study did not include analysis for 1,4-dioxane, nor were comprehensive published references identified for typical 1,4-dioxane

concentrations in landfill leachate.

As such, no additional data are available for comparison.

However, based on the general similarity in PFAS concentrations

1,4-Dioxane							
Concentration and Daily Mass in Leachate							
Parameter Min Max Mean							
1,4-Dioxane Concentration	14.8	469	120				
(µg/L)	14.0	409	120				
1,4-Dioxane Daily Mass	0.0022	0.0944	0.0255				
(lbs/day)	0.0022	0.0944	0.0255				

reported in the North Carolina Collective Study, Michigan Study, and United States published literature, the 1,4-dioxane concentrations detected during the North Carolina Collective Study are expected to be similar to those for other MSWLFs across the United States. Daily mass calculations for 1,4-dioxane are summarized in **Table 5** and depicted on **Figure 7**.



#### 4.0 Influence on WWTP Influent

#### 4.1 Description of Receiving WWTPs

The MSWLFs covered under the North Carolina Collective Study each dispose of leachate via one or more publicly-owned WWTPs. H&H compiled locations for the receiving WWTPs based on information provided by each landfill. A summary of the receiving WWTP names, addresses, and National Pollutant Discharge Elimination System (NPDES) permit numbers is provided in **Table 2**. H&H determined the permitted flow for each WWTP based on information obtained from permit applications on the NCDEQ on-line Laserfiche document repository. Permitted flows are used rather than actual flows to be consistent with the approach used by NCDEQ during evaluation of the WWTP sampling data referenced below.

#### 4.2 WWTP Sampling Data Source

In 2019, the NCDEQ DWR issued letters to publicly owned utilities with pretreatment programs and industrial dischargers in the Cape Fear River Basin requiring influent sampling for 1,4-dioxane and PFAS for three consecutive months beginning in July 2019. The sampling was performed in July, August, and September 2019. H&H retrieved the results of the sampling from the NCDEQ website (NCDEQ, 2020). Discussions in this report are based on average concentrations detected during the three monthly sampling events between July and September 2019.

The NCDEQ website contains PFAS and 1,4-dioxane data for the following WWTPs which receive leachate from landfills in the North Carolina Collective Study, including:

- City of Asheboro WWTP
- East Burlington WWTP
- Utley Creek Water Reclamation Facility
- Harnett County Lillington Plant



#### 4.3 Discussion of WWTP Influent Sampling Results and Comparison to Other Studies

The WWTP sampling data are summarized on **Table 6**. For the WWTPs that receive leachate from facilities in the North Carolina Collective Study, the concentrations of PFOS and PFOA in the influent range from 8.86 to 49.5 ng/L (based on the average of the samples collected at each WWTP). Based on documentation provided on the NCDEQ website, NCDEQ concluded that the PFOS and PFOA concentrations for these facilities would not cause levels at downstream PWS intakes that exceed the EPA Drinking Water Health Advisory Level of 70 ng/L.

For 1,4-dioxane, the average concentrations of WWTP influent range from 5.95 to 18.5  $\mu$ g/L, with the exception of one outlier which indicated a significantly higher average concentration of 163  $\mu$ g/L. Based on documentation provided on the NCDEQ website, the elevated outlier concentration is primarily attributed to an industrial discharger rather than a landfill leachate source. Overall, for the WWTPs that receive leachate from facilities in the North Carolina Collective Study, NCDEQ concluded that the 1,4-dioxane concentrations for these WWTPs are not anticipated to cause levels that exceed the EPA Drinking Water Health Advisory Level of 35  $\mu$ g/L at downstream PWS intakes.

The WWTP sampling and flow data were used to calculate the estimated daily mass of PFOS, PFOA, and 1,4-dioxane for each facility with available data. For PFOS and PFOA, the calculated daily mass values were then compared to WWTP daily mass values calculated during the Michigan Study. The results of this comparison indicated that the daily PFOS and PFOA mass for the North Carolina WWTPs are generally similar to or lower than the corresponding daily mass for the Michigan WWTPs. Daily WWTP mass calculations summarized in **Tables 6** and **7**, and depicted on **Figures 4** and **8**.



#### 4.4 Leachate Contribution to WWTP Daily Mass

In order to evaluate the relative contribution of landfill leachate to WWTP daily mass, the daily mass values calculated for leachate were compared to the daily mass values calculated for WWTP influent. The results of these calculations for the North Carolina Collective Study facilities are summarized in **Table 8**. The PFOS and PFOA data are depicted along with similar data from the

Percent Contribution to WWTP Influent Daily Mass						
Constituent	stituent Leachate Sources					
PFOS	0.7 to 2.9%	97.1 to 99.3%				
PFOA	0.6 to 10.2%	89.8 to 99.4%				
1,4-Dioxane	0.3 to 3.6%	96.4 to 99.7%				

Michigan Study on Figures 5 and 6, respectively. The 1,4-dioxane data are depicted on Figure 8. Review of the graphical depiction demonstrates that the mass of PFOS, PFOA, and 1,4-dioxane from landfill leachate represents a minor contribution to overall WWTP influent mass. The estimated percent contribution of landfill leachate to overall WWTP mass for the sites in the North Carolina Collective Study ranges from only 0.3 to 10.2% for PFOS, PFOA, and 1,4-dioxane (see

inset), with an average of 3.3%. The PFOS and PFOA results are corroborated by the larger data set included in the Michigan Study, which also confirms that landfill leachate represents a minor contribution to overall WWTP influent mass and

Review of the graphical depictions on Figures 5, 6, and 8 demonstrates that the mass of PFOS, PFOA, and 1,4-dioxane from landfill leachate represents a minor contribution to overall WWTP influent mass.

non-leachate sources represent a much larger contribution.



#### 5.0 Conclusions and Recommendations

The North Carolina Collective Study included collection of leachate samples from nine MSWLF facilities located across the State of North Carolina for analysis of PFAS constituents and 1,4-dioxane. Where available, the results of the sampling were evaluated in conjunction with WWTP influent volumes and published sampling data in order to estimate the relative contribution of landfill leachate to overall WWTP influent mass of PFAS and 1,4-dioxane. The data were also evaluated with respect to the results of a larger study performed in Michigan using similar methodology.

The results of the North Carolina Collective Study clearly show that landfill leachate represents a minor contribution of PFOS, PFOA, and 1,4-dioxane mass to overall WWTP influent mass for these compounds. Non-leachate sources contribute significantly more mass to WWTP influent than leachate. These conclusions are supported by both the North Carolina Collective Study and the Michigan Study. Importantly, NCDEQ concluded that WWTP influent sampling data for facilities in the Cape Fear River Basin that receive leachate from landfills in the Collective Study indicate that PFOS, PFOA, and 1,4-dioxane concentrations do not pose a threat to downstream PWS intakes.

MSWLFs and WWTPs generally have an interdependent relationship for waste management (WWTPs accept leachate from MSWLFs and MSWLFs accept biosolids from WWTPs). Landfills and WWTPs are not producers of the original sources of PFAS and 1,4-dioxane. Rather, they both receive and manage PFAS contaminated waste and wastewater from households, business, and industry. MSWLFs and WWTPs are designed to manage waste in ways that are protective of human health and the environment. If long term reductions of CECs in the environment are to be achieved, then manufacturing and product utilization in society need to be addressed. The evidence provided by this report that landfill leachate represents only a small percentage of total influent mass of PFAS and 1,4-dioxane into WWTPs indicates the ubiquitous nature of these compounds in society. In spite of this ubiquitous nature, it is encouraging to note



that in the Cape Fear River basin, NCDEQ concluded that WWTP discharges do not represent a threat to drinking water supplies in most cases.

Based on the findings of both the North Carolina Collective Study and the Michigan Study, continued work towards PFAS and 1,4-dioxane source reduction solutions, such as the United States' phase-out of PFOS and PFOA in manufacturing, is recommended. We also recommend collaboration between the solid waste and WWTP industries, NCDEQ, and the scientific community in order to identify best management practices and other solutions for safe management of wastes generated by our communities.



#### 6.0 References

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**TABLES** 



Table 1
Literature Summary of PFOS and PFOA in Landfill Leachate
North Carolina Collective Study
H&H Job No. NWA-001

	Landing			PFOA <sup>1</sup>			PFOS <sup>2</sup>			
Source Cited	Location/ Region	Sample Size	Detection Frequency (%)	Concentration Range (ng/l) <sup>3</sup>	Median (ng/l)	Detection Frequency (%)	Concentration Range (ng/l)	Median (ng/l)		
Huset, et al (2011)	USA	5	100	380 - 1,000	490	100	56 -160	97		
Allred, et al (2015)	USA	6	100	150 - 5,000	1,055	100	25 - 590	155		
Lang, et al (2017)	USA	87	100	30 - 5,000	590	96	3 - 800	99		
Benskin, et al (2012)	Canada	5	100	210 - 1,500	520	100	80 - 4,400	390		
Kallenborn, et al (2004)	Nordic Countries	NA	NA	90 - 501	230	NA	30 - 190	80		
Bossi, et al (2008)	Denmark	NA	NA	0 - 6	3	NA	0 - 4	NA		
Woldegiorgis, et al (2008)	Sweden	NA	NA	40 - 1,000	540	NA	30 - 1,500	550		
Busch, et al (2010)	Germany	20	95	0 - 926	57	100	0 - 235	3		
Fuertes, et al (2017)	Spain	6	100	200 - 585	437	17	0 - 44	NA		
Gullen, et al (2016)	Australia	17	100	19 - 2,100	450	89	0 - 100	31		
Gullen, et al (2017)	Australia	97	64	17 - 7,500	600	65	13 - 2,700	220		
Yan, et al (2015)	China	6	100	281 - 214,000	2,260	100	1,150 - 6,020	1,740		

#### Notes:

- 1. PFOA = Perfluorooctanoic acid
- 2. PFOS = Perfluorooctanesulfonate
- 3. ng/L = nanograms per liter

Data Source: Michigan Waste & Recycling Association Statewide Study on Landfill Leachate PFOA and PFOS Impact on Water Resource Recovery Facility Influent (March 2019).

#### Table 2 Landfill and WWTP Facility Information North Carolina Collective Study H&H Job No. NWA-001

Landfill Name	NCDEQ Permit Number	Landfill Address	Estimated Annual Leachate Volume (gallons/day)	Description of Sampling Location	Receiving WWTP <sup>1</sup> Name	WWTP NPDES <sup>2</sup> Permit Number	WWTP Permitted Flow Limit (gallons/day)*	Receiving WWTP Address	Receiving WWTP River Basin
Foothills Environmental Landfill	1403-MSWLF-1998	2800 Cheraw Road Lenoir, NC 28645	24,364	Valve at Bottom of Holding Tank	Henry Fork WWTP	NC0040797	9,000,000	4014 River Road Hickory, NC	Catawba
BFI-Charlotte Motor Speedway Landfill V	1304-MSWLF-1992	5105 Morehead Road Concord, NC 28027	40,027	Direct from Lagoon	Rocky River Regional WWTP	NC0036269	26,500,000	6400 Breezy Lane Concord, NC	Yadkin Pee Dee
Chambers Development MSWLF	0403-MSWLF-2010	375 Dozer Drive Polkton, NC 28135	17,452	Valve at Bottom of Holding Tank	Anson County WWTP	NC0041408	3,500,000	1306 Hollywood Road Wadesboro, NC	Yadkin Pee Dee
Uwharrie Environmental Regional Landfill	6204-MSWLF-1995	500 Landfill Road Mt Gilead, NC 27306	31,649	Valve at Bottom of Holding Tank	Town of Troy WWTP	NC0028916	1,200,000	Troy, NC	Yadkin Pee Dee
Great Oak Landfill	7607-MSWLF-2015	3597 Old Cedar Falls Road Randleman, NC 27317	9,589	Direct from Holding Tank	City of Asheboro WWTP	NC0026123	9,000,000	1032 Bonkemeyer Dr Asheboro, NC	Cape Fear
Upper Piedmont Regional Landfill	7304-MSWLF-1997	9650 Oxford Road Rougemont, NC 27572	31,830	Valve at Bottom of Holding Tank	East Burlington WWTP	NC0023868	12,000,000	225 Stone Quarry Road Haw River, NC	Cape Fear
Wake County South Wake	9222-MSWLF-2008	6124 Old Smithfield Road	5,260	- Valve on Discharge Line	Utley Creek Water Reclamation Facility	NC0063096	6,000,000**	150 Treatment Plant Road Holly Springs, NC	Cape Fear
MSWLF	9222-WSWLF-2000	Apex, NC 27502	3,890	Valve on Discharge Line	City of Lumberton WWTP	NC0024571	20,000,000	700 Lafayette Street Lumberton, NC	Lumber
			8,658		Harnett County Lillington Plant	NC0021636	7,500,000	175 Bain Street Lillington, NC	Cape Fear
Sampson County Disposal,	8202-MSWLF-2000	7434 Roseboro Highway	16,219	- Valve on Discharge Line	Harnett County South Plant	NC0088366	15,000,000	3224 Shady Grove Road Spring Lake, NC	Cape Fear
LLC	0202-W0WLI -2000	Roseboro, NC 28382	20,411	valve on Discharge Line	City of Lumberton WWTP	NC0024571	20,000,000	700 Lafayette Street Lumberton, NC	Lumber
			22,137		Not applicable - Evaporation	Not applicable	Not applicable	Not applicable	Not applicable
East Carolina Regional Landfill	0803-MSWLF-1993	1922 Republican Road Aulander, NC 27805	41,044	Valve at Bottom of Holding Tank	Tar River Regional WWTP	NC0030317	21,000,000	3031 Treatment Plant Road Rocky Mount, NC	Tar-Pamlico

Notes:

1. WWTP = wastewater treatment plant

<sup>2.</sup> NPDES = National Pollutant Discharge Elimination System

\* = Permitted flow obtained from Section A.6 of latest NPDES permit application retrieved from North Carolina Department of Environmental Quality on-line Laserfiche document repository in December 2019.

\*\* = After receiving an Authorization to Construct, the treatment capacity will increase to 8 millions of gallons per day.

Table 3
Leachate Analytical Data
North Carolina Collective Study
H&H Job No. NWA-001

	Sample ID		9222-1	1403-1	1304-1	0403-1	6204-1	7607-1	0803-1	7304-1	8202-1
	Sampling Dat	:e	09/18/19	09/16/19	09/16/19*	09/16/19	09/17/19	09/17/19**	09/19/19	09/17/19	09/18/19
Parameter	Landfill Name		Wake County South Wake MSWLF <sup>1</sup>	Foothills Environmental Landfill	BFI-Charlotte Motor Speedway Landfill V	Chambers Development MSWLF	Uwharrie Environmental Regional Landfill	Great Oak Landfill	East Carolina Regional Landfill	Upper Piedmont Regional Landfill	Sampson County Disposal, LLC
	Laboratory Method	Units <sup>2</sup>	MSWLF	Landini	Lanum V	IVISVVLF	Regional Landilli				
Fluorotelomer sulfonate 4:2 (4:2 FTS)	EPA 537.1 Mod	ng/L	$ND^3$	ND	ND	ND	ND	ND	ND	ND	ND
Fluorotelomer sulfonate 6:2 (6:2 FTS)	EPA 537.1 Mod	ng/L	ND	ND	ND	180J⁴	ND	ND	ND	ND	ND
Fluorotelomer sulfonate 8:2 (8:2 FTS)	EPA 537.1 Mod	ng/L	ND	ND	39.7	ND	35.8J	ND	ND	ND	ND
N-ethylperfluoro-1-octanesulfonamidoacetic acid (NEtFOSAA)	EPA 537.1 Mod	ng/L	ND	101	87.2	14.9J	68.0	15.6J	237	48.7	43.8
N-methylperfluoro-1-octanesulfonamidoacetic acid (NMeFOSAA)	EPA 537.1 Mod	ng/L	35.8J	257	258	50.5	180	42.4	230	106	104
Perfluorobutyric acid (PFBA)	EPA 537.1 Mod	ng/L	600	744	1920	831	2400	303EB <sup>5</sup>	650	743	4770
Perfluorobutanesulfonate (PFBS)	EPA 537.1 Mod	ng/L	1420	4400	5260	6290	2870	72.2	3850	1420	7530
Perfluorotetradecanoic acid (PFTeDA)	EPA 537.1 Mod	ng/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorotridecanoic acid (PFTrDA)	EPA 537.1 Mod	ng/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorodecanesulfonate (PFDS)	EPA 537.1 Mod	ng/L	ND	ND	6.87J	ND	ND	7.10J	ND	14.9J	ND
Perfluorodecanoic acid (PFDA)	EPA 537.1 Mod	ng/L	17.3J	82.6	590	23.6	632	18.5J	90.8	48.0	90.9
Perfluorododecanoic acid (PFDoA)	EPA 537.1 Mod	ng/L	7.40J	ND	63.3	ND	184	ND	ND	ND	9.17J
Perfluoroheptanesulfonate (PFHpS)	EPA 537.1 Mod	ng/L	ND	6.82J	8.17J	ND	9.40J	ND	9.39J	ND	ND
Perfluoroheptanoic acid (PFHpA)	EPA 537.1 Mod	ng/L	241	571	983	249	1560	68.4	689	344	5520
Perfluorohexanesulfonate (PFHxS)	EPA 537.1 Mod	ng/L	237	794	925	218	640	59.1	536	190	424
Perfluorohexanoic acid (PFHxA)	EPA 537.1 Mod	ng/L	2940	3920	3470	2200	5540	449	3610	2350	6730
Perfluorononanesulfonate (PFNS)	EPA 537.1 Mod	ng/L	20.7	ND	ND	ND	ND	ND	ND	13.4J	ND
Perfluorononanoic acid (PFNA)	EPA 537.1 Mod	ng/L	28.8	71.4	269	15.5J	326	32.8	89.0	44.1	128
Perfluorooctanesulfonamide (PFOSA)	EPA 537.1 Mod	ng/L	ND	7.08J	11.5J	ND	ND	8.75J	17.3J	ND	ND
Perfluorooctanesulfonate (PFOS)	EPA 537.1 Mod	ng/L	82.3	296	356	84.2	356	83.9	402	254	222
Perfluorooctanoic acid (PFOA)	EPA 537.1 Mod	ng/L	803	1650	2210	345	3690	108	1640	884	1790
Perfluoropentanesulfonate (PFPeS)	EPA 537.1 Mod	ng/L	32.3	50.6	73.2	19.6	41.4	10.3J	54.7	28.1	61.0
Perfluoropentanoic acid (PFPeA)	EPA 537.1 Mod	ng/L	577	1070	2160	780	2150	159	1220	621	86400
Perfluoroundecanoic acid (PFUdA)	EPA 537.1 Mod	ng/L	ND	7.04J	30.8	ND	33.0	7.44J	ND	ND	10.2J
2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid (PFPrOPrA) <sup>6</sup>	EPA 537.1 Mod	ng/L	NA <sup>7</sup>	NA	NA	NA	NA	NA	NA	NA	10800
1,4-Dioxane	EPA 8270 SIM	μg/L	30.0	99.7	214	14.8Q <sup>8</sup>	357	469	157	177	184

#### Notos:

- 1. MSWLF = municipal solid waste landfill
- 2.  $ng/L = nanograms per liter; \mu g/L = micrograms per liter$
- 3. ND = Not detected above laboratory method detection limt
- 4. J = Estimated concentration between method detection limit and reporting limit
- 5. EB = Constituent was also detected in associated equipment blank sample
- 6. PFPrOPrA also known by trade name GenX
- 7. NA = Not analyzed
- 8. Q = Value indicates results of reanalysis outside laboratory holding time
- \* = BFI-Charlotte Motor Speedway Landfill V was resampled for 1,4-dioxane (new sample ID 1,1A,2,2A) on 12/4/19
- \*\* = Great Oak Landfill (sample ID 7607-1) was resampled for 1,4-dioxane analysis on 9/30/19

#### Table 4 PFOS and PFOA Daily Leachate Mass Calculations North Carolina Collective Study H&H Job No. NWA-001

Sampling Reference	Average Leachate Volume (gallons/day)	PFOS <sup>1</sup> (ng/L) <sup>3</sup>	PFOA <sup>2</sup> (ng/L)	PFOS Daily Mass (lbs/day) <sup>4</sup>	PFOA Daily Mass (lbs/day)
	North Carolina Colle	ective Study	1		I.
Wake County South Wake MSWLF <sup>5</sup>	9,151	82.3	803	0.00001	0.00001
Foothills Environmental Landfill	24,364	296	1,650	0.00006	0.00006
BFI-Charlotte Motor Speedway Landfill V	40,027	356	2,210	0.00012	0.00074
Chambers Development MSWLF	17,452	84	345	0.00001	0.00005
Uwharrie Environmental Regional Landfill	31,649	356	3,690	0.00009	0.00098
Great Oak Landfill	9,589	84	108	0.00001	0.00001
East Carolina Regional Landfill	41,044	402	1,640	0.00014	0.00056
Upper Piedmont Regional Landfill	31,830	254	884	0.00007	0.00024
Sampson County Disposal, LLC*	45,288	222	1,790	0.00008	0.00068
Minimum	9,151	82	108	0.00001	0.00001
Maximum	45,288	402	3,690	0.00014	0.00098
Geometric Mean	24,152	199	1,005	0.00004	0.00013
	Michigan St	udy <sup>6</sup>			
Arbor Hills Landfill	98,400	220	3,200	0.00018	0.0026
Autumn Hills RDF <sup>7</sup>	54,800	380	1,300	0.00017	0.0006
Brent Run Landfill	16,400	110	540	0.00002	0.0001
C&C Expanded Sanitary Landfill	42,000	450	1,300	0.00015	0.0004
Carleton Farms Landfill	123,300	250	1,800	0.00026	0.0018
Central Sanitary Landfill	30,100	470	2,500	0.00012	0.0006
Citizen's Disposal Inc.	32,900	180	1,100	0.00005	0.0003
Dafter Sanitary Landfill	16,500	130	680	0.00002	0.0001
Eagle Valley RDF	32,900	170	490	0.00005	0.0001
Glens Sanitary Landfill	3,800	210	770	0.00001	0.00002
Granger Grand River Landfill	64,400	160	240	0.00009	0.0001
Granger Wood Street Landfill	19,200	110	470	0.00002	0.0001
K&W Landfill	17,500	170	830	0.00002	0.0001
Manistee County Landfill	4,700	220	420	0.000009	0.000016
McGill Road Landfill	13,700	170	760	0.00002	0.0001
Michigan Environs Inc. (Menominee)	13,100	100	1,400	0.00001	0.0002
Northern Oaks RDF	12,300	220	1,000	0.00002	0.0001
Oakland Heights Development	17,800	230	780	0.00003	0.0001
Orchard Hill Sanitary Landfill	12,500	110	650	0.00001	0.0001
Ottawa County Farms Landfill	82,200	530	1,800	0.0004	0.0012
People's Landfill	21,900	710	2,500	0.00013	0.0005
Pine Tree Acres RDF	74,000	430	1,800	0.0003	0.001
Pitsch Sanitary Landfill	15,000	260	1,300	0.00003	0.0002
Sauk Trail Hills Landfill	20,500	610	2,800	0.00010	0.0005
SC Holdings	16,000	410	960	0.00005	0.0001
Tri-City RDF	9,600	160	1,200	0.00001	0.0001
Venice Park RDF MH#20/Venice Park RDF MH#21**	32,900	190	910	0.0002	0.0007
	·	630	1,500		
Vienna Junction Industrial Park Sanitary Landfill	13,700	130	1,300	0.00001	0.0001
Waters Landfill	NONE	230	930	NONE	NONE
Westside RDF	60,800	160	1,300	0.00008	0.0007
Whitefeather Landfill	NONE	550	1,700	NONE	NONE
Woodland Meadows RDF -Van Buren	54,800	510	2,000	0.00023	0.0009
Diversion 000/Diversion 004/Diversion 0057	07.400	270	1,900	0.00004	0.0000
Riverview 003/Riverview 004/Riverview 007**	37,400	140	860	0.00004	0.0003
		8.5	38		
South Kent Outfall/South Kent Hauled**	48,000	960	725	0.0002	0.0001
	,	130	16		
Smith's Creek Landfill**	32,900	120	510	0.00003	0.0001
Minimum	3,800	9	16	0.00001	0.00002
Maximum	123,300	960	3,200	0.00040	0.00260
Geometric Mean	25,501	222	881	0.00005	0.00022

- Notes:
  1. PFOS = Perfluorooctanesulfonate
- 2. PFOA = Perfluorooctanoic acid
- ng/L = nanograms per liter
   lbs/day = pounds per day
- 5. MSWLF = municipal solid waste landfill
- 6. Michigan Study Michigan Waste & Recycling Association Statewide Study on Landfill Leachate PFOA and PFOS Impact on Water Resource Recovery Facility Influent (March 2019)
- 7. RDF = recycling and disposal facility
- \* = Leachate volume does not include volume disposed of via evaporation.
- \*\* = Multiple laboratory results reported, average used for daily mass calculations.

# Table 5 1,4-Dioxane Daily Leachate Mass Calculations North Carolina Collective Study H&H Job No. NWA-001

Sampling Reference	Average Leachate Volume (gallons/day)	1,4-Dioxane (μg/L) <sup>1</sup>	1,4-Dioxane Daily Mass (lbs/day) <sup>2</sup>
North Carolina	Collective Study		
Wake County South Wake MSWLF <sup>3</sup>	9,151	30.0	0.0023
Foothills Environmental Landfill	24,364	99.7	0.0203
BFI-Charlotte Motor Speedway Landfill V	40,027	214	0.0716
Chambers Development MSWLF	17,452	14.8Q <sup>4</sup>	0.0022
Uwharrie Environmental Regional Landfill	31,649	357	0.0944
Great Oak Landfill	9,589	469	0.0376
East Carolina Regional Landfill	41,044	157	0.0538
Upper Piedmont Regional Landfill	31,830	177	0.0471
Sampson County Disposal, LLC*	45,288	184	0.0696
Minimum	9,151	14.8	0.0022
Maximum	45,288	469	0.0944
Geometric Mean	24,152	120	0.0255

#### Notes:

- 1.  $\mu$ g/L = micrograms per liter
- 2. lbs/day = pounds per day
- 3. MSWLF = municipal solid waste landfill
- 4. Q = value indicates results of reanalysis outside laboratory holding time
- \* = Leachate volume is representative of volume disposed at WWTPs.

## Table 6 PFOS and PFOA Daily WWTP Mass Calculations North Carolina Collective Study H&H Job No. NWA-001

Facility	WWTP <sup>1</sup> Permitted Flow Limit (gallons/day)*	PFOS <sup>2</sup> Concentration (ng/l) <sup>4</sup>	PFOA <sup>3</sup> Concentration (ng/l)	PFOS Daily Mass (lbs/day) <sup>5</sup>	PFOA Daily Mass (lbs/day)			
WWTPs that receive leachate from landfills in North Carolina Collective Study								
City of Asheboro WWTP	9,000,000	10.6	19.3	0.0008	0.0014			
East Burlington WWTP	12,000,000	49.5	39.6	0.0050	0.0040			
Utley Creek Water Reclamation Facility	6,000,000**	10	9.8	0.0005	0.0005			
Harnett County Lillington Plant	7,500,000	8.86	20.2	0.0006	0.0013			
Michigan Study <sup>®</sup> WWTPs that receive leachate from landfills included in Study								
Menominee	3,200,000	5.6	12	0.0001	0.0003			
Clinton River	30,600,000	7.68	4.94	0.0019	0.0013			
Genesee Co-Ragnone	25,900,000	5.22	4	0.0012	0.0009			
GLWA	650,000,000	7.54	6.02	0.0406	0.0324			
Grand Rapids	61,100,000	12.7	5.06	0.0066	0.0026			
Holland	12,000,000	3.79	8.93	0.0004	0.0009			
Lansing	35,000,000	ND <sup>7</sup>	4.98	ND	0.0014			
Sandusky	2,550,000	7.98	12.2	0.0002	0.0003			
Three Rivers	2,750,000	7.39	21.44	0.0002	0.0005			
Wyoming	22,000,000	6.2 to 26.4	5.08 to 25	0.0048	0.0046			
YCUA	51,200,000	4.8 to 7.51	12	0.0032	0.0051			
Michigan Study W	WTPs that receive leac	hate from landfills no	t included in Study					
Bay City	18,000,000	18.2	4.87	0.0027	0.0007			
Downriver	125,000,000	22.2	7.2	0.0230	0.0075			
Flint	50,000,000	62.4	10.3	0.0258	0.0043			
Kalamazoo	53,500,000	ND	ND	ND	ND			
Muskegon Co Metro	43,000,000	10.5 to 24.3	11.7 to 36.9	0.0086	0.0131			
North Kent S A	8,000,000	31.1	11.2	0.0021	0.0007			
Port Huron	20,000,000	19.5	64.6	0.0032	0.0107			
S Huron Valley UA (SHUVA)	24,000,000	ND	3.76	ND	0.0007			

#### Notes:

- 1. WWTP = wastewater treatment plant
- $2. \ \, \mathsf{PFOS} = \mathsf{Perfluorooctane sulfonate} \\$
- 3. PFOA = Perfluorooctanoic acid
- 4. ng/L = nanograms per liter
- 5. lbs/day = pounds per day
- 6. Michigan Study = Michigan Waste & Recycling Association Statewide Study on Landfill Leachate PFOA and PFOS Impact on Water Resource Recovery Facility Influent (March 2019)
- 7. ND = not detected
- \* = Permitted flow obtained from Section A.6 of latest National Pollutant Discharge Elimination System permit application retrieved from North Carolina Department of Environmental Quality on-line Laserfiche document repository in December 2019.
- \*\* = After receiving an Authorization to Construct, the treatment capacity will increase to 8 millions of gallons per day. The lower value of 6 millions of gallons per day was conservatively used for concentration calculations.

Table only shows facilities for which sampling data are available.

For Michigan sites, daily mass calculations performed using maximum value where multiple data are available. For North Carolina sites, concentrations shown and associated daily mass calculations are based on average values for three sampling events performed between July and September 2019.

## Table 7 1,4-Dioxane Daily WWTP Mass Calculations North Carolina Collective Study H&H Job No. NWA-001

Facility	WWTP <sup>1</sup> Permitted Flow Limit (gallons/day)*	1,4-Dioxane Concentration (µg/I) <sup>2</sup>	1,4-Dioxane Daily Mass (lbs/day) <sup>3</sup>				
WWTPs that receive leachate from landfills in North Carolina Collective Study							
City of Asheboro WWTP	9,000,000	163	12.2927				
East Burlington WWTP	12,000,000	18.5	1.8583				
Utley Creek Water Reclamation Facility	6,000,000**	7.3	0.3635				
Harnett County Lillington Plant	7,500,000	5.95	0.3729				

#### Notes:

- 1. WWTP = wastewater treatment plant
- 2.  $\mu$ g/L = micrograms per liter
- 3. lbs/day = pounds per day
- \* = Permitted flow obtained from Section A.6 of latest National Pollutant Discharge Elimination System permit application retrieved from North Carolina Department of Environmental Quality on-line Laserfiche document repository in December 2019.
- \*\* = After receiving an Authorization to Construct, the treatment capacity will increase to 8 millions of gallons per day. The lower value of 6 millions of gallons per day was conservatively used for concentration calculations.

Concentrations shown and associated daily mass calculations are based on average values for three sampling events performed between July and September 2019.

### Table 8 Percent of WWTP Daily Mass Contributed by Landfill Leachate North Carolina Collective Study H&H Job No. NWA-001

Landfill Name	Average Leachate Volume (gallons/day)	Receiving WWTP <sup>1</sup> Name	WWTP Permitted Flow Limit (gallons per day)*	Constituent	Concentration Data			Daily Mass Data		Percentage of WWTP Influent
					Concentration Units <sup>2</sup>	Landfill Leachate Concentration	WWTP Influent Concentration	Landfill Leachate Daily Mass (lbs/day) <sup>3</sup>	WWTP Influent Daily Mass (lbs/day)	Daily Mass Associated with Landfill Leachate***
		Utley Creek Water		PFOS <sup>5</sup>	ng/L	82.3	10	0.00000	0.0005	0.7%
	5,260	Reclamation	6,000,000**	PFOA <sup>6</sup>	ng/L	803	9.8	0.00004	0.0005	7.2%
Wake County	0,200	Facility		PFOS+PFOA	ng/L	885	20	0.00004	0.0010	3.9%
South Wake MSWLF <sup>4</sup>		,		1,4-Dioxane	μg/L	30	7.3	0.00132	0.3635	0.4%
			20,000,000	PFOS	ng/L	82.3	NS'	0.00000	NS	NS
	3,890	City of Lumberton		PFOA	ng/L	803	NS	0.00003	NS	NS
		WWTP		PFOS+PFOA	ng/L	885	NS NS	0.00003 0.00098	NS NS	NS NS
				1,4-Dioxane	μg/L	30				
Foothills			9,000,000	PFOS	ng/L	296	NS	0.00006	NS	NS
Environmental	24,364	Henry Fork		PFOA	ng/L	1650	NS	0.00034	NS	NS
Landfill	,	WWTP		PFOS+PFOA	ng/L	1946	NS	0.00040	NS	NS NC
				1,4-Dioxane	μg/L	99.7	NS	0.02030	NS	NS
BFI-Charlotte			26,500,000	PFOS	ng/L	356	NS	0.00012	NS	NS
Motor Speedway	40.027	Rocky River		PFOA	ng/L	2210	NS	0.00074	NS	NS
Landfill V	,	Regional WWTP		PFOS+PFOA	ng/L	2566	NS NS	0.00086	NS NS	NS
				1,4-Dioxane	μg/L	214	NS	0.07157	NS	NS
Chambers				PFOS	ng/L	84.2	NS	0.00001	NS	NS
Development	17,452	Anson County	3,500,000	PFOA	ng/L	345	NS	0.00005	NS	NS
MSWLF	11,102	WWTP	3,300,000	PFOS+PFOA	ng/L	429	NS	0.00006	NS	NS
				1,4-Dioxane	μg/L	14.8Q <sup>8</sup>	NS	0.00216	NS	NS
Uwharrie				PFOS	ng/L	356	NS	0.00009	NS	NS
Environmental	31,649	Town of Troy	1,200,000	PFOA	ng/L	3690	NS	0.00098	NS	NS
Regional Landfill	31,049	WWTP		PFOS+PFOA	ng/L	4046	NS	0.00107	NS	NS
				1,4-Dioxane	μg/L	357	NS	0.09441	NS	NS
				PFOS	ng/L	83.9	10.6	0.00001	0.0008	0.8%
Great Oak Landfill	9,589 Cit	City of Asheboro	9,000,000	PFOA	ng/L	108	19.3	0.00001	0.0014	0.6%
Oreat Oak Landiii	3,303	9,569 WWTP	9,000,000	PFOS+PFOA	ng/L	192	29.9	0.00002	0.0022	0.7%
				1,4-Dioxane	μg/L	469	163	0.03758	12.2927	0.3%
				PFOS	ng/L	402	NS	0.00014	NS	NS
East Carolina		Tar River Regional WWTP	21,000,000	PFOA	ng/L	1640	NS	0.00056	NS	NS
Regional Landfill				PFOS+PFOA	ng/L	2042	NS	0.00070	NS	NS
				1,4-Dioxane	μg/L	157	NS	0.05384	NS	NS
	31,830		12,000,000	PFOS	ng/L	254	49.5	0.00007	0.0050	1.4%
Upper Piedmont		East Burlington		PFOA	ng/L	884	39.6	0.00024	0.0040	5.9%
Regional Landfill		WWTP		PFOS+PFOA	ng/L	1138	89.0	0.00030	0.0089	3.4%
				1,4-Dioxane	μg/L	177	18.5	0.04707	1.8583	2.5%
	8,658	Harnett County Lillington Plant		PFOS	ng/L	222	8.86	0.00002	0.0006	2.9%
				PFOA	ng/L	1790	20.2	0.00013	0.0013	10.2%
				PFOS+PFOA	ng/L	2012	29.0	0.00015	0.0018	8.0%
				1,4-Dioxane PFPrOPrA <sup>9</sup>	μg/L ng/L	184 10800	5.95 NS	0.01331 0.00078	0.3729 NS	3.6% NS
	16,219		15,000,000	PFOS	ng/L	222	NS	0.00003	NS	NS
		Harnett County South Plant		PFOA	ng/L	1790	NS NC	0.00024	NS NC	NS NC
				PFOS+PFOA 1,4-Dioxane	ng/L μg/L	2012 184	NS NS	0.00027 0.02494	NS NS	NS NS
Sampson County				PFPrOPrA	ng/L	10800	NS NS	0.00146	NS NS	NS NS
Disposal, LLC										
Dispusal, LLC	20,411		20,000,000	PFOS	ng/L	222 1790	NS NS	0.00004 0.00031	NS NS	NS NS
		City of Lumberton		PFOA PFOS+PFOA	ng/L ng/L	1790 2012	NS NS	0.00031	NS NS	NS NS
		WWTP		1,4-Dioxane	μg/L	184	NS NS	0.00034	NS NS	NS NS
				PFPrOPrA	ng/L	10800	NS	0.00184	NS	NS
				DECC	# c #	200	NA <sup>TO</sup>	NA	NA	NA
	22,137		vaporation Not applicable	PFOS PFOA	ng/L ng/L	222 1790	NA NA	NA NA	NA NA	NA NA
		22,137 Evaporation		PFOS+PFOA	ng/L	2012	NA NA	NA NA	NA NA	NA NA
				1,4-Dioxane	μg/L	184	NA NA	NA NA	NA NA	NA NA
				PFPrOPrA	ng/L	10800	NA	NA	NA	NA

- Notes:

  1. WWTP = wastewater treatment plant
- 1. WWTF = wastewater treatment praint:
  2. ng/L = nanograms per liter; µg/L = micrograms per liter
  3. lbs/day = pounds per day
  4. MSWLF = municipal solid waste landfill
  5. PFOS = perfluorooctanesulfonate

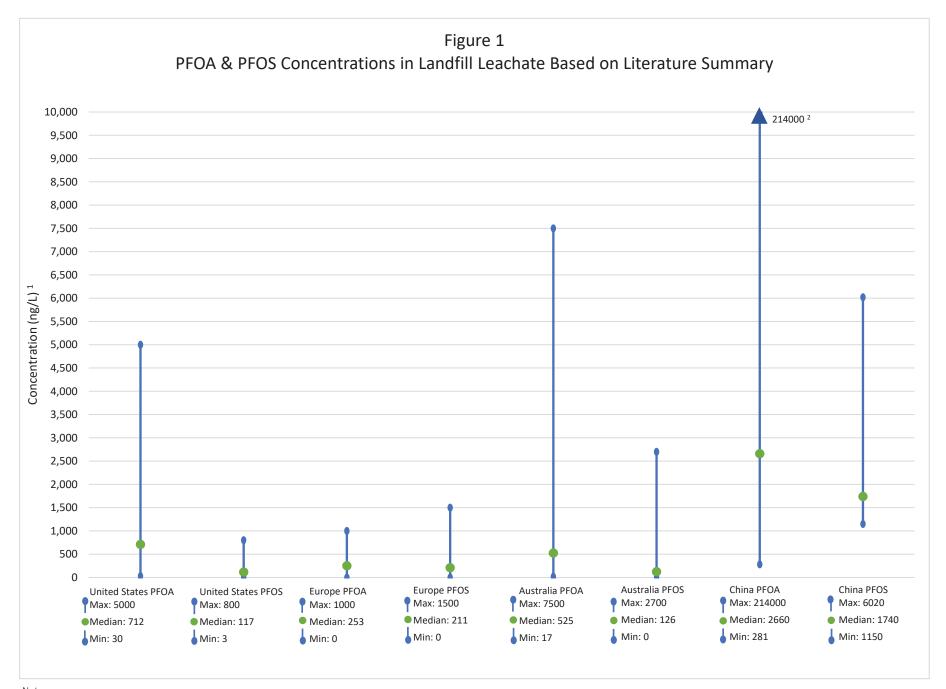
- PFOA = perfluorooctanoic acid
   NS = no sampling data available
- 8. Q = value indicates results of reanalysis outside laboratory holding time
- 9. PFPrOPrA = 2,3,3,3-tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid (trade name GenX)
- 10. NA = not applicable
- = Permitted flow obtained from Section A.6 of latest National Pollutant Discharge Elimination System permit application retrieved from North Carolina Department of Environmental Quality on-line Laserfiche
- document repository in December 2019.

  \*\*\* = After receiving an Authorization to Construct, the treatment capacity will increase to 8 millions of gallons per day. The lower value of 6 millions of gallons per day was conservatively used for concentration calculations.

  \*\*\* = WWTP mass attributed to landfill leachate only includes contributions from landfills covered under the North Carolina Collective Study.

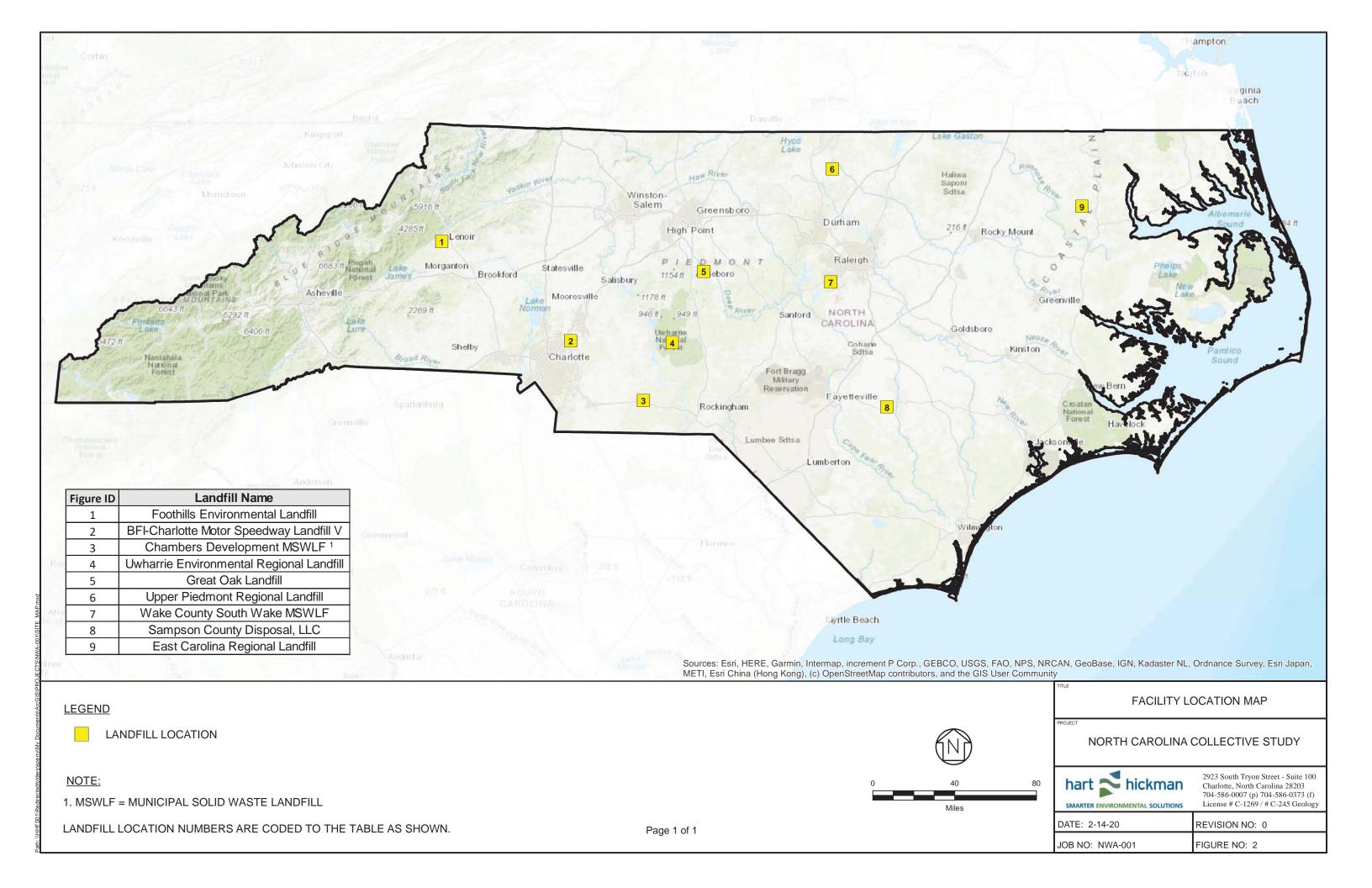
**FIGURES** 

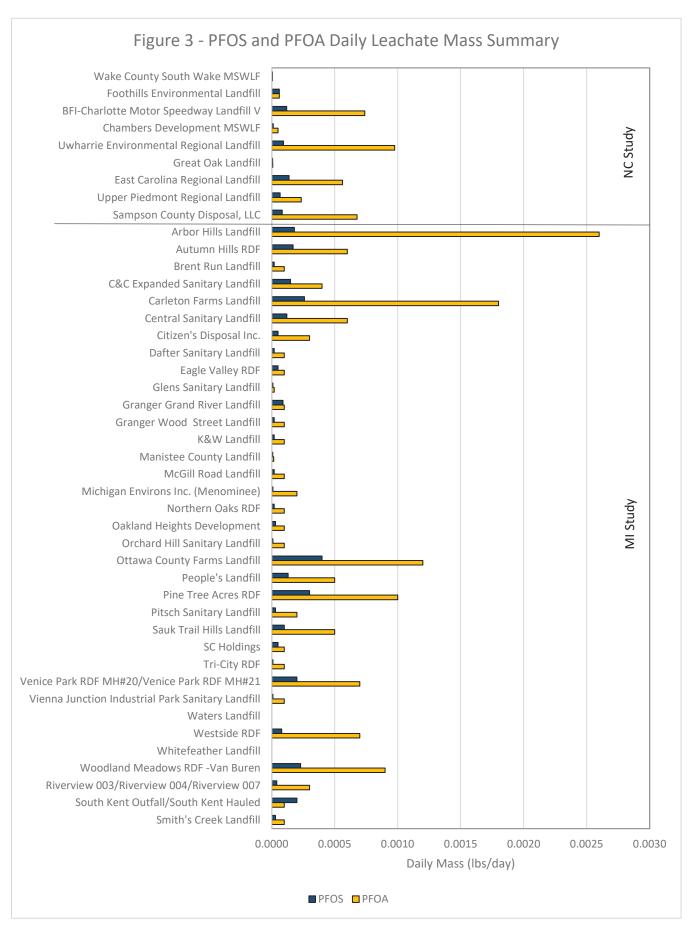




#### Notes:

<sup>1.</sup> ng/L = nanograms per liter





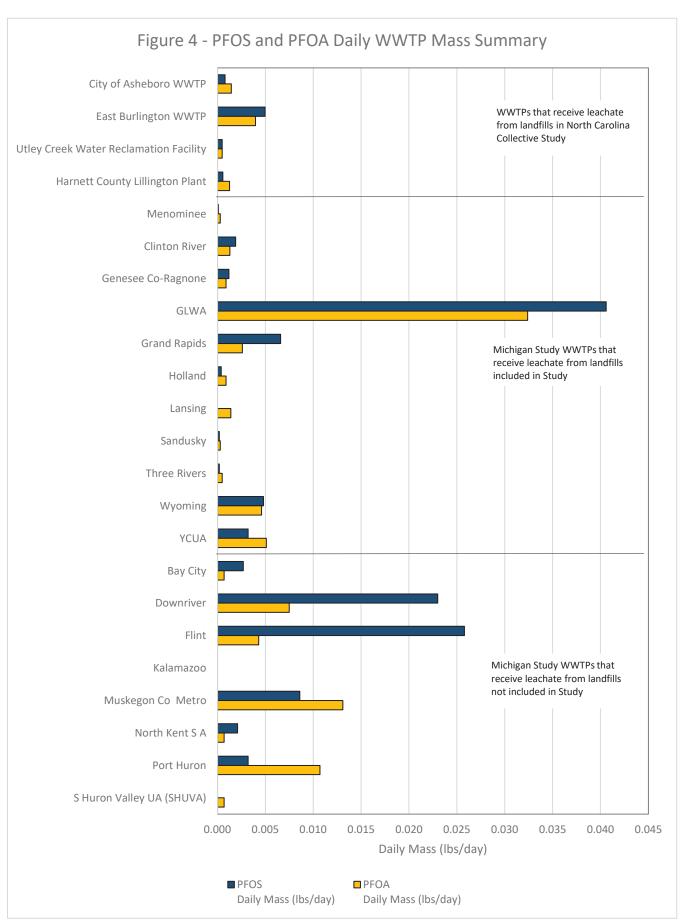
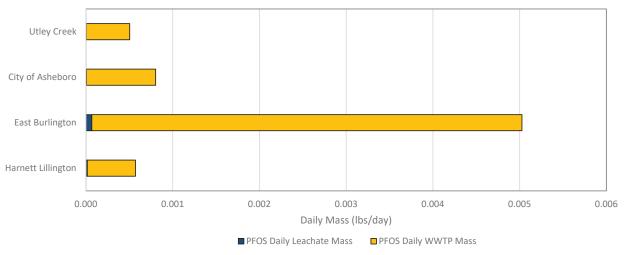
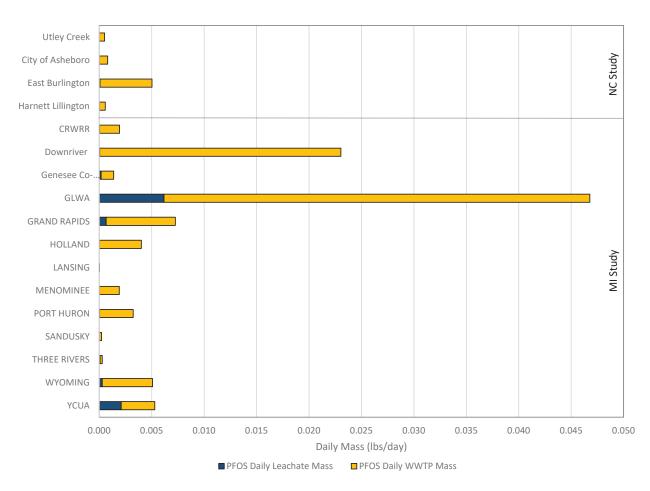


Figure 5 - PFOS Landfill Leachate Contribution to WWTP Daily Mass  $\,$ 

#### NC Study



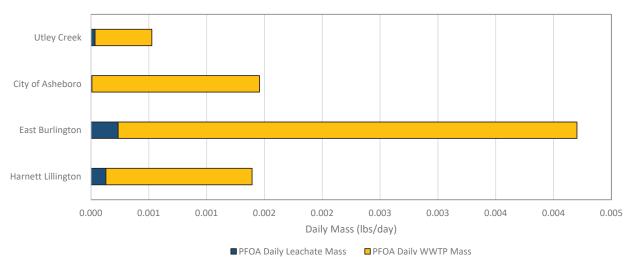
#### NC and MI Studies



#### Notes:

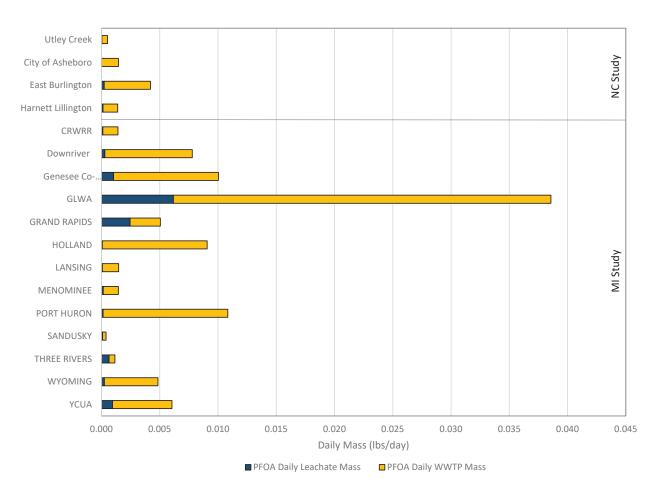
Figure 6 - PFOA Landfill Leachate Contribution to WWTP Daily Mass

#### NC Study



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#### NC and MI Studies



#### Notes:

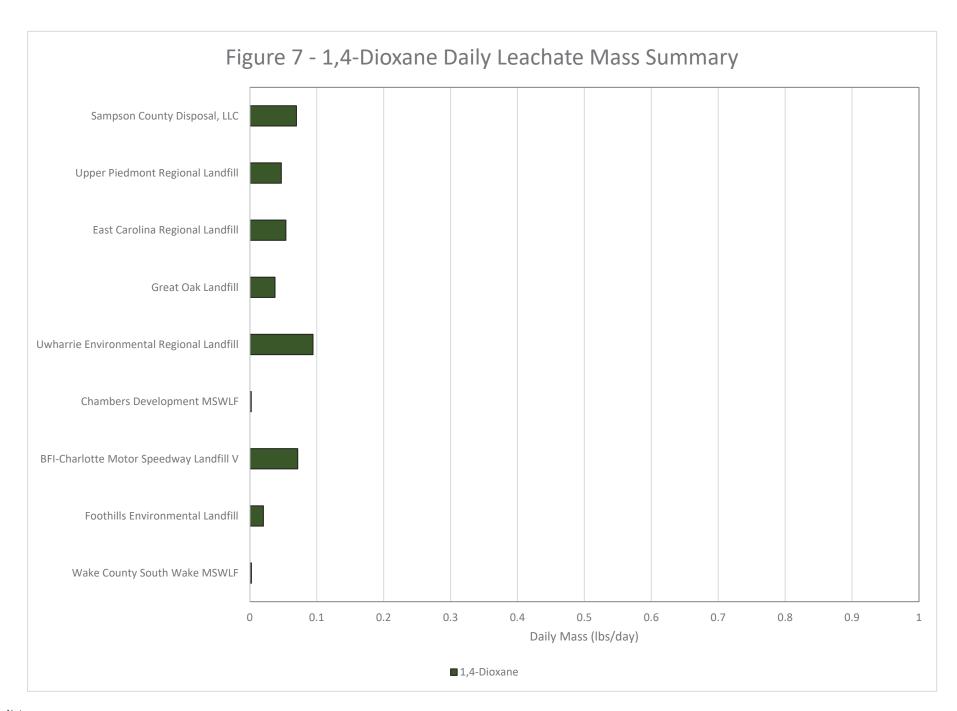
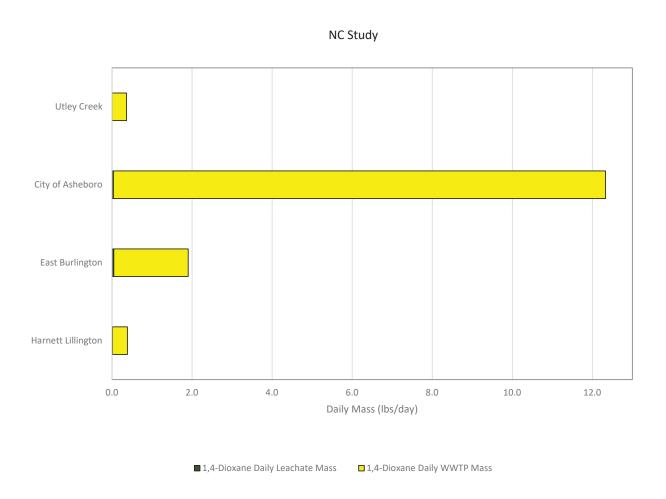


Figure 8 - 1,4-Dioxane Landfill Leachate Contribution to WWTP Daily Mass



#### Notes:

# APPENDIX A LABORATORY ANALYTICAL REPORTS







#### a member of The GEL Group INC



PO Box 30712 Charleston, SC 29417 2040 Savage Road Charleston, SC 29407 P 843.556.8171 F 843.766.1178

gel.com

November 08, 2019

Mr. Jim Riley NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804 Arlington, Virginia 22202

Re: Analytical for South Wake MSWLF

Work Order: 490673

Dear Mr. Riley:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 19, 2019. This revised data report has been prepared and reviewed in accordance with GEL's standard operating procedures. This package was revised to include PFPeA and PFOA.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,

Julie Robinson Project Manager

Purchase Order: GELP19-0905

Enclosures

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# Certificate of Analysis Report for

NWRA001 NWRA – Carolinas Chapter Client SDG: 490673 GEL Work Order: 490673

#### The Qualifiers in this report are defined as follows:

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- J See case narrative for an explanation
- J Value is estimated
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Julie Robinson.

Pulie Robinson

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# **Certificate of Analysis**

Project:

Client ID:

NWRA00119

NWRA001

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forSouth Wake MSWLF

Client Sample ID: 9222-1
Sample ID: 490673001
Matrix: Misc Liquid
Collect Date: 18-SEP-19 10:00

Receive Date: 19-SEP-19 Collector: Client

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Anal	lyst Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537Mod PFCs by Lo	C-MS/MS	"As Received"										
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N EtFOSAA)	U N-	ND	13.2	40.0	ng/L	0.200	1	JLS	10/04/19	1109	1921240	1
N-methylperfluoro-1- octanesulfonamidoacetic acid (N MeFOSAA)	J N-	35.8	13.2	40.0	ng/L	0.200	1					
Perfluorobutanesulfonic acid (P.	FBS)	1420	6.60	17.8	ng/L	0.200	1					
Perfluorodecanesulfonic acid (PFDS)	U	ND	6.60	19.4	ng/L	0.200	1					
Perfluorodecanoic acid (PFDA)	J	17.3	7.80	20.0	ng/L	0.200	1					
Perfluorododecanoic acid (PFD	oA) J	7.40	6.60	20.0	ng/L	0.200	1					
Perfluoroheptanesulfonic acid (PFHpS)	U	ND	6.60	19.0	ng/L	0.200	1					
Perfluoroheptanoic acid (PFHpA	A)	241	6.60	20.0	ng/L	0.200	1					
Perfluorohexanesulfonic acid (PFHxS)		237	6.60	18.2	ng/L	0.200	1					
Perfluorohexanoic acid (PFHxA	<b>A</b> )	2940	6.60	20.0	ng/L	0.200	1					
Perfluorononanesulfonic acid (PFNS)		20.7	7.00	19.2	ng/L	0.200	1					
Perfluorononanoic acid (PFNA)	)	28.8	6.60	20.0	ng/L	0.200	1					
Perfluorooctanesulfonamide (PFOSA)	U	ND	6.60	18.6	ng/L	0.200	1					
Perfluorooctanesulfonic acid (P	FOS)	82.3	8.00	20.0	ng/L	0.200	1					
Perfluorooctanoic acid (PFOA)		803	7.00	20.0	ng/L	0.200	1					
Perfluoropentanesulfonic acid (PFPeS)		32.3	6.60	18.8	ng/L	0.200	1					
Perfluoropentanoic acid (PFPeA	A)	577	6.60	20.0	ng/L	0.200						
Perfluoroundecanoic acid (PFU	*	ND	6.60	20.0	ng/L	0.200	1					
Fluorotelomer sulfonate 8:2 (8:2 FTS)	2 U	ND	132	384	ng/L	0.200	10	JLS	10/02/19	0622	1921240	2
Perfluorobutyric acid (PFBA)		600	66.0	200	ng/L	0.200						
Perfluorotetradecanoic acid (PFTeDA)	U	ND	66.0	200	ng/L	0.200	10					
Perfluorotridecanoic acid (PFTr		ND	66.0	200	ng/L	0.200	10					
Fluorotelomer sulfonate 4:2 (4:2 FTS)	2 U	ND	1320	3760	ng/L	0.200	100	JLS	10/02/19	1016	1921240	3
Fluorotelomer sulfonate 6:2 (6:2 FTS)	2 U	ND	1320	3800	ng/L	0.200	100					
Semi-Volatile-GC/MS												

Page 3 of 16 SDG: 490673 Rev1

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forSouth Wake MSWLF

Client Sample ID: 9222-1 Project: NWRA00119 Sample ID: 490673001 Client ID: NWRA001

Parameter	Qualifier	Result	DL	RL	Units	PF DF	Analyst Date	Time Batch	Method
Semi-Volatile-GC/	MS								
SW846 8270 SIM	1,4-Dioxane in Li	quid "As Received"							
1,4-Dioxane		30.0	10.0	20.0	ug/L	0.200 10	JMB3 09/24/19	1314 1919444	4
The following Prep	Methods were pe	erformed:							
Method	Description	n		Analyst	Date	Time	e Prep Batch		
EPA 537.1 Mod, PFAS	, Compl PFCs Extracti	ion in Liquid		LM1	09/27/19	0830	1921239		
SW846 3535A	SW8270E SII	M Prep 1,4-Dioxane		SJW1	09/23/19	1200	1919441		
The following Ans	alvtical Methods v	vere performed:							

Method	Description		Analyst Co	omments	
1	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15		· ·		
2	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15				
3	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15				
4	SW846 3535A/8270E SIM				
Surrogate/Tracer	Recovery Test	Result	Nominal	Recovery%	Accentable Limits

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
1,4-Dioxane-d8	SW846 8270 SIM 1,4-Dioxane in Liquid "As Received"	26.2 ug/L	40.0	66*	(70%-130%)

#### **Notes:**

Column headers are defined as follows:

DF: Dilution Factor Lc/LC: Critical Level
DL: Detection Limit PF: Prep Factor
MDA: Minimum Detectable Activity RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

Page 4 of 16 SDG: 490673 Rev1

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# **QC Summary**

NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804

Arlington, Virginia Mr. Jim Riley

Workorder: 490673

**Contact:** 

Report Date: November 8, 2019

Page 1 of 7

Parmname	NOM	Sample Qual	QC	Units R	PD/D% REC%	Range	Anlst	Date	Time
Perfluorinated Compounds Batch 1921240 ———									
QC1204391614 LCS Fluorotelomer sulfonate 4:2 (4:2 FTS)	18.2		15.7	ng/L	86	(60%-145%)	JLS	10/02/19	9 06:05
Fluorotelomer sulfonate 6:2 (6:2 FTS)	18.5		20.4	ng/L	110	(56%-143%)			
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.7		17.5	ng/L	94	(57%-138%)			
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	19.5		19.3	ng/L	99	(63%-131%)			
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	19.5		21.5	ng/L	111	(62%-133%)			
Perfluorobutanesulfonic acid (PFBS)	17.2		16.6	ng/L	96	(68%-136%)			
Perfluorobutyric acid (PFBA)	19.5		19.7	ng/L	101	(70%-133%)			
Perfluorodecanesulfonic acid (PFDS)	18.8		16.8	ng/L	89	(53%-142%)			
Perfluorodecanoic acid (PFDA)	19.5		18.0	ng/L	93	(62%-135%)			
Perfluorododecanoic acid (PFDoA)	19.5		19.5	ng/L	100	(66%-131%)			
Perfluoroheptanesulfonic acid (PFHpS)	18.5		18.1	ng/L	98	(66%-138%)			
Perfluoroheptanoic acid (PFHpA)	19.5		17.9	ng/L	92	(67%-135%)			
Perfluorohexanesulfonic acid (PFHxS)	17.7		14.5	ng/L	82	(64%-137%)			
Perfluorohexanoic acid (PFHxA)	19.5		18.9	ng/L	97	(67%-133%)			

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# **QC Summary**

Workorder: 490673 Page 2 of 7

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst		Time
Perfluorinated Compounds		•						.,			
Batch 1921240											
Perfluorononanesulfonic acid (PFNS)	18.7			17.5	ng/L		93	(66%-130%)	) JLS	10/02/1	9 06:05
Perfluorononanoic acid (PFNA)	19.5			21.1	ng/L		108	(66%-134%	)		
Perfluorooctanesulfonamide (PFOSA)	19.5			21.5	ng/L		111	(68%-137%	)		
Perfluorooctanesulfonic acid (PFOS)	19.5			19.8	ng/L		102	(61%-131%)	)		
Perfluorooctanoic acid (PFOA)	19.5			18.8	ng/L		97	(63%-145%	)		
Perfluoropentanesulfonic acid (PFPeS)	18.3			16.5	ng/L		90	(62%-139%)	)		
Perfluoropentanoic acid (PFPeA)	19.5			19.3	ng/L		99	(69%-132%	)		
Perfluorotetradecanoic acid (PFTeDA)	19.5			22.5	ng/L		115	(65%-143%)	)		
Perfluorotridecanoic acid (PFTrDA)	19.5			19.9	ng/L		102	(57%-149%	)		
Perfluoroundecanoic acid (PFUdA)	19.5			19.1	ng/L		98	(65%-134%	)		
QC1204391615 LCSD Fluorotelomer sulfonate 4:2 (4:2 FTS)	17.6			20.5	ng/L	26	116	(0%-35%)	)	10/02/1	9 06:14
Fluorotelomer sulfonate 6:2 (6:2 FTS)	17.9			17.6	ng/L	14	98	(0%-36%)	)		
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.1			19.9	ng/L	13	110	(0%-39%)	)		
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	18.8			20.1	ng/L	4	107	(0%-25%)	)		
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	18.8			21.9	ng/L	2	116	(0%-26%)	)		

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# **QC Summary**

Workorder: 490673 Page 3 of 7

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range Anlst	Date Time
Perfluorinated Compounds	110111	Sumple Quar	<u> </u>	CIIII	10 2/2 /0	ILLE 70	Tunge Time	Dute Time
Batch 1921240								
Perfluorobutanesulfonic acid (PFBS)	16.7		17.2	ng/L	4	103	(0%-30%) JLS	10/02/19 06:14
Perfluorobutyric acid (PFBA)	18.8		19.3	ng/L	2	102	(0%-30%)	
Perfluorodecanesulfonic acid (PFDS)	18.2		17.2	ng/L	3	95	(0%-28%)	
Perfluorodecanoic acid (PFDA)	18.8		21.1	ng/L	16	112	(0%-29%)	
Perfluorododecanoic acid (PFDoA)	18.8		19.0	ng/L	3	101	(0%-30%)	
Perfluoroheptanesulfonic acid (PFHpS)	17.9		17.7	ng/L	2	99	(0%-30%)	
Perfluoroheptanoic acid (PFHpA)	18.8		19.6	ng/L	9	104	(0%-30%)	
Perfluorohexanesulfonic acid (PFHxS)	17.2		16.8	ng/L	15	98	(0%-30%)	
Perfluorohexanoic acid (PFHxA)	18.8		20.9	ng/L	10	111	(0%-23%)	
Perfluorononanesulfonic acid (PFNS)	18.1		18.2	ng/L	4	101	(0%-27%)	
Perfluorononanoic acid (PFNA)	18.8		18.7	ng/L	12	99	(0%-27%)	
Perfluorooctanesulfonamide (PFOSA)	18.8		20.2	ng/L	6	107	(0%-30%)	
Perfluorooctanesulfonic acid (PFOS)	18.8		19.9	ng/L	1	106	(0%-27%)	
Perfluorooctanoic acid (PFOA)	18.8		18.9	ng/L	0	100	(0%-30%)	
Perfluoropentanesulfonic acid (PFPeS)	17.7		17.3	ng/L	4	98	(0%-29%)	

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# **QC Summary**

Workorder: 490673 Page 4 of 7 QC **Parmname** NOM Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** Batch 1921240 Perfluoropentanoic acid (PFPeA) 18.8 20.0 ng/L 3 106 (0%-30%)JLS 10/02/19 06:14 Perfluorotetradecanoic acid 18.8 20.6 ng/L 9 109 (0%-30%)(PFTeDA) Perfluorotridecanoic acid 18.8 17.7 ng/L 11 94 (0%-35%)(PFTrDA) Perfluoroundecanoic acid (PFUdA) 18.8 21.2 ng/L 10 112 (0%-28%)QC1204391613 MB U Fluorotelomer sulfonate 4:2 (4:2 ND 10/02/19 05:56 ng/L FTS) U Fluorotelomer sulfonate 6:2 (6:2 ND ng/L FTS) U ND Fluorotelomer sulfonate 8:2 (8:2 ng/L FTS) U N-ethylperfluoro-1-ND ng/L octanesulfonamidoacetic acid (N-EtFOSAA) U ND N-methylperfluoro-1ng/L octanesulfonamidoacetic acid (N-MeFOSAA) U ND Perfluorobutanesulfonic acid ng/L (PFBS) Perfluorobutyric acid (PFBA) U ND ng/L U Perfluorodecanesulfonic acid ND ng/L (PFDS) Perfluorodecanoic acid (PFDA) U ND ng/L U ND Perfluorododecanoic acid (PFDoA) ng/L Perfluoroheptanesulfonic acid U ND ng/L (PFHpS)

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# **QC Summary**

Page 5 of 7 NOM QC **Parmname** Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** 1921240 Batch Perfluoroheptanoic acid (PFHpA) U ND ng/L JLS 10/02/19 05:56 U ND Perfluorohexanesulfonic acid ng/L (PFHxS) U Perfluorohexanoic acid (PFHxA) ND ng/L U Perfluorononanesulfonic acid ND ng/L (PFNS) U Perfluorononanoic acid (PFNA) ND ng/L U Perfluorooctanesulfonamide ND ng/L (PFOSA) U Perfluorooctanesulfonic acid ND ng/L (PFOS) U ND Perfluorooctanoic acid (PFOA) ng/L U ND Perfluoropentanesulfonic acid ng/L (PFPeS) Perfluoropentanoic acid (PFPeA) U ND ng/L U ND Perfluorotetradecanoic acid ng/L (PFTeDA) Perfluorotridecanoic acid U ND ng/L (PFTrDA) U ND Perfluoroundecanoic acid (PFUdA) ng/L Semi-Volatile-GC/MS 1919444 QC1204387349 LCS 3.55 \*\*1,4-Dioxane-d8 4.00 ug/L (70%-130%) JMB3 09/24/19 12:24

Workorder:

490673

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### **QC Summary**

Workorder: 490673									Page 6 of 7	,
Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date Time	
<b>Semi-Volatile-GC/MS</b> Batch 1919444										
QC1204387350 LCSD **1,4-Dioxane-d8	4.00		3.18	ug/L		79	(70%-130%)	JMB3	09/24/19 12:49	
QC1204387348 MB 1,4-Dioxane		U	ND	ug/L					09/24/19 11:59	
*1,4-Dioxane-d8	4.00		3.05	ug/L		76	(70%-130%)			

#### **Notes:**

The Qualifiers in this report are defined as follows:

- \*\* Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B The target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- E Concentration of the target analyte exceeds the instrument calibration range
- H Analytical holding time was exceeded
- J See case narrative for an explanation
- J Value is estimated
- JNX Non Calibrated Compound
- N Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N/A RPD or %Recovery limits do not apply.
- N1 See case narrative
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, the difference is >70%.
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UJ Compound cannot be extracted

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# **QC Summary**

Page 7 of 7 **Parmname NOM** Sample Qual  $\mathbf{QC}$ Units RPD/D% REC% Range Anlst Date Time

- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y QC Samples were not spiked with this compound

490673

Workorder:

- ٨ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
- h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

- ^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
- \* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Page 11 of 16 SDG: 490673 Rev1

#### Technical Case Narrative NWRA - Carolinas Chapter SDG #: 490673

### **GC/MS Semivolatile**

**Product:** Analysis of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas

**Chromatography/Mass Spectrometry** 

**Analytical Method:** SW846 3535A/8270E SIM **Analytical Procedure:** GL-OA-E-073 REV# 2

**Analytical Batch:** 1919444

**Preparation Method:** SW846 3535A

**Preparation Procedure:** GL-OA-E-073 REV# 2

**Preparation Batch:** 1919441

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
490673001	9222-1
1204387348	Method Blank (MB)
1204387349	Laboratory Control Sample (LCS)
1204387350	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

#### **Quality Control (QC) Information**

#### **Surrogate Recoveries**

Sample (See Below) did not meet surrogate recovery acceptance criteria. The sample was analyzed at a dilution. As a result, one or more surrogates were diluted out of the acceptance limits.

Sample	Analyte	Value
490673001 (9222-1)	1, 4-Dioxane-d8	66* (70%-130%)

#### **Laboratory Control Sample Duplicate (LCSD)**

An LCSD was used in place of matrix QC due to limited sample volume.

#### **Technical Information**

#### **Sample Dilutions**

Sample 490673001 (9222-1) was diluted due to the presence of non-target analytes. The data from the dilution are reported.

Page 12 of 16 SDG: 490673 Rev1

#### **LCMSMS-Misc**

**Product:** The Extraction and Analysis of Per and Polyfluroalkyl Substances Using LCMSMS

Analytical Method: EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15

<u>Analytical Procedure:</u> GL-OA-E-076 REV# 7 <u>Analytical Batches:</u> 1921240 and 1921239

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID# Client Sample Identification

490673001 9222-1

1204391613 Method Blank (MB)

1204391614 Laboratory Control Sample (LCS)

1204391615 Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

#### **Technical Information**

#### **Sample Dilutions**

The following samples were diluted to bring the over range concentrations within the calibration range and/or due to matrix interference that caused internal standards recoveries to fall outside the acceptance range. 490673001 (9222-1).

A1	490673
Analyte	001
Fluorotelomer sulfonate 4:2 (4:2 FTS)	100X
Fluorotelomer sulfonate 6:2 (6:2 FTS)	100X
Fluorotelomer sulfonate 8:2 (8:2 FTS)	10X
Perfluorobutyric acid (PFBA)	10X
Perfluorotetradecanoic acid (PFTeDA)	10X
Perfluorotridecanoic acid (PFTrDA)	10X

#### **Miscellaneous Information**

#### **Additional Comments**

Additional sample volume was not provided for matrix QC. Also, reduced sample volumes were used for all samples except 490876002 (7607-EB) due to elevated concentrations of target analytes.

#### **Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

Page 13 of 16 SDG: 490673 Rev1

	A D W C LO CONTROLLES I CONTROL			hora	†Original P					GEL Laboratories,	GEL Laboratories, LLC		
WKA Quote	4大人	arjeb 6 of		Chemistry I Radiochemistry I Radiobioassay I Specialty Analytics	hemistry I R	adiobioassay	1 Specialty	nalytics		Charleston SC 29407	SC 29407		
or (1).	6 h	Cha Cha	in of Cu	stody an	d Analy	tical Rec	uest			Phone: (843) 556-8171	1) 556-8171		
NA CE	GEL Work Order Number:	:		GEL Project Manager:	ct Manag	er:				Fax: (843) 766-1178	766-1178		
Inch Name: NWRA c/o Hart & Hickman, PC		Phone # g	919-847-4241	4241		S	ample An	Sample Analysis Requested (5)		(Fill in the number of containers for each test)	of container	for each test)	
roject/Site Name: South Wake MSWLF		Fax# 7	704-586-0007	2000	She	Should this	8.3					< Preservative Type (6)	(9)
ddress: Apex, NC					<u> </u>	sample be	onien	PFAS	21 cmpd l	PFAS 21 cmpd list by FPA 537 mod	537 mod		
ollected By: Patrick Stevens Send Res	Send Results To:Genna Olson golson@harthickman	Olson gol	son@h	arthickma	8	sp.	100 10	15	ioxane hv	1.4-Dioxane hv FPA 8270SIM	L MI	Comments	
Sample ID * For composites - indicate start and stop date/time	*Date Collected (mm-dd-vy)	*Time Collected (Military)	Social Confession Conf	Field Sample Filtered (2) Matrix (4)	Alddus əsvələ ƏAlfəvolpvy	sotopic info. 7) Known or 10 Saible hazar	'otal number	<u></u>				Note: extra sample 1s required for sample specific QC	ile is
9222-1	09-18-19	1000	z	N			4 ×	×					
													T
	Chain of Custody Signatures					TA	TAT Requested:	d: Normal:	X Rush:	Specify:	- - - -	(Subject to Surcharge)	ge)
Date	Received by (signed)	k	Date	Time		Fax Resi	Fax Results: [ ] Yes	s [X] No					
- Maria H. Jans 09-18-19 1630	6	87	0	88	2	Select D	Select Deliverable: [ ] C of A	1 1	[ ] QC Summary	[ ] level [	[ ] Level 2	[ Level 3   Level 4	4
	2					Addition	Additional Remarks.					1	
For community of the state of t	3					For Lab	Receiving	Use Only: C	For Lab Receiving Use Only: Custody Seal Intact? [ ] Yes	1 1	[ ] No Coc	Cooler Temp:°C	
t or sampre supports una aetrecy aetauts, see sampte Keecept & Kevrew Jorm (SKK). Chain of Custody Number = Client Determined	рг & кемен Јогт	(SKK.)	Sa	Sample Collection Time Zone: K] Eastern	tion Time	Zone: [X]	Sastem	[ ] Pacific [	[ ] Central [	[ ] Mountain	[ ] Other:		Ī
QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix	.B = Equipment Blank.	MS = Matrix Sp	oike Sample,	Spike Sample, MSD = Matrix Spike Duplicate Sample, $G$ = Grab, $C$ = Composite	Spike Duplic	ate Sample, G	= Grab, C =	Composite					
Field Filtered: For fiquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered.  Matrix Codes: DW=Drinking Water CW=Groundwater GW=Groundwater GW=GW=GW=GW=GW=GW=GW=GW=GW=GW=GW=GW=GW=G	was field filtered or - N -	for sample was	not field filts	red.	;								<del></del>
Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B7/470A) and number of containers provided for each (i.e. 8260B - 3, 6010B7/470A).	o, HH-Wasie Water. 9B/7470A) and number	w=water, mt. of containers pr	antse Enquid ovided for ea	, 50=501, 5D= ch (i.e. <i>8260B</i>	-3, 6010B/7-	L=Sludge, SS 170,4 - 1).	-Solid Waste.	O=Oil, F=Filter.	P=Wipe, U=Urine	, F=Fecal, N=Nasal	_		
Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, HX = Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfac, If no preservative is added = leave field blank	m Hydroxide, SA = Sulfi	ıric ∆cid, AA =	Ascorbic Ac	id, HX = Hexa	ne, ST = Sod	nım Thiosulfa	te, If no prese	vative is added ==	leave field blank				
associated with these samples?  FL = Flam	Characteristic Hazards FL = Flammable/Ignitable	Listed V	Waste Listed Waste		_	Other OT= Oth	Other OT= Other / Unknown	Wn			Hease provid elow regardi	Please provide any additional details below regarding handling and/or disposal	Jasous
CO = Corrosive  CRA Metals  RE = Reactive  = Arsenic Hg= Mercury	osive tive	(F,K,P a Waste co	(F,K,P and U-listed wastes,) Waste code(s):	t wastes.)		(i.e.: High/lc misc. health	(i.e.: High/low pH, asbesto misc. health hazards, etc.)	isbestos, bery ; etc.)	(i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards, etc.)		oncerns. (i.e f site collecte	concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)	npe etc.)
= Barium Se= Selenium TSCA Reg	TSCA Regulated PCB = Polychlorinated				1 1	the last							
MR= Miscellaneous	biphenyls												

	Client: NNBA		Th	SAMPLE RECEIPT & REVIEW FORM
	Received By: ArA			SDG/AR/COC/Work Order: 0002
	- yrt			Date Received: 9/19/19
	Carrier and Tracking Number			FedEx Express FedEx Ground UPS Field Services Courier Other 7762 7563 2308 -1, 7762 7563 3418-1° 7762 7563 2764-1, 7762 7563 3418-1°
	Suspected Hazard Information	Yes	Š	*If Net Counts > 100cpin on samples not marked " ii
	A)Shipped as a DOT Hazardous?			*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation  Hazard Class Shipped:  UN#:  If UN2910, Is the Radioactive Shipment Survey Compliant? Yes No
	B) Did the client designate the samples are to be received as radioactive?			COC notation or radioactive stickers on containers equal client designation.
ł	C) Did the RSO classify the samples as radioactive?		1	Maximum Net Counts Observed* (Observed Counts - Area Realism + C
	D) Did the client designate samples are nazardous?	,		OC notation or hazard labels on containers equal client documents
	E) Did the RSO identify possible hazards?	V	Z!"	Of E is yes, select Hazards below.  CB's Flammable Foreign Soil RCRA Ashactes D. III.
f	Sample Receipt Criteria  Shipping containers received intact and sealed?	Y cs	2	C. Serymum Other:
-	- Tanica,			Comments/Qualifiers (Required for Non-Conforming Items)  Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
	Chain of custody documents included with shipment?	7	-	Circle Applicable: Client contacted at least
3	within (0 ≤ 6 deg. C)?*	7	_	Preservation Method West
4	Daily check performed and passed on IR temperature gun?			*all temperatures are recorded in Celsius  Temperature Device Serial #: 784-16 Secondary Temperature Device Serial # (If Applicable):
5	Sample containers intact and sealed?		1	Circle Applicable: Scalsdroken Damayed contained Leaking cognainer Other (describe)
6	Samples requiring chemical preservation at proper pH?		ľ	Sample ID's and Containers Affected:
7	Do any samples require Volatile		- 11	f Preservation added. Lati: f Yes, are Encores or Soil Kits present for solids? YesNoNA(If yes, take to YOA 5.
	Analysis?		/A	Do liquid VOA vials contain acid present for solids? Yes No NA (If yes, take to VOA Freezer)  are liquid VOA vials free of headspace? Yes No NA (If unknown, select No)  ample ID's and containers affected:
	Samples received within holding time?			D's and tests affected:
H-1°	ample ID's on COC match ID's on ottles?		(II	's and containers affected:
	Date & time on COC match date & time in bottles?		Cii	rele Applicable: No dates on containers No times on containers COC missing info Other (describe)
	umber of containers received match umber indicated on COC?		Cir	cle Applicable: No container count on COC Other (describe)
	re sample containers identifiable as EL nrovided?		T	
fici	OC form is properly signed in inquished/received sections?	/	Circ	ele Applicable: (Not relinquished) Other (describe)
	rom it needed);			

Page 15 of 16 SDG: 490673 Rev1

PM (or PMA) review: Initials ...

GL-CHL-SR-001 Rev 6

List of current GEL Certifications as of 08 November 2019

State	Certification
Alaska	17–018
Alaska Drinking Water	SC00012
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M-SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122020-1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	2019–165
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-19-15
Utah NELAP	SC000122019-28
Vermont	VT87156
Virginia NELAP	460202
Washington	C780









PO Box 30712 Charleston, SC 29417 2040 Savage Road Charleston, SC 29407 P 843.556.8171 F 843.766.1178

gel.com

November 08, 2019

Mr. Jim Riley NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804 Arlington, Virginia 22202

Re: Analytical for Foothills Environmental Landfill

a member of The GEL Group INC

Work Order: 490860

Dear Mr. Riley:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 19, 2019. This revised data report has been prepared and reviewed in accordance with GEL's standard operating procedures. This package was revised to include PFPeA and PFOA.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,

Julie Robinson Project Manager

Purchase Order: GELP19-0905

Enclosures

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# Certificate of Analysis Report for

NWRA001 NWRA – Carolinas Chapter Client SDG: 490860 GEL Work Order: 490860

#### The Qualifiers in this report are defined as follows:

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- J See case narrative for an explanation
- J Value is estimated
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Julie Robinson.

Reviewed by

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# **Certificate of Analysis**

Project:

Client ID:

NWRA00119

NWRA001

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forFoothills Environmental Landfill

Client Sample ID: 1403-1 Sample ID: 490860001

Matrix: Misc Liquid
Collect Date: 16-SEP-19 09:20
Receive Date: 19-SEP-19
Collector: Client

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst Date	Time Batch	Method
LCMSMS PFCs										
EPA 537Mod PFCs by LC	C-MS/MS '	'As Received"								
Fluorotelomer sulfonate 4:2 (4:2		ND	13.2	37.6	ng/L	0.200	1	JLS 10/02/19	0849 1921240	1
FTS)										
N-ethylperfluoro-1-		101	13.2	40.0	ng/L	0.200	1			
octanesulfonamidoacetic acid (N	-									
EtFOSAA) N-methylperfluoro-1-		257	13.2	40.0	ng/L	0.200	1			
octanesulfonamidoacetic acid (N	ſ <b>_</b>	231	13.2	40.0	ng/L	0.200	1			
MeFOSAA)										
Perfluorodecanesulfonic acid	U	ND	6.60	19.4	ng/L	0.200	1			
(PFDS)										
Perfluorodecanoic acid (PFDA)		82.6	7.80	20.0	ng/L	0.200	1			
Perfluorododecanoic acid (PFDo	*	ND	6.60	20.0	ng/L	0.200	1			
Perfluoroheptanesulfonic acid (PFHpS)	J	6.82	6.60	19.0	ng/L	0.200	1			
Perfluoroheptanoic acid (PFHpA	)	571	6.60	20.0	ng/L	0.200	1			
Perfluorohexanesulfonic acid	-/	794	6.60	18.2	ng/L	0.200	1			
(PFHxS)		,,,			8		_			
Perfluorononanesulfonic acid (PFNS)	U	ND	7.00	19.2	ng/L	0.200	1			
Perfluorononanoic acid (PFNA)		71.4	6.60	20.0	ng/L	0.200	1			
Perfluorooctanesulfonamide	J	7.08	6.60	18.6	ng/L	0.200	1			
(PFOSA)										
Perfluorooctanesulfonic acid (PF	FOS)	296	8.00	20.0	ng/L	0.200	1			
Perfluoropentanesulfonic acid (PFPeS)		50.6	6.60	18.8	ng/L	0.200	1			
Perfluoropentanoic acid (PFPeA	)	1070	6.60	20.0	ng/L	0.200	1			
Perfluoroundecanoic acid (PFUd	lA) J	7.04	6.60	20.0	ng/L	0.200	1			
Fluorotelomer sulfonate 8:2 (8:2 FTS)	U	ND	132	384	ng/L	0.200	10	JLS 10/02/19	0657 1921240	2
Perfluorobutanesulfonic acid (PI	FBS)	4400	66.0	178	ng/L	0.200	10			
Perfluorobutyric acid (PFBA)		744	66.0	200	ng/L	0.200	10			
Perfluorohexanoic acid (PFHxA	)	3920	66.0	200	ng/L	0.200	10			
Perfluorooctanoic acid (PFOA)		1650	70.0	200	ng/L	0.200	10			
Perfluorotetradecanoic acid (PFTeDA)	U	ND	66.0	200	ng/L	0.200	10			
Perfluorotridecanoic acid (PFTrI	DA) U	ND	66.0	200	ng/L	0.200	10			
Fluorotelomer sulfonate 6:2 (6:2 FTS)		ND	1320	3800	ng/L	0.200		JLS 10/02/19	1059 1921240	3

Semi-Volatile-GC/MS

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# **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forFoothills Environmental Landfill

Client Sample ID: 1403-1 Project: NWRA00119 Sample ID: 490860001 Client ID: NWRA001

Parameter	Qualifier	Result	DL	RL	Units	PF DF	Analyst Date	Time Batch	Method
Semi-Volatile-GC	/MS								
SW846 8270 SIM	1,4-Dioxane in Li	quid "As Received"							
1,4-Dioxane		99.7	2.00	4.00	ug/L	0.200 2	JMB3 09/24/19	1829 1919444	4
The following Pre	p Methods were pe	erformed:							
Method	Description	n		Analyst	Date	Time	e Prep Batch		
EPA 537.1 Mod, PFAS	, Compl PFCs Extracti	ion in Liquid		LM1	09/27/19	0830	1921239		
SW846 3535A	SW8270E SII	M Prep 1,4-Dioxane		SJW1	09/23/19	1200	1919441		
The following An	alytical Methods v	were performed:							

Analyst Comments

The following	Analytical Methods were performed.
Method	Description

1.10tilou	Description	1 Milui	y St Comments
1	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15		
2	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15		
3	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15		
4	SW846 3535A/8270E SIM		

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
1,4-Dioxane-d8	SW846 8270 SIM 1,4-Dioxane in Liquid "As	30.0 ug/L	40.0	75	(70%-130%)

#### Received"

**Notes:** 

Column headers are defined as follows:

DF: Dilution Factor Lc/LC: Critical Level
DL: Detection Limit PF: Prep Factor
MDA: Minimum Detectable Activity RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

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# **QC Summary**

Report Date: November 8, 2019

Page 1 of 7

**NWRA - Carolinas Chapter** 1550 Crystal Drive, Suite 804

Arlington, Virginia Mr. Jim Riley

**Contact:** 

Workorder: 490860

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Perfluorinated Compounds Batch 1921240											
QC1204391614 LCS Fluorotelomer sulfonate 4:2 (4:2 FTS)	18.2			15.7	ng/L		86	(60%-145%)	JLS	10/02/1	9 06:05
Fluorotelomer sulfonate 6:2 (6:2 FTS)	18.5			20.4	ng/L		110	(56%-143%)			
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.7			17.5	ng/L		94	(57%-138%)			
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	19.5			19.3	ng/L		99	(63%-131%)			
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	19.5			21.5	ng/L		111	(62%-133%)			
Perfluorobutanesulfonic acid (PFBS)	17.2			16.6	ng/L		96	(68%-136%)			
Perfluorobutyric acid (PFBA)	19.5			19.7	ng/L		101	(70%-133%)			
Perfluorodecanesulfonic acid (PFDS)	18.8			16.8	ng/L		89	(53%-142%)			
Perfluorodecanoic acid (PFDA)	19.5			18.0	ng/L		93	(62%-135%)			
Perfluorododecanoic acid (PFDoA)	19.5			19.5	ng/L		100	(66%-131%)			
Perfluoroheptanesulfonic acid (PFHpS)	18.5			18.1	ng/L		98	(66%-138%)			
Perfluoroheptanoic acid (PFHpA)	19.5			17.9	ng/L		92	(67%-135%)			
Perfluorohexanesulfonic acid (PFHxS)	17.7			14.5	ng/L		82	(64%-137%)			
Perfluorohexanoic acid (PFHxA)	19.5			18.9	ng/L		97	(67%-133%)			

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# **QC Summary**

Workorder: 490860 Page 2 of 7

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date Time
<b>Perfluorinated Compounds</b> Batch 1921240									
Perfluorononanesulfonic acid (PFNS)	18.7		17.5	ng/L		93	(66%-130%)	JLS	10/02/19 06:05
Perfluorononanoic acid (PFNA)	19.5		21.1	ng/L		108	(66%-134%)		
Perfluorooctanesulfonamide (PFOSA)	19.5		21.5	ng/L		111	(68%-137%)		
Perfluorooctanesulfonic acid (PFOS)	19.5		19.8	ng/L		102	(61%-131%)		
Perfluorooctanoic acid (PFOA)	19.5		18.8	ng/L		97	(63%-145%)		
Perfluoropentanesulfonic acid (PFPeS)	18.3		16.5	ng/L		90	(62%-139%)		
Perfluoropentanoic acid (PFPeA)	19.5		19.3	ng/L		99	(69%-132%)		
Perfluorotetradecanoic acid (PFTeDA)	19.5		22.5	ng/L		115	(65%-143%)		
Perfluorotridecanoic acid (PFTrDA)	19.5		19.9	ng/L		102	(57%-149%)		
Perfluoroundecanoic acid (PFUdA)	19.5		19.1	ng/L		98	(65%-134%)		
QC1204391615 LCSD Fluorotelomer sulfonate 4:2 (4:2 FTS)	17.6		20.5	ng/L	26	116	(0%-35%)		10/02/19 06:14
Fluorotelomer sulfonate 6:2 (6:2 FTS)	17.9		17.6	ng/L	14	98	(0%-36%)		
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.1		19.9	ng/L	13	110	(0%-39%)		
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	18.8		20.1	ng/L	4	107	(0%-25%)		
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	18.8		21.9	ng/L	2	116	(0%-26%)		

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# **QC Summary**

Workorder: 490860

Parmname

NOM Sample Qual QC Units RPD/D% REC% Range Anlst Date Time

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range Anlst	Date Time
<b>Perfluorinated Compounds</b> Batch 1921240								
Perfluorobutanesulfonic acid (PFBS)	16.7		17.2	ng/L	4	103	(0%-30%) JLS	10/02/19 06:14
Perfluorobutyric acid (PFBA)	18.8		19.3	ng/L	2	102	(0%-30%)	
Perfluorodecanesulfonic acid (PFDS)	18.2		17.2	ng/L	3	95	(0%-28%)	
Perfluorodecanoic acid (PFDA)	18.8		21.1	ng/L	16	112	(0%-29%)	
Perfluorododecanoic acid (PFDoA)	18.8		19.0	ng/L	3	101	(0%-30%)	
Perfluoroheptanesulfonic acid (PFHpS)	17.9		17.7	ng/L	2	99	(0%-30%)	
Perfluoroheptanoic acid (PFHpA)	18.8		19.6	ng/L	9	104	(0%-30%)	
Perfluorohexanesulfonic acid (PFHxS)	17.2		16.8	ng/L	15	98	(0%-30%)	
Perfluorohexanoic acid (PFHxA)	18.8		20.9	ng/L	10	111	(0%-23%)	
Perfluorononanesulfonic acid (PFNS)	18.1		18.2	ng/L	4	101	(0%-27%)	
Perfluorononanoic acid (PFNA)	18.8		18.7	ng/L	12	99	(0%-27%)	
Perfluorooctanesulfonamide (PFOSA)	18.8		20.2	ng/L	6	107	(0%-30%)	
Perfluorooctanesulfonic acid (PFOS)	18.8		19.9	ng/L	1	106	(0%-27%)	
Perfluorooctanoic acid (PFOA)	18.8		18.9	ng/L	0	100	(0%-30%)	
Perfluoropentanesulfonic acid (PFPeS)	17.7		17.3	ng/L	4	98	(0%-29%)	

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# **QC Summary**

Workorder: 490860 Page 4 of 7 QC **Parmname** NOM Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** Batch 1921240 Perfluoropentanoic acid (PFPeA) 18.8 20.0 ng/L 3 106 (0%-30%)JLS 10/02/19 06:14 Perfluorotetradecanoic acid 18.8 20.6 ng/L 9 109 (0%-30%)(PFTeDA) Perfluorotridecanoic acid 18.8 17.7 ng/L 11 94 (0%-35%)(PFTrDA) Perfluoroundecanoic acid (PFUdA) 18.8 21.2 ng/L 10 112 (0%-28%)QC1204391613 MB U Fluorotelomer sulfonate 4:2 (4:2 ND 10/02/19 05:56 ng/L FTS) U Fluorotelomer sulfonate 6:2 (6:2 ND ng/L FTS) U ND Fluorotelomer sulfonate 8:2 (8:2 ng/L FTS) U N-ethylperfluoro-1-ND ng/L octanesulfonamidoacetic acid (N-EtFOSAA) U ND N-methylperfluoro-1ng/L octanesulfonamidoacetic acid (N-MeFOSAA) U ND Perfluorobutanesulfonic acid ng/L (PFBS) Perfluorobutyric acid (PFBA) U ND ng/L U Perfluorodecanesulfonic acid ND ng/L (PFDS) Perfluorodecanoic acid (PFDA) U ND ng/L U ND Perfluorododecanoic acid (PFDoA) ng/L Perfluoroheptanesulfonic acid U ND ng/L (PFHpS)

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# **QC Summary**

Page 5 of 7 NOM QC **Parmname** Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** 1921240 Batch Perfluoroheptanoic acid (PFHpA) U ND ng/L JLS 10/02/19 05:56 U ND Perfluorohexanesulfonic acid ng/L (PFHxS) U Perfluorohexanoic acid (PFHxA) ND ng/L U Perfluorononanesulfonic acid ND ng/L (PFNS) U Perfluorononanoic acid (PFNA) ND ng/L U Perfluorooctanesulfonamide ND ng/L (PFOSA) U Perfluorooctanesulfonic acid ND ng/L (PFOS) U ND Perfluorooctanoic acid (PFOA) ng/L U ND Perfluoropentanesulfonic acid ng/L (PFPeS) Perfluoropentanoic acid (PFPeA) U ND ng/L U ND Perfluorotetradecanoic acid ng/L (PFTeDA) Perfluorotridecanoic acid U ND ng/L (PFTrDA) U ND Perfluoroundecanoic acid (PFUdA) ng/L Semi-Volatile-GC/MS 1919444 QC1204387349 LCS 3.55 \*\*1,4-Dioxane-d8 4.00 ug/L (70%-130%) JMB3 09/24/19 12:24

Workorder:

490860

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### **QC Summary**

Workorder: 490860											Page	6 of 7
Parmname		NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Semi-Volatile-GC/MS</b> Batch 1919444												
QC1204387350 LC **1,4-Dioxane-d8	SD	4.00			3.18	ug/L		79	(70%-130%)	JMB3	09/24/1	9 12:49
QC1204387348 ME 1,4-Dioxane	3			U	ND	ug/L					09/24/1	9 11:59
**1,4-Dioxane-d8		4.00			3.05	ug/L		76	(70%-130%)			

#### **Notes:**

The Qualifiers in this report are defined as follows:

- \*\* Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B The target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- E Concentration of the target analyte exceeds the instrument calibration range
- H Analytical holding time was exceeded
- J See case narrative for an explanation
- J Value is estimated
- JNX Non Calibrated Compound
- N Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N/A RPD or %Recovery limits do not apply.
- N1 See case narrative
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, the difference is >70%.
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UJ Compound cannot be extracted

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### **QC Summary**

Page 7 of 7 **Parmname NOM** Sample Qual  $\mathbf{QC}$ Units RPD/D% REC% Range Anlst Date Time

- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y QC Samples were not spiked with this compound

490860

Workorder:

- ٨ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
- h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

- ^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
- \* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

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#### Technical Case Narrative NWRA - Carolinas Chapter SDG #: 490860

### **GC/MS Semivolatile**

**Product:** Analysis of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas

**Chromatography/Mass Spectrometry** 

**Analytical Method:** SW846 3535A/8270E SIM **Analytical Procedure:** GL-OA-E-073 REV# 2

**Analytical Batch:** 1919444

**Preparation Method:** SW846 3535A

**Preparation Procedure:** GL-OA-E-073 REV# 2

**Preparation Batch:** 1919441

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
490860001	1403-1
1204387348	Method Blank (MB)
1204387349	Laboratory Control Sample (LCS)
1204387350	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

#### **Quality Control (QC) Information**

#### **Laboratory Control Sample Duplicate (LCSD)**

An LCSD was used in place of matrix QC due to limited sample volume.

#### **Technical Information**

#### **Sample Dilutions**

Sample 490860001 (1403-1) was diluted due to the presence of one or more over-range target analytes.

#### **LCMSMS-Misc**

**Product:** The Extraction and Analysis of Per and Polyfluroalkyl Substances Using LCMSMS

Analytical Method: EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15

Analytical Procedure: GL-OA-E-076 REV# 7 Analytical Batches: 1921240 and 1921239

Page 12 of 16 SDG: 490860 Rev1

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
490860001	1403-1
1204391613	Method Blank (MB)
1204391614	Laboratory Control Sample (LCS)

1204391615 Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

#### **Technical Information**

#### **Sample Dilutions**

The following samples were diluted to bring the over range concentrations within the calibration range and/or due to matrix interference that caused internal standards recoveries to fall outside the acceptance range. 490860001 (1403-1).

A1	490860
Analyte	001
Fluorotelomer sulfonate 6:2 (6:2 FTS)	100X
Fluorotelomer sulfonate 8:2 (8:2 FTS)	10X
Perfluorobutanesulfonate (PFBS)	10X
Perfluorobutyric acid (PFBA)	10X
Perfluorohexanoic acid (PFHxA)	10X
Perfluorooctanoic acid (PFOA)	10X
Perfluorotetradecanoic acid (PFTeDA)	10X
Perfluorotridecanoic acid (PFTrDA)	10X

#### **Miscellaneous Information**

#### **Additional Comments**

Additional sample volume was not provided for matrix QC. Also, reduced sample volumes were used for all samples except 490876002 (7607-EB) due to elevated concentrations of target analytes.

#### **Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

Page 13 of 16 SDG: 490860 Rev1

GEL Laboratories, LLC 2040 Savage Road	Charleston, SC 29407 Phone: (843) 556-8171	Fax: (843) 766-1178	(Fill in the number of containers for each test)	< Preservative Type (6)	EPA 537 mod	70SIM Note: extra sample is	required for sample specific QC						Specify: (Subject to Surcharge)		el [ ] Level 2 [ ] Level 3 [ ] Level 4			ng [ ] Others a selection of the selecti		Z. S. Cal	11611.	The state of the s	r tense provine any avantonar acturs below regarding handling andor disposal concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)	
	alty Analytics		Sample Analysis Requested <sup>(5)</sup> (Fill in the numb		PFAS 21 cmpd list by	spat	Please supply isotopic info-	x x 4		-			TAT Requested: Normal: X Rush: Spe	Fax Results: [ ] Yes [X] No	Select Deliverable: [ ] C of A [ ] QC Summary [ ] level 1	Additional Remarks:	- 1	Sample Collection Time Zone: XJ Eastern: [ ] Pactite [ ] Central [ ] Mountain:	Spike Sample, $\mathbf{MSD}$ = Matrix Spike Duplicate Sample, $\mathbf{G}$ = Grab, $\mathbf{C}$ = Composite	n Slækinder SSækalid Waste O±Oli F=Eiler PæWine Helfrine Fæfered Na	0874704 - 1).	Southin Thoshbare, if no preservative is added - reave frest blank.	OT= Other / Unknown (i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards, etc.) Description:	
GEL Laboratories LC	_ 7	er:	n, PC Phone # 919-847-4241	Fax # 704-586-0007		Send Results To:Genna Olson golson@harthickman.com	*Date Collected Collected QC Field Sample (Military) QC Field Sample (man-dd-yy) (fihmm) Code (a) Filtered (b) Matrix (4)	09-16-19 0920 N N ML					Chain of Custody Signatures	Received by (signed) Date Time	as80 6116116 ss.	2,	7 10 40 10 40 40			3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered.  3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered.  3.) Matrix Codes: Indicate with a - Y - for yes the sample was field filtered or - N - for sample was filtered.  3.) Matrix Codes: Indicate with a - Y - for yes the sample was filtered or - N - for sample was filtered or - N - for yes the sample was filtered or - N - for yes th	5.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1).	0.) Freetraive type: Ha * hydrochoric activity, vi = mint activity, vi = mint activity in	- Т <u>.</u> П	biphenyls
Page: 1 of 1 Project # NWA-001	GEL Quote #: NWRA Quote	NA	Client Name: NWRA c/o Hart & Hickman, PC	Project/Site Name: Foothills Environmental Landfill	Address: Lenoir, NC	Collected By: Patrick Stevens	Sample ID * For composites - indicate start and stop date/time	1403-1					Cha	Relinquished By (Signed) Date Time	1 / Men H. Sont 09-18-19 1630	2	3	> For sample shipping and delivery details, see Sample Receipt & Review Jorm (SRK). <ol> <li>Chain of Custody Number = Client Determined</li> </ol>	2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank. MS = Matrix	<ol> <li>Field Filtered: For liquid matrices, indicate with a • Y • for ya</li> <li>Morriv Cobse DW=Drinking Water CWaffroundwater SW</li> </ol>	5.) Sample Analysis Requested: Analytical method requested (i.e.	6.) Preservanve type: HA = rivaroemone acia, m = mnoc acia. 7.) Are there any known or mascible hazards		MR= Miscellaneous RCRA metals

	Client: NWBA			Th	SPCUPICO REVIEW FORM
	Received By: ATA				SAMPLE RECEIPT & REVIEW FORM SDG/AR/COC/Work Order: 10 10 10 10 10 10 10 10 10 10 10 10 10
	9.0		··-		Date Received: 9/1/9/19
	Carrier and Tracking Number				Fedex Express Fedex Ground UPS Field Services Courier Other 7762 7563 230% -1, 7762 7563 3418-1° 7762 7563 3290-1°
	Suspected Hazard Information	T	, CG	<sub>2</sub>	*If Net Counts > 100cpm on samples were
	A)Shipped as a DOT Hazardous?	1	1	/	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigatio  Hazard Class Shipped:  UN#:
	B) Did the client designate the samples are to be received as radioactive?	-			If UN2910, Is the Radioactive Shipment Survey Compliant? Yes No  COC notation or radioactive stickers.
	C) Did the RSO classify the samples as adioactive?	$\dagger$	1	Λ	COC notation or radioactive stickers on containers equal client designation.  Maximum Net Counts Observed* (Observed Counts - Area Background Counts):CPM / mR/Hr  Classified as: Rad 1
þ	Did the client designate samples are azardous?	+	1/	7	
E	) Did the RSO identify possible hazards?	+	1/	711	OC notation or hazard labels on containers equal client designation.  D or E is yes, select Hazards below.  CB's Flannmable Foreign Soil PCD and the properties of the propert
	Sample Receipt Criteria	Yes	15	上	roreign Soil RCRA Asbestos Beryllium Other
	Shipping containers received intact and sealed?	1	NA.		Comments/Qualifiers (Required for Non-Conforming Items)  Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	with shipment?			-	Circle Applicable: Client contacted and provided COC COC created upon receipt
3	Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	1	69942	_	Preservation Method: Net le lee Packs Dry ice None Other:
4	Daily check performed and passed on IR temperature gun?	1			Temperature Device Serial #: 7.84-16 Secondary Temperature Device Serial # (If Applicable):
	Sample containers intact and sealed?			/	Cricic Applicable: Seals broken Damaged contained Leaking container Other (describe)
6	Samples requiring chemical preservation at proper pH?		/		Sample ID's and Containers Affected:
7	Do any samples require Volatile Analysis?		v		If Preservation added, Lotti If Yes, are Encores or Soil Kits present for solids? YesNoNA (If yes, take to VOA Freezer)  Do liquid VOA vials contain acid preservation? YesNoNA (If unknown, select No)  Are liquid VOA vials free of headspace? YesNoNA (If unknown, select No)  Sample ID's and containers affected:
	Samples received within holding time?			1	D's and tests affected:
-10	ample ID's on COC match ID's on ottles?			1	D's and containers affected:
101	pate & time on COC match date & time n bottles?			C	ircle Applicable: No dates on containers No times on containers COC missing info Other (describe)
1111	umber of containers received match umber indicated on COC?			c	ircle Applicable: No container count on COC Other (describe)
1011	re sample containers identifiable as EL provided?  OC form is properly signed in			I	
_frei	inquished/received sections?  nts (Use Continuation Form if needed):		$\checkmark$	Ci	rele Applicable: Not relinquished Other (describe)

Page 15 of 16 SDG: 490860 Rev1

PM (or PMA) review; Initials

GL-CHL-SR-001 Rev 6

List of current GEL Certifications as of 08 November 2019

State	Certification
Alaska	17-018
Alaska Drinking Water	SC00012
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M-SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122020-1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	2019–165
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-19-15
Utah NELAP	SC000122019-28
Vermont	VT87156
Virginia NELAP	460202
Washington	C780





a member of The GEL Group INC





PO Box 30712 Charleston, SC 29417 2040 Savage Road Charleston, SC 29407 P 843.556.8171 F 843.766.1178

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November 08, 2019

Mr. Jim Riley NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804 Arlington, Virginia 22202

Re: Analytical for BFI-Charlotte motor Speedway Landfill V

Work Order: 490866

Dear Mr. Riley:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 19, 2019. This revised data report has been prepared and reviewed in accordance with GEL's standard operating procedures. This package was revised to include PFPeA and PFOA.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,

Julie Robinson Project Manager

Purchase Order: GELP19-0905

Enclosures

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# Certificate of Analysis Report for

NWRA001 NWRA – Carolinas Chapter Client SDG: 490866 GEL Work Order: 490866

### The Qualifiers in this report are defined as follows:

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- J See case narrative for an explanation
- J Value is estimated
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Julie Robinson.

	Irlie	Roberson	
Reviewed by			

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# **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forBFI-Charlotte motor Speedway Landfill V

Client Sample ID: 1304-1 Project: NWRA00119 Sample ID: 490866001 Client ID: NWRA001

Matrix: Misc Liquid
Collect Date: 16-SEP-19 12:55
Receive Date: 19-SEP-19
Collector: Client

Parameter Qualifie	r Result	DL	RL	Units	PF	DF	Anal	yst Date	Time	Batch	Method
LCMSMS PFCs											
EPA 537Mod PFCs by LC-MS/M	S "As Receiv	ved"									
Fluorotelomer sulfonate 8:2 (8:2	39.7	13.2	38.4	ng/L	0.200	1	JLS	10/02/19	0907	1921240	1
FTS)	07.2	12.2	40.0	/1	0.200						
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N-	87.2	13.2	40.0	ng/L	0.200	1					
EtFOSAA)											
N-methylperfluoro-1-	258	13.2	40.0	ng/L	0.200	1					
octanesulfonamidoacetic acid (N-											
MeFOSAA)			10.4	/1	0.200						
Perfluorodecanesulfonic acid (PFDS)	J 6.87	6.60	19.4	ng/L	0.200	1					
Perfluorodecanoic acid (PFDA)	590	7.80	20.0	ng/L	0.200	1					
Perfluorododecanoic acid (PFDoA)	63.3	6.60	20.0	ng/L	0.200						
` '	J 8.17	6.60	19.0	ng/L	0.200						
(PFHpS)				Č							
Perfluoroheptanoic acid (PFHpA)	983	6.60	20.0	ng/L	0.200						
Perfluorohexanesulfonic acid (PFHxS)	925	6.60	18.2	ng/L	0.200	1					
Perfluorononanesulfonic acid (PFNS)	U ND	7.00	19.2	ng/L	0.200	1					
Perfluorononanoic acid (PFNA)	269	6.60	20.0	ng/L	0.200	1					
Perfluorooctanesulfonamide (PFOSA)	J 11.5	6.60	18.6	ng/L	0.200	1					
Perfluorooctanesulfonic acid (PFOS)	356	8.00	20.0	ng/L	0.200	1					
Perfluoropentanesulfonic acid	73.2	6.60	18.8	ng/L	0.200						
(PFPeS)	75.2			8							
Perfluoroundecanoic acid (PFUdA)	30.8	6.60	20.0	ng/L	0.200	1					
Perfluorobutanesulfonic acid (PFBS)	5260	66.0	178	ng/L	0.200		JLS	10/02/19	0706	1921240	2
Perfluorobutyric acid (PFBA)	1920	66.0	200	ng/L	0.200						
Perfluorohexanoic acid (PFHxA)	3470	66.0	200	ng/L	0.200						
Perfluorooctanoic acid (PFOA)	2210	70.0	200	ng/L	0.200						
Perfluoropentanoic acid (PFPeA)	2160	66.0	200	ng/L	0.200						
Perfluorotetradecanoic acid (PFTeDA)	U ND	66.0	200	ng/L	0.200	10					
Perfluorotridecanoic acid (PFTrDA)	U ND	66.0	200	ng/L	0.200	10					
Fluorotelomer sulfonate 4:2 (4:2 FTS)	U ND	1320	3760	ng/L	0.200	100	JLS	10/02/19	1117	1921240	3
	U ND	1320	3800	ng/L	0.200	100					
The following Prep Methods were	e performed:										

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# **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forBFI-Charlotte motor Speedway Landfill V

Client Sample ID: 1304-1 Project: NWRA00119 Sample ID: 490866001 Client ID: NWRA001

Parameter	Qualifier Result	DL	RL	Units P	F DF	Analyst Date	Time Batch	Method
The following Pre	p Methods were performed:							
Method	Description		Analyst	Date	Time	Prep Batch		
EPA 537.1 Mod, PFA	S, Compl PFCs Extraction in Liquid		LM1	09/27/19	0830	1921239		
The following Ar	valutical Mathoda ware perform	nad.						

#### The following Analytical Methods were performed:

Method	Description	Analyst Comments	
1	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15	•	
2	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15		
3	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15		

#### **Notes:**

Column headers are defined as follows:

DF: Dilution Factor Lc/LC: Critical Level
DL: Detection Limit PF: Prep Factor
MDA: Minimum Detectable Activity RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

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# **QC Summary**

**NWRA - Carolinas Chapter** 1550 Crystal Drive, Suite 804

Arlington, Virginia Mr. Jim Riley

**Contact:** 

Workorder: 490866 Report Date: November 8, 2019

Page 1 of 6

Parmname	NOM	Sample Qual	QC	Units F	RPD/D% REC%	Range	Anlst	Date	Time
Perfluorinated Compounds Batch 1921240 ———									
QC1204391614 LCS Fluorotelomer sulfonate 4:2 (4:2 FTS)	18.2		15.7	ng/L	86	(60%-145%)	JLS	10/02/19	9 06:05
Fluorotelomer sulfonate 6:2 (6:2 FTS)	18.5		20.4	ng/L	110	(56%-143%)			
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.7		17.5	ng/L	94	(57%-138%)			
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	19.5		19.3	ng/L	99	(63%-131%)			
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	19.5		21.5	ng/L	111	(62%-133%)			
Perfluorobutanesulfonic acid (PFBS)	17.2		16.6	ng/L	96	(68%-136%)			
Perfluorobutyric acid (PFBA)	19.5		19.7	ng/L	101	(70%-133%)			
Perfluorodecanesulfonic acid (PFDS)	18.8		16.8	ng/L	89	(53%-142%)			
Perfluorodecanoic acid (PFDA)	19.5		18.0	ng/L	93	(62%-135%)			
Perfluorododecanoic acid (PFDoA)	19.5		19.5	ng/L	100	(66%-131%)			
Perfluoroheptanesulfonic acid (PFHpS)	18.5		18.1	ng/L	98	(66%-138%)			
Perfluoroheptanoic acid (PFHpA)	19.5		17.9	ng/L	92	(67%-135%)			
Perfluorohexanesulfonic acid (PFHxS)	17.7		14.5	ng/L	82	(64%-137%)			
Perfluorohexanoic acid (PFHxA)	19.5		18.9	ng/L	97	(67%-133%)			

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# **QC Summary**

Workorder: 490866 Page 2 of 6

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range A	Anlst	Date Time
Perfluorinated Compounds Batch 1921240									
Perfluorononanesulfonic acid (PFNS)	18.7		17.5	ng/L		93	(66%-130%)	JLS	10/02/19 06:05
Perfluorononanoic acid (PFNA)	19.5		21.1	ng/L		108	(66%-134%)		
Perfluorooctanesulfonamide (PFOSA)	19.5		21.5	ng/L		111	(68%-137%)		
Perfluorooctanesulfonic acid (PFOS)	19.5		19.8	ng/L		102	(61%-131%)		
Perfluorooctanoic acid (PFOA)	19.5		18.8	ng/L		97	(63%-145%)		
Perfluoropentanesulfonic acid (PFPeS)	18.3		16.5	ng/L		90	(62%-139%)		
Perfluoropentanoic acid (PFPeA)	19.5		19.3	ng/L		99	(69%-132%)		
Perfluorotetradecanoic acid (PFTeDA)	19.5		22.5	ng/L		115	(65%-143%)		
Perfluorotridecanoic acid (PFTrDA)	19.5		19.9	ng/L		102	(57%-149%)		
Perfluoroundecanoic acid (PFUdA)	19.5		19.1	ng/L		98	(65%-134%)		
QC1204391615 LCSD Fluorotelomer sulfonate 4:2 (4:2 FTS)	17.6		20.5	ng/L	26	116	(0%-35%)		10/02/19 06:14
Fluorotelomer sulfonate 6:2 (6:2 FTS)	17.9		17.6	ng/L	14	98	(0%-36%)		
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.1		19.9	ng/L	13	110	(0%-39%)		
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	18.8		20.1	ng/L	4	107	(0%-25%)		
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	18.8		21.9	ng/L	2	116	(0%-26%)		

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# **QC Summary**

Workorder: 490866 Page 3 of 6

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range Anlst	Date Time
<b>Perfluorinated Compounds</b> Batch 1921240								
Perfluorobutanesulfonic acid (PFBS)	16.7		17.2	ng/L	4	103	(0%-30%) JLS	10/02/19 06:14
Perfluorobutyric acid (PFBA)	18.8		19.3	ng/L	2	102	(0%-30%)	
Perfluorodecanesulfonic acid (PFDS)	18.2		17.2	ng/L	3	95	(0%-28%)	
Perfluorodecanoic acid (PFDA)	18.8		21.1	ng/L	16	112	(0%-29%)	
Perfluorododecanoic acid (PFDoA)	18.8		19.0	ng/L	3	101	(0%-30%)	
Perfluoroheptanesulfonic acid (PFHpS)	17.9		17.7	ng/L	2	99	(0%-30%)	
Perfluoroheptanoic acid (PFHpA)	18.8		19.6	ng/L	9	104	(0%-30%)	
Perfluorohexanesulfonic acid (PFHxS)	17.2		16.8	ng/L	15	98	(0%-30%)	
Perfluorohexanoic acid (PFHxA)	18.8		20.9	ng/L	10	111	(0%-23%)	
Perfluorononanesulfonic acid (PFNS)	18.1		18.2	ng/L	4	101	(0%-27%)	
Perfluorononanoic acid (PFNA)	18.8		18.7	ng/L	12	99	(0%-27%)	
Perfluorooctanesulfonamide (PFOSA)	18.8		20.2	ng/L	6	107	(0%-30%)	
Perfluorooctanesulfonic acid (PFOS)	18.8		19.9	ng/L	1	106	(0%-27%)	
Perfluorooctanoic acid (PFOA)	18.8		18.9	ng/L	0	100	(0%-30%)	
Perfluoropentanesulfonic acid (PFPeS)	17.7		17.3	ng/L	4	98	(0%-29%)	

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# **QC Summary**

Workorder: 490866 Page 4 of 6 QC **Parmname** NOM Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** Batch 1921240 Perfluoropentanoic acid (PFPeA) 18.8 20.0 ng/L 3 106 (0%-30%)JLS 10/02/19 06:14 Perfluorotetradecanoic acid 18.8 20.6 ng/L 9 109 (0%-30%)(PFTeDA) Perfluorotridecanoic acid 18.8 17.7 ng/L 11 94 (0%-35%)(PFTrDA) Perfluoroundecanoic acid (PFUdA) 18.8 21.2 ng/L 10 112 (0%-28%)QC1204391613 MB U Fluorotelomer sulfonate 4:2 (4:2 ND 10/02/19 05:56 ng/L FTS) U Fluorotelomer sulfonate 6:2 (6:2 ND ng/L FTS) U ND Fluorotelomer sulfonate 8:2 (8:2 ng/L FTS) U N-ethylperfluoro-1-ND ng/L octanesulfonamidoacetic acid (N-EtFOSAA) U ND N-methylperfluoro-1ng/L octanesulfonamidoacetic acid (N-MeFOSAA) U ND Perfluorobutanesulfonic acid ng/L (PFBS) Perfluorobutyric acid (PFBA) U ND ng/L U Perfluorodecanesulfonic acid ND ng/L (PFDS) Perfluorodecanoic acid (PFDA) U ND ng/L U ND Perfluorododecanoic acid (PFDoA) ng/L Perfluoroheptanesulfonic acid U ND ng/L (PFHpS)

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# **QC Summary**

Workorder: 490866 Page 5 of 6 NOM QC **Parmname** Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** 1921240 Batch Perfluoroheptanoic acid (PFHpA) U ND ng/L JLS 10/02/19 05:56 U ND Perfluorohexanesulfonic acid ng/L (PFHxS) U Perfluorohexanoic acid (PFHxA) ND ng/L U Perfluorononanesulfonic acid ND ng/L (PFNS) U ND Perfluorononanoic acid (PFNA) ng/L U Perfluorooctanesulfonamide ND ng/L (PFOSA) U Perfluorooctanesulfonic acid ND ng/L (PFOS) U ND Perfluorooctanoic acid (PFOA) ng/L U ND Perfluoropentanesulfonic acid ng/L (PFPeS) Perfluoropentanoic acid (PFPeA) U ND ng/L U ND Perfluorotetradecanoic acid ng/L (PFTeDA) Perfluorotridecanoic acid U ND ng/L (PFTrDA)

U

ND

ng/L

#### **Notes:**

The Qualifiers in this report are defined as follows:

\*\* Analyte is a surrogate compound

Perfluoroundecanoic acid (PFUdA)

- < Result is less than value reported
- > Result is greater than value reported

Page 9 of 15 SDG: 490866 Rev1

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### **QC Summary**

Workorder: 490866 Page 6 of 6 Sample Qual Parmname **NOM** OC Units RPD/D% REC% Range Anlst Date Time Α The TIC is a suspected aldol-condensation product В The target analyte was detected in the associated blank. C Analyte has been confirmed by GC/MS analysis D Results are reported from a diluted aliquot of the sample E Concentration of the target analyte exceeds the instrument calibration range Н Analytical holding time was exceeded J See case narrative for an explanation J Value is estimated JNX Non Calibrated Compound Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor N Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor N/A RPD or %Recovery limits do not apply. N<sub>1</sub> See case narrative ND Analyte concentration is not detected above the detection limit NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, the difference is >70%. Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER. R Sample results are rejected U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD. UJ Compound cannot be extracted X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier Y QC Samples were not spiked with this compound

- ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
- h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.  $^{\circ}$  The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

\* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Page 10 of 15 SDG: 490866 Rev1

### LCMSMS-Misc Technical Case Narrative NWRA - Carolinas Chapter SDG #: 490866

**Product:** The Extraction and Analysis of Per and Polyfluroalkyl Substances Using LCMSMS

Analytical Method: EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15

Analytical Procedure: GL-OA-E-076 REV# 7 Analytical Batches: 1921240 and 1921239

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
490866001	1304-1
1204391613	Method Blank (MB)
1204391614	Laboratory Control Sample (LCS)
1204391615	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

#### **Technical Information**

### **Sample Dilutions**

The following samples were diluted to bring the over range concentrations within the calibration range and/or due to matrix interference that caused internal standards recoveries to fall outside the acceptance range. 490866001 (1304-1).

A 1.	490866
Analyte	001
Fluorotelomer sulfonate 4:2 (4:2 FTS)	100X
Fluorotelomer sulfonate 6:2 (6:2 FTS)	100X
Perfluorobutanesulfonate (PFBS)	10X
Perfluorobutyric acid (PFBA)	10X
Perfluorohexanoic acid (PFHxA)	10X
Perfluorooctanoic acid (PFOA)	10X
Perfluoropentanoic acid (PFPeA)	10X
Perfluorotetradecanoic acid (PFTeDA)	10X
Perfluorotridecanoic acid (PFTrDA)	10X

#### **Miscellaneous Information**

#### **Additional Comments**

Additional sample volume was not provided for matrix QC. Also, reduced sample volumes were used for all samples except 490876002 (7607-EB) due to elevated concentrations of target analytes.

Page 11 of 15 SDG: 490866 Rev1

### **Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

Page 12 of 15 SDG: 490866 Rev1

GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407	Fax: (843) 766-1178	number of containers for each test)	< Preservative Type (6)		8270SIM Note: extra cample is							Specify: (Subject to Surcharge)		[ ] level 1 [ ] Level 2 [ ] Level 3 [ ] Level 4			ntain is [ ] Other; is a constant of the const		ı, N=Nasal			Please provide any additional details below regarding handling and/or disposal concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)	
alty Analytics		Sample Analysis Requested (5) (Fill in the number of containers for each test)		sample be PFAS 21 cmpd list by EPA 537 mod	rds	olyopic info	7	Andrew Control of the				TAT Requested: Normal: X Rush:	Fax Results: [ ] Yes [X] No	Cof A [ 1QC Summary	Additional Remarks:	ing Use Only: Custody Seal	e Zone: [X] Eastern [ ] Pactite [ ] Central [ ] Mountain	icate Sample, $G=Grab$ , $C=Composite$	SI=Sladge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Feeal	74704 - 1).	≈ Ascorbic Acid. HX = Hexane, ST ≈ Sodium Thiosulfate, If no preservative is added ≈ leave field blank	Other OT= Other / Unknown (i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards, etc.) Description:	
CEL   Laboratories LLC   Laboratories LLC   Chemistry   Radiochemistry   R	ber:	In, PC Phone # 919-847-4241	Fax # 704-586-0007		Send Results To:Genna Olson golson@harthickman.com	*Date Collected Collected Collected (Military) QC Field Sample (Military) (Ode (3) Filed Sample (Interded-yy) (thinam) Code (3) Filected (3) Matrix (4) Released (4) Matrix (4) Released (5) Matrix (6) Released (5) Matrix (6) Released (5) Matrix (6) Released (5) Matrix (6) Released (6) (	09-16-19 1255 N N ML					Chain of Custody Signatures	Received by (signed) Date Time	14 cs - 9119/19 6850	2 4		npie necept a newew form (ann.)	.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite 1. Field Fillered: For found matrices, indicate with a * Y - for use the commle was field fillered as some tool field interest.	Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Waste Water, WW=Water, ML=Miso Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Soild Waste, O=Oil, F=Filter, P=Wipe, U=Urinc, F=Feeal, N=Nasal	Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1).	, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = So	Characteristic Hazards FL = Flammable/Ignitable CO = Corrosive RE = Reactive Ifaxte code(s):  TSCA Regulated PCB = Polychlorinated	bipticnyls
Page:  Project # NWA-001  SEL Quote #: NWRA Quote  COC Number (1): NA	NA	Client Name: NWRA c/o Hart & Hickman, PC	hoject/Site Name: BFI-Charlotte Motor Speedway Landfill V	Address: Concord, NC	Collected By: Patrick Stevens Sa	Sample ID *For composites - indicate start and stop dateritime	1304-1						Relinquished By (Signed) Date Time	- Fatur H. Aux 09-18-19 1630		For counts chiming and delivere details on Counts Dening & Denies Co. (COD)	Chain of Custody Number ** Client Determined	QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field D Field Fillered: For houst matrices, indicate with a - V - for wes fi	Matrix Codes: DW≈Drinking Water, GW≈Groundwater, SW≈S	Sample Analysis Requested: Analytical method requested (i.e. 8.	Altric Aci	associated with these samples?  CC CC CCA Metals S = Arsenic Hg= Mercury a = Barium Se= Selenium FTS d = Cadmium Ag= Silver FC	MR= Miscellaneous RCRA metals

CEE Laboratories (1.0	
Client: NWRA	THE REVIEW FORM.
Received By: ATA	SOCIATOCOCAYork Order:
9.0	Date Received: 9/19/19
Carrier and Tracking Number	Fedex Express Fedex Ground UPS Field Services Courier Other 7762 7563 2308 -1", 7762 7563 3418-1" 7762 7563 2764-1", 7762 7563 3290-1"
Suspected Hazard Information	"If Net Counts > 100000 and 1
A)Shipped as a DOT Hazardous?	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.  Hazard Class Shipped:  UN#:  If UN2910, Is the Radioactive Shipment Survey Compliant? Yes No
B) Did the client designate the samples are to be received as radioactive?	COC notation or radioactive stickers on containers equal elient designation.
radioactive?	Maximum Net Counts Observed* (Observed Counts - Area Part
The the cheft designate samples are	COC notation or hazard labels on containers equal client designation.
E) Did the RSO identify possible hazards?	PCB's Flammable Foreign Soil RCRA Ashastas D. III
Sample Receipt Criteria	Seryllium Other:
Shipping containers received intact and sealed?	Comments/Qualifiers (Required for Non-Conforming Items)  Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2 Chain of custody documents included with shipment?	Circle Applicable: Client contacted and provided COC COC created upon receipt
3 Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	Preservation Method West A Land
Daily check performed and passed on IR temperature gun?	Temperature Davies Section 70000
5 Sample containers intact and sealed?	Secondary Temperature Device Serial # (If Applicable):  Circle Applicable: Seals broken Damaged contained Leaking container Other (describe)
6 Samples requiring chemical preservation at proper pH?	Sample ID's and Containers Affected:
7 Do any samples require Volatile Analysis?	If Preservation added, Lotti- If Yes, are Encores or Soil Kits present for solids? YesNo NA (If yes, take to VOA Freezer)  Do liquid VOA vials contain acid preservation? Yes No NA (If unknown, select No)  Are liquid VOA vials free of headspace? Yes No NA  Sample ID's and containers affected:
8 Samples received within holding time?	ID's and tests affected:
V	D's and containers affected:
Date & time on COC match date & time on bottles?	Circle Applicable: No dates on containers No times on containers COC missing info Other (describe)
number indicated on COC?	Tirele Applicable: No container count on COC Other (describe)
Are sample containers identifiable as GEL provided?  COC form is properly signed in	
relinquished/received sections?  Comments (Use Continuation Form if needed):	ircle Applicable: (Mot relinquished Applicable: Other (describe)
PM (or PMA) review: Initials	Date 125 1 A Page of
•	GL-CHL-SR-001 Rev 6

List of current GEL Certifications as of 08 November 2019

State	Certification
Alaska	17-018
Alaska Drinking Water	SC00012
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M-SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122020-1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	2019–165
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-19-15
Utah NELAP	SC000122019-28
Vermont	VT87156
Virginia NELAP	460202
Washington	C780











PO Box 30712 Charleston, SC 29417 2040 Savage Road Charleston, SC 29407 P 843.556.8171 F 843.766.1178

gel.com

November 08, 2019

Mr. Jim Riley NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804 Arlington, Virginia 22202

Re: Analytical for Chambers Development MSWLF

a member of The GEL Group INC

Work Order: 490872

Dear Mr. Riley:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 19, 2019. This revised data report has been prepared and reviewed in accordance with GEL's standard operating procedures. This package was revised to include PFPeA and PFOA.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,

Julie Robinson Project Manager

Purchase Order: GELP19-0905

Enclosures

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# Certificate of Analysis Report for

NWRA001 NWRA – Carolinas Chapter Client SDG: 490872 GEL Work Order: 490872

### The Qualifiers in this report are defined as follows:

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- J See case narrative for an explanation
- J Value is estimated
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- h Preparation or preservation holding time was exceeded

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Julie Robinson.

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# **Certificate of Analysis**

Project:

Client ID:

NWRA00119

NWRA001

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical for Chambers Development MSWLF

Client Sample ID: 0403-1 Sample ID: 490872001

Matrix: Misc Liquid
Collect Date: 16-SEP-19 15:30
Receive Date: 19-SEP-19
Collector: Client

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Anal	yst Date	Time Batch	Method
LCMSMS PFCs											
EPA 537Mod PFCs by L	C-MS/MS '	"As Received"									
Fluorotelomer sulfonate 8:2 (8:	2 U	ND	13.2	38.4	ng/L	0.200	1	JLS	10/02/19	0915 1921240	1
FTS) N-ethylperfluoro-1-	J	14.9	13.2	40.0	ng/L	0.200	1				
octanesulfonamidoacetic acid (I		14.9	13.2	40.0	ng/L	0.200	1				
EtFOSAA)											
N-methylperfluoro-1-		50.5	13.2	40.0	ng/L	0.200	1				
octanesulfonamidoacetic acid (I	N-										
MeFOSAA)	**	ND	6.60	10.4	/T	0.200	1				
Perfluorodecanesulfonic acid (PFDS)	U	ND	6.60	19.4	ng/L	0.200	1				
Perfluorodecanoic acid (PFDA)	)	23.6	7.80	20.0	ng/L	0.200	1				
Perfluorododecanoic acid (PFD		ND	6.60	20.0	ng/L	0.200					
Perfluoroheptanesulfonic acid	U	ND	6.60	19.0	ng/L	0.200					
(PFHpS)					Č						
Perfluoroheptanoic acid (PFHp.	A)	249	6.60	20.0	ng/L	0.200	1				
Perfluorohexanesulfonic acid (PFHxS)		218	6.60	18.2	ng/L	0.200	1				
Perfluorononanesulfonic acid (PFNS)	U	ND	7.00	19.2	ng/L	0.200	1				
Perfluorononanoic acid (PFNA)	J	15.5	6.60	20.0	ng/L	0.200	1				
Perfluorooctanesulfonamide	U	ND	6.60	18.6	ng/L	0.200	1				
(PFOSA)					_						
Perfluorooctanesulfonic acid (P	,	84.2	8.00	20.0	ng/L	0.200					
Perfluorooctanoic acid (PFOA)		345	7.00	20.0	ng/L	0.200					
Perfluoropentanesulfonic acid (PFPeS)		19.6	6.60	18.8	ng/L	0.200	1				
Perfluoropentanoic acid (PFPeA	A)	780	6.60	20.0	ng/L	0.200	1				
Perfluoroundecanoic acid (PFU	dA) U	ND	6.60	20.0	ng/L	0.200	1				
Fluorotelomer sulfonate 6:2 (6:2 FTS)	2 J	180	132	380	ng/L	0.200	10	JLS	10/02/19	0714 1921240	2
Perfluorobutanesulfonic acid (P	FBS)	6290	66.0	178	ng/L	0.200	10				
Perfluorobutyric acid (PFBA)		831	66.0	200	ng/L	0.200	10				
Perfluorohexanoic acid (PFHxA	A)	2200	66.0	200	ng/L	0.200	10				
Perfluorotetradecanoic acid (PFTeDA)	U	ND	66.0	200	ng/L	0.200	10				
Perfluorotridecanoic acid (PFT)	DA) U	ND	66.0	200	ng/L	0.200	10				
Fluorotelomer sulfonate 4:2 (4:2 FTS)	2 U	ND	1320	3760	ng/L	0.200	100	JLS	10/02/19	1125 1921240	3
0 1111 11 00010											

Semi-Volatile-GC/MS

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# **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical for Chambers Development MSWLF

Client Sample ID: 0403-1 Project: NWRA00119 Sample ID: 490872001 Client ID: NWRA001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analy	st Date	Time	e Batch	Method
Semi-Volatile-GC/N	AS .											
SW846 8270 SIM 1	,4-Dioxane in Li	quid "As Received"										
1,4-Dioxane	Q	9.22	1.00	2.00	ug/L	0.200	1	JMB3	09/24/19	1854	1919444	4
1,4-Dioxane	h	14.8	1.00	2.00	ug/L	0.200	1	JMB3	10/02/19	1652	1922216	5
TI. C. 11	M . 4 1											

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
EPA 537.1 Mod, PFAS, Comp	ol PFCs Extraction in Liquid	LM1	09/27/19	0830	1921239
SW846 3535A	SW8270E SIM Prep 1,4-Dioxane	SJ	10/02/19	1000	1922215
SW846 3535A	SW8270E SIM Prep 1,4-Dioxane	SJW1	09/23/19	1200	1919441

#### The following Analytical Methods were performed:

Method	Description	Analyst Comments
1	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15	
2	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15	
3	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15	
4	SW846 3535A/8270E SIM	
5	SW846 3535A/8270E SIM	

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
1,4-Dioxane-d8	SW846 8270 SIM 1,4-Dioxane in Liquid "As	24.2 ug/L	40.0	60*	(70%-130%)
1,4-Dioxane-d8	Received" SW846 8270 SIM 1,4-Dioxane in Liquid "As Received"	37.7 ug/L	40.0	94	(70%-130%)

### Notes:

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

MDA: Minimum Detectable Activity

Lc/LC: Critical Level

PF: Prep Factor

RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

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# **QC Summary**

NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804

Arlington, Virginia Mr. Jim Riley

Workorder: 490872

**Contact:** 

Report Date: November 8, 2019

Page 1 of 7

Parmname	NOM	Sample Qual	QC	Units RI	PD/D% REC%	Range	Anlst	Date '	Гіте
Perfluorinated Compounds Batch 1921240 ———									
QC1204391614 LCS Fluorotelomer sulfonate 4:2 (4:2 FTS)	18.2		15.7	ng/L	86	(60%-145%)	JLS	10/02/19	06:05
Fluorotelomer sulfonate 6:2 (6:2 FTS)	18.5		20.4	ng/L	110	(56%-143%)			
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.7		17.5	ng/L	94	(57%-138%)			
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	19.5		19.3	ng/L	99	(63%-131%)			
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	19.5		21.5	ng/L	111	(62%-133%)			
Perfluorobutanesulfonic acid (PFBS)	17.2		16.6	ng/L	96	(68%-136%)			
Perfluorobutyric acid (PFBA)	19.5		19.7	ng/L	101	(70%-133%)			
Perfluorodecanesulfonic acid (PFDS)	18.8		16.8	ng/L	89	(53%-142%)			
Perfluorodecanoic acid (PFDA)	19.5		18.0	ng/L	93	(62%-135%)			
Perfluorododecanoic acid (PFDoA)	19.5		19.5	ng/L	100	(66%-131%)			
Perfluoroheptanesulfonic acid (PFHpS)	18.5		18.1	ng/L	98	(66%-138%)			
Perfluoroheptanoic acid (PFHpA)	19.5		17.9	ng/L	92	(67%-135%)			
Perfluorohexanesulfonic acid (PFHxS)	17.7		14.5	ng/L	82	(64%-137%)			
Perfluorohexanoic acid (PFHxA)	19.5		18.9	ng/L	97	(67%-133%)			

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# **QC Summary**

Workorder: 490872 Page 2 of 7

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date Time
<b>Perfluorinated Compounds</b> Batch 1921240									
Perfluorononanesulfonic acid (PFNS)	18.7		17.5	ng/L		93	(66%-130%)	JLS	10/02/19 06:05
Perfluorononanoic acid (PFNA)	19.5		21.1	ng/L		108	(66%-134%)		
Perfluorooctanesulfonamide (PFOSA)	19.5		21.5	ng/L		111	(68%-137%)		
Perfluorooctanesulfonic acid (PFOS)	19.5		19.8	ng/L		102	(61%-131%)		
Perfluorooctanoic acid (PFOA)	19.5		18.8	ng/L		97	(63%-145%)		
Perfluoropentanesulfonic acid (PFPeS)	18.3		16.5	ng/L		90	(62%-139%)		
Perfluoropentanoic acid (PFPeA)	19.5		19.3	ng/L		99	(69%-132%)		
Perfluorotetradecanoic acid (PFTeDA)	19.5		22.5	ng/L		115	(65%-143%)		
Perfluorotridecanoic acid (PFTrDA)	19.5		19.9	ng/L		102	(57%-149%)		
Perfluoroundecanoic acid (PFUdA)	19.5		19.1	ng/L		98	(65%-134%)		
QC1204391615 LCSD Fluorotelomer sulfonate 4:2 (4:2 FTS)	17.6		20.5	ng/L	26	116	(0%-35%)		10/02/19 06:14
Fluorotelomer sulfonate 6:2 (6:2 FTS)	17.9		17.6	ng/L	14	98	(0%-36%)		
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.1		19.9	ng/L	13	110	(0%-39%)		
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	18.8		20.1	ng/L	4	107	(0%-25%)		
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	18.8		21.9	ng/L	2	116	(0%-26%)		

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# **QC Summary**

Workorder: 490872 Page 3 of 7

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range Anlst	Date Time
Perfluorinated Compounds Batch 1921240								
Perfluorobutanesulfonic acid (PFBS)	16.7		17.2	ng/L	4	103	(0%-30%) JLS	10/02/19 06:14
Perfluorobutyric acid (PFBA)	18.8		19.3	ng/L	2	102	(0%-30%)	
Perfluorodecanesulfonic acid (PFDS)	18.2		17.2	ng/L	3	95	(0%-28%)	
Perfluorodecanoic acid (PFDA)	18.8		21.1	ng/L	16	112	(0%-29%)	
Perfluorododecanoic acid (PFDoA)	18.8		19.0	ng/L	3	101	(0%-30%)	
Perfluoroheptanesulfonic acid (PFHpS)	17.9		17.7	ng/L	2	99	(0%-30%)	
Perfluoroheptanoic acid (PFHpA)	18.8		19.6	ng/L	9	104	(0%-30%)	
Perfluorohexanesulfonic acid (PFHxS)	17.2		16.8	ng/L	15	98	(0%-30%)	
Perfluorohexanoic acid (PFHxA)	18.8		20.9	ng/L	10	111	(0%-23%)	
Perfluorononanesulfonic acid (PFNS)	18.1		18.2	ng/L	4	101	(0%-27%)	
Perfluorononanoic acid (PFNA)	18.8		18.7	ng/L	12	99	(0%-27%)	
Perfluorooctanesulfonamide (PFOSA)	18.8		20.2	ng/L	6	107	(0%-30%)	
Perfluorooctanesulfonic acid (PFOS)	18.8		19.9	ng/L	1	106	(0%-27%)	
Perfluorooctanoic acid (PFOA)	18.8		18.9	ng/L	0	100	(0%-30%)	
Perfluoropentanesulfonic acid (PFPeS)	17.7		17.3	ng/L	4	98	(0%-29%)	

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### **QC Summary**

Workorder: 490872 Page 4 of 7 QC **Parmname** NOM Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** Batch 1921240 Perfluoropentanoic acid (PFPeA) 18.8 20.0 ng/L 3 106 (0%-30%)JLS 10/02/19 06:14 Perfluorotetradecanoic acid 18.8 20.6 ng/L 9 109 (0%-30%)(PFTeDA) Perfluorotridecanoic acid 18.8 17.7 ng/L 11 94 (0%-35%)(PFTrDA) Perfluoroundecanoic acid (PFUdA) 18.8 21.2 ng/L 10 112 (0%-28%)QC1204391613 MB U Fluorotelomer sulfonate 4:2 (4:2 ND 10/02/19 05:56 ng/L FTS) U Fluorotelomer sulfonate 6:2 (6:2 ND ng/L FTS) U ND Fluorotelomer sulfonate 8:2 (8:2 ng/L FTS) U N-ethylperfluoro-1-ND ng/L octanesulfonamidoacetic acid (N-EtFOSAA) U ND N-methylperfluoro-1ng/L octanesulfonamidoacetic acid (N-MeFOSAA) U ND Perfluorobutanesulfonic acid ng/L (PFBS) Perfluorobutyric acid (PFBA) U ND ng/L U Perfluorodecanesulfonic acid ND ng/L (PFDS) Perfluorodecanoic acid (PFDA) U ND ng/L U ND Perfluorododecanoic acid (PFDoA) ng/L Perfluoroheptanesulfonic acid U ND ng/L (PFHpS)

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# **QC Summary**

Page 5 of 7 NOM QC **Parmname** Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** 1921240 Batch Perfluoroheptanoic acid (PFHpA) U ND ng/L JLS 10/02/19 05:56 U ND Perfluorohexanesulfonic acid ng/L (PFHxS) U Perfluorohexanoic acid (PFHxA) ND ng/L U Perfluorononanesulfonic acid ND ng/L (PFNS) U Perfluorononanoic acid (PFNA) ND ng/L U Perfluorooctanesulfonamide ND ng/L (PFOSA) U Perfluorooctanesulfonic acid ND ng/L (PFOS) U ND Perfluorooctanoic acid (PFOA) ng/L U ND Perfluoropentanesulfonic acid ng/L (PFPeS) Perfluoropentanoic acid (PFPeA) U ND ng/L U ND Perfluorotetradecanoic acid ng/L (PFTeDA) Perfluorotridecanoic acid U ND ng/L (PFTrDA) U ND Perfluoroundecanoic acid (PFUdA) ng/L Semi-Volatile-GC/MS 1919444 QC1204387349 LCS 3.55 \*\*1,4-Dioxane-d8 4.00 ug/L (70%-130%) JMB3 09/24/19 12:24

Workorder:

490872

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

# **QC Summary**

			<u> </u>		<u>.,,</u>					
Workorder: 490	0872									Page 6 of 7
Parmname		NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date Time
<b>Semi-Volatile-GC/MS</b> Batch 19194										
QC1204387350 **1,4-Dioxane-d8	LCSD	4.00		3.18	ug/L		79	(70%-130%)	JMB3	09/24/19 12:49
QC1204387348 1,4-Dioxane	MB		U	ND	ug/L					09/24/19 11:59
**1,4-Dioxane-d8		4.00		3.05	ug/L		76	(70%-130%)		
Batch 19222	216 —									
QC1204393997 **1,4-Dioxane-d8	LCS	4.00		4.08	ug/L		102	(70%-130%)	JMB3	10/02/19 15:34
QC1204393998 **1,4-Dioxane-d8	LCSD	4.00		3.76	ug/L		94	(70%-130%)		10/02/19 16:02
QC1204393996 1,4-Dioxane	MB		U	ND	ug/L					10/02/19 15:07
**1,4-Dioxane-d8		4.00		3.87	ug/L		97	(70%-130%)		

#### **Notes:**

The Qualifiers in this report are defined as follows:

- \*\* Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B The target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- E Concentration of the target analyte exceeds the instrument calibration range
- H Analytical holding time was exceeded
- J See case narrative for an explanation
- J Value is estimated

JNX Non Calibrated Compound

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### **QC Summary**

Workorder: 490872 Page 7 of 7 Sample Qual Parmname **NOM**  $\mathbf{OC}$ Units RPD/D% REC% Range Anlst Date Time Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor Ν Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor N/A RPD or %Recovery limits do not apply. N1See case narrative ND Analyte concentration is not detected above the detection limit NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, the difference is >70%. Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER. R Sample results are rejected U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD. UJ Compound cannot be extracted X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier Y QC Samples were not spiked with this compound

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.

^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

\* Indicates that a Quality Control parameter was not within specifications.

Preparation or preservation holding time was exceeded

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For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

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### Technical Case Narrative NWRA - Carolinas Chapter SDG #: 490872

### **GC/MS Semivolatile**

**Product:** Analysis of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas

**Chromatography/Mass Spectrometry** 

**Analytical Method:** SW846 3535A/8270E SIM **Analytical Procedure:** GL-OA-E-073 REV# 2

**Analytical Batch:** 1919444

**Preparation Method:** SW846 3535A

**Preparation Procedure:** GL-OA-E-073 REV# 2

**Preparation Batch:** 1919441

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
490872001	0403-1
1204387348	Method Blank (MB)
1204387349	Laboratory Control Sample (LCS)
1204387350	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

### **Quality Control (QC) Information**

#### **Surrogate Recoveries**

Sample (See Below) did not meet surrogate recovery acceptance criteria. The sample was re-extracted out of holding and met acceptance criteria for all surrogates. Both sets of data results have been reported.

Sample	Analyte	Value					
490872001 (0403-1)	1, 4-Dioxane-d8	60* (70%-130%)					

#### **Laboratory Control Sample Duplicate (LCSD)**

An LCSD was used in place of matrix QC due to limited sample volume.

**Product:** Analysis of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas

**Chromatography/Mass Spectrometry** 

**Analytical Method:** SW846 3535A/8270E SIM **Analytical Procedure:** GL-OA-E-073 REV# 2

Page 12 of 17 SDG: 490872 Rev1

**Analytical Batch:** 1922216

**Preparation Method:** SW846 3535A

Preparation Procedure: GL-OA-E-073 REV# 2

**Preparation Batch:** 1922215

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID# Client Sample Identification

490872001 0403-1

1204393996 Method Blank (MB)

1204393997 Laboratory Control Sample (LCS)

1204393998 Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

### **Quality Control (QC) Information**

### **Laboratory Control Sample Duplicate (LCSD)**

An LCSD was used in place of matrix QC due to limited sample volume.

#### **Technical Information**

#### **Holding Time Specifications**

Sample (See Below) was re-extracted out of holding due to QC failure. The failure did not confirm, so both sets of results are reported and have been qualified accordingly.

Sample	Value
490872001 (0403-1)	Received 19-SEP-19, within holding, prepped 02-OCT-19, out of holding 23-SEP-19

#### **Miscellaneous Information**

#### **Manual Integrations**

Sample (See Below) required manual integration in order to properly identify one or more peaks and/or to correctly position the baseline as set in the calibration standard injections.

Sample	Analyte	Value				
490872001 (0403-1)	Tetrahydrofuran-d8	Result 100ug/L				

### **LCMSMS-Misc**

**Product:** The Extraction and Analysis of Per and Polyfluroalkyl Substances Using LCMSMS

Analytical Method: EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15

Analytical Procedure: GL-OA-E-076 REV# 7 Analytical Batches: 1921240 and 1921239

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
490872001	0403-1
1204391613	Method Blank (MB)
1204391614	Laboratory Control Sample (LCS)
1204391615	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

#### **Technical Information**

### **Sample Dilutions**

The following samples were diluted to bring the over range concentrations within the calibration range and/or due to matrix interference that caused internal standards recoveries to fall outside the acceptance range. 490872001 (0403-1).

Amalanta	490872
Analyte	001
Fluorotelomer sulfonate 4:2 (4:2 FTS)	100X
Fluorotelomer sulfonate 6:2 (6:2 FTS)	10X
Perfluorobutanesulfonate (PFBS)	10X
Perfluorobutyric acid (PFBA)	10X
Perfluorohexanoic acid (PFHxA)	10X
Perfluorotetradecanoic acid (PFTeDA)	10X
Perfluorotridecanoic acid (PFTrDA)	10X

#### **Miscellaneous Information**

#### **Additional Comments**

Additional sample volume was not provided for matrix QC. Also, reduced sample volumes were used for all samples except 490876002 (7607-EB) due to elevated concentrations of target analytes.

#### **Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

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GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407	Fax: (843) 766-1178	(Fill in the number of containers for each test)	< Preservative Type (6)	PFAS 21 cmpd list by EPA 537 mod	EPA 8270SIM Note: extra sample is	1						Specify: (Subject to Surcharge)		y [] level i [] Level 2 [] Level 3 [] Level 4	act? [ ] Vos [ ] Wo Conton Tomm.	1 Other	1			r, F=Fecal, N=Nasal		Please provide any additional details		of site collected from, odd matrices, etc.)			
Chemistry I Radiochemistry I Radiochemis	aiyiical Nequesi nager:	Sample Analysis Requested <sup>(5)</sup> (Fill in			Lqs	Please supply  Total number	X X X					TAT Requested: Normal: X Rush:	Fax Results: [ ] Yes [X] No	Select Deliverable: [ ] C	Fur Lab Ravairing Fise Only: Custody Soul Intract? [ ] Yes	Sample Collection Time Zone: K Eastern [ 1 Pacific   1 Central   1 Mountain		Duplicate Sample, $G = Grab$ , $C = Composite$		nent, SL≓Shadge, SS≅Solid Waste. O≅Oll, F∝Filter. P≅Wipe, U≈Urine. 10B:74704 - 1).	= Sodium Thiosulfate, If no preservative is added $=$ leave field blank	Other OT= (Then / Unknown	(i.e.: Highlow pH, asbestos, beryllium, irritants, other	mise, neatin nazaras, etc.) Description:			
LM 0872 Calcon Chemistry i Radiochemistry i Radiochemistr	GEL Work Order Number: GEL Project Manager:	nan, PC Phone # 919-847-4241	ent MSWLF Fax # 704-586-0007		Send Results To:Genna Olson golson@harthickman.co	*Plime *Time   *Date Collected   Collected   QC   Field   Sample   Collected   (Military)   QC   Field   Sample   Colline   (mm-4d-yy)   (themm)   Code Ol   Filected Ol Matrix (**)	09-16-19 1530					Chain of Custody Signatures	Received by (signed)	0580 61/61/6 80/61 08	3			2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite	3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered.	4.) Marrix Codes; DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Water, Wt=Water, ML=Mrse Liquid, SO=Sediment, SL=Sindge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Nasal, Sample Analysis Requested, Analytical method requested (i.e. 82608, 6010B77470A) and number of containers provided for each (i.e. 82608 - 3, 6010B774704 - 1).	6.) Preservaive Type: Ha = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfate, If no preservative is added = leave field blank	Characteristic Hazards   Listed Waste   FL = Flammahle/Ioniphe   I.W= Listed Waste		RE - Reacuve Waste coue(s):	TSCA Regulated	biphenyls	
of 1 NWA-001 NWRA Quote		Client Name: NWRA c/o Hart & Hickman, PC	Project/Site Name: Chambers Development MSWLF	Address: Polkton, NC	Collected By: Patrick Stevens	Sample ID * For composites - indicate start and stop datertime	0403-1					Ch	Relinquished By (Signed) Date Time	1 Palled H. Arect 09-18-19 1630	3	> For sumple shipping and delivery details, see Sample Receipt & Review form (SRR.)	1.) Chain of Custody Number = Client Determined	2.) QC Codes: $N = Normal Sample, TB = Trip Blank, FD = Fig.$	3.) Field Filtered: For liquid matrices, indicate with a - $\mathbf{Y}$ - for	<ol> <li>Matrix Codes: DW=Drinking Water, GW=Greundwater, S.</li> <li>Sample Analysis Requested: Analytical method requested (i)</li> </ol>	6.) Preservative Type: HA = Hydrochloric Acid, NI = Mitric Ac	7.) Are there any known or possible hazards associated with these samules?	S. C. C. C. C.	<u>~</u>	Ba = Barium Se= Selenium Cd = Cadminm Ac= Silver	MR=	1-1-1-10 P. 1-1-1-10

SAMPLE RECEIPT & DEVICE.	
Client: NWBA SAMPLE RECEIPT & REVIEW FORM SDG/AR/COC/Work Order:	
Received By: Date Received: 9/19/19	
Carrier and Tracking Number  Circle Applicable:  FedEx Ground UPS Field Services Co.  7762 7563 2308 -1, 7762 7563  Field Services Co.  7762 7563 2764 -1, 7762 7563  Suspected Hazard Information	ourier Other 3 3418-1°
Suspected Hazard Information $\frac{3}{2}$ 2 *If Net Counts > 100cmm on campular with the	3290-10
A)Shipped as a DOT Hazardous?    A)Shipped as a DOT Hazardous?   If UN2910, is the Radioactive Shipped: UN#:	Jroup for further investigation.
received as radioactive?  COC notation or radioactive stickers on containers equal client designation	
Maximum Net Counts Observed Counts - Area Background - Area	
D) Did the client designate samples are According to the client designation of hazard labels on containers equal client designation.	ot / mR/Hr
E) Did the RSO identify possible hazards?    Or E is yes, select Hazards below.   PCB's Flammable Foreign Soil   PCB   P	. ,
Sample Receipt Criteria	
Shipping containers received intact and sealed?  Comments/Qualifiers (Required for Non-Conforming Items paraged container   Leaking container   Chain of custody describe)	)
with shipment? Circle Applicable: Client contacted and provided COC COC created upon a significant contacted and con	
3 Samples requiring cold preservation within (0 ≤ 6 deg. C)?*  Preservation Method: Wet to lee Packs Dry ice None Other.	
Daily check performed and passed on IR temperature gun?  Temperature Device Serial #: TR4-16 Secondary Temperature Device Serial # (If Applicable):	гемр: 10
Sample containers intact and sealed? Circle Applicable: Seals broken Damaged container Leaking cognainer Other (describe)	
at proper pH?    Sample ID's and Confainers Affected:	
Do any samples require Volatile Analysis?  If Preservation added, Lotti If Yes, are Encores or Soil Kits present for solids? Yes No NA (If yes, take to VOA) Are liquid VOA vials contain acid preservation? Yes No NA (If unknown, select No Sample ID's and containers affected:	Frcezer)
8 Samples received within holding time? / ID's and tests affected:	
9 Sample ID's on COC match 1D's on bottles? ID's and containers affected:	
Date & time on COC match date & time on bottles?    Date & time on COC match date & time on bottles?   Circle Applicable: No dates on containers   No times on containers   COC missing info   Other	T (describe)
number indicated on COC?  Circle Applicable: No container count on COC Other (describe)	. (40301100)
12 Are sample containers identifiable as  GEL provided?  COC form is properly signed in	
relinquished/received sections? Circle Applicable: Other (describe)  Comments (Use Continuation Form if needed):	
PM (or PMA) review: Initials Date Date Page of Page	-SR-001 Rev 6

List of current GEL Certifications as of 08 November 2019

00253



a member of The GEL Group INC







PO Box 30712 Charleston, SC 29417 2040 Savage Road Charleston, SC 29407 P 843.556.8171 F 843.766.1178

gel.com

November 08, 2019

Mr. Jim Riley NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804 Arlington, Virginia 22202

Re: Analytical for Uwharrie Environmental Regional Landfill

Work Order: 490875

Dear Mr. Riley:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 19, 2019. This revised data report has been prepared and reviewed in accordance with GEL's standard operating procedures. This package was revised to include PFPeA and PFOA.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,

Julie Robinson Project Manager

Purchase Order: GELP19-0905

Enclosures

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# Certificate of Analysis Report for

NWRA001 NWRA – Carolinas Chapter Client SDG: 490875 GEL Work Order: 490875

#### The Qualifiers in this report are defined as follows:

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- J See case narrative for an explanation
- J Value is estimated
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Julie Robinson.

Reviewed by

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical for Uwharrie Environmental Regional Landfill

Client Sample ID: 6204-1 Project: NWRA00119 Sample ID: 490875001 Client ID: NWRA001

Matrix: Misc Liquid
Collect Date: 17-SEP-19 08:55
Receive Date: 19-SEP-19
Collector: Client

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Anal	yst Date	Time	e Batch	Method
LCMSMS PFCs												
EPA 537Mod PFCs by L	.C-MS/MS	'As Received"										
Fluorotelomer sulfonate 8:2 (8	:2 J	35.8	13.2	38.4	ng/L	0.200	1	JLS	10/02/19	0924	1921240	1
FTS)		60.0	10.0	40.0	/T	0.200						
N-ethylperfluoro-1- octanesulfonamidoacetic acid (	N_	68.0	13.2	40.0	ng/L	0.200	1					
EtFOSAA)	(14-											
N-methylperfluoro-1-		180	13.2	40.0	ng/L	0.200	1					
octanesulfonamidoacetic acid (	(N-											
MeFOSAA)	**	ND	6.60	10.4	/7	0.200						
Perfluorodecanesulfonic acid (PFDS)	U	ND	6.60	19.4	ng/L	0.200	1					
Perfluorodecanoic acid (PFDA	)	632	7.80	20.0	ng/L	0.200	1					
Perfluorododecanoic acid (PFI	*	184	6.60	20.0	ng/L	0.200						
Perfluoroheptanesulfonic acid	J	9.40	6.60	19.0	ng/L	0.200						
(PFHpS)					Č							
Perfluoroheptanoic acid (PFHp	oA)	1560	6.60	20.0	ng/L	0.200						
Perfluorohexanesulfonic acid (PFHxS)		640	6.60	18.2	ng/L	0.200	1					
Perfluorononanesulfonic acid (PFNS)	U	ND	7.00	19.2	ng/L	0.200	1					
Perfluorononanoic acid (PFNA	<b>(</b> )	326	6.60	20.0	ng/L	0.200	1					
Perfluorooctanesulfonamide (PFOSA)	U	ND	6.60	18.6	ng/L	0.200	1					
Perfluorooctanesulfonic acid (I	PFOS)	356	8.00	20.0	ng/L	0.200						
Perfluoropentanesulfonic acid (PFPeS)		41.4	6.60	18.8	ng/L	0.200	1					
Perfluoroundecanoic acid (PFU	JdA)	33.0	6.60	20.0	ng/L	0.200	1					
Perfluorobutanesulfonic acid (l	PFBS)	2870	66.0	178	ng/L	0.200		JLS	10/02/19	0731	1921240	2
Perfluorobutyric acid (PFBA)		2400	66.0	200	ng/L	0.200						
Perfluorohexanoic acid (PFHx.	,	5540	66.0	200	ng/L	0.200						
Perfluorooctanoic acid (PFOA)	,	3690	70.0	200	ng/L	0.200						
Perfluoropentanoic acid (PFPe	*	2150	66.0	200	ng/L	0.200						
Perfluorotetradecanoic acid (PFTeDA)	U	ND	66.0	200	ng/L	0.200						
Perfluorotridecanoic acid (PFT	,	ND	66.0	200	ng/L	0.200						
Fluorotelomer sulfonate 4:2 (4 FTS)		ND	1320	3760	ng/L	0.200		JLS	10/02/19	1134	1921240	3
Fluorotelomer sulfonate 6:2 (6 FTS)	:2 U	ND	1320	3800	ng/L	0.200	100					
Semi-Volatile-GC/MS												

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# **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical for Uwharrie Environmental Regional Landfill

Client Sample ID: 6204-1 Project: NWRA00119 Sample ID: 490875001 Client ID: NWRA001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analy	st Date	Time	Batch	Method
Semi-Volatile-GC/MS												
SW846 8270 SIM 1,4-D	ioxane in Lic	quid "As Received"										
1,4-Dioxane		357	10.0	20.0	ug/L	0.200	10	JMB3	09/24/19	1528	1919444	4
The following Prep Met	hods were pe	rformed:										
Method	Description		Aı	nalyst	Date	,	Time	e Pi	rep Batch			
EPA 537.1 Mod, PFAS, Comp	ol PFCs Extracti	on in Liquid	LN	11	09/27/19		0830	19	21239			
SW846 3535A	SW8270E SIN	I Prep 1,4-Dioxane	SJ	W1	09/23/19		1200	19	19441			
The following Analytical Methods were performed:												

Triculou	Beschiption		7 Illuly St C	JIIIIICIIC	
1	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15		•		
2	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15				
3	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15				
4	SW846 3535A/8270E SIM				
Surrogato/Tracar	Pagayary Tagt	Pacult	Nominal	Dagovory0/	Accontable Limits

Analyst Comments

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
1,4-Dioxane-d8	SW846 8270 SIM 1,4-Dioxane in Liquid "As Received"	40.4 ug/L	40.0	101	(70%-130%)

### **Notes:**

Method

Column headers are defined as follows:

DF: Dilution Factor Lc/LC: Critical Level
DL: Detection Limit PF: Prep Factor
MDA: Minimum Detectable Activity RL: Reporting Limit

Description

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

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# **QC Summary**

Report Date: November 8, 2019

Page 1 of 7

NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804

Arlington, Virginia Mr. Jim Riley

**Contact:** 

Workorder: 490875

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Perfluorinated Compounds Batch 1921240											
QC1204391614 LCS Fluorotelomer sulfonate 4:2 (4:2 FTS)	18.2			15.7	ng/L		86	(60%-145%)	JLS	10/02/1	9 06:05
Fluorotelomer sulfonate 6:2 (6:2 FTS)	18.5			20.4	ng/L		110	(56%-143%)			
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.7			17.5	ng/L		94	(57%-138%)			
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	19.5			19.3	ng/L		99	(63%-131%)			
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	19.5			21.5	ng/L		111	(62%-133%)			
Perfluorobutanesulfonic acid (PFBS)	17.2			16.6	ng/L		96	(68%-136%)			
Perfluorobutyric acid (PFBA)	19.5			19.7	ng/L		101	(70%-133%)			
Perfluorodecanesulfonic acid (PFDS)	18.8			16.8	ng/L		89	(53%-142%)			
Perfluorodecanoic acid (PFDA)	19.5			18.0	ng/L		93	(62%-135%)			
Perfluorododecanoic acid (PFDoA)	19.5			19.5	ng/L		100	(66%-131%)			
Perfluoroheptanesulfonic acid (PFHpS)	18.5			18.1	ng/L		98	(66%-138%)			
Perfluoroheptanoic acid (PFHpA)	19.5			17.9	ng/L		92	(67%-135%)			
Perfluorohexanesulfonic acid (PFHxS)	17.7			14.5	ng/L		82	(64%-137%)			
Perfluorohexanoic acid (PFHxA)	19.5			18.9	ng/L		97	(67%-133%)			

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# **QC Summary**

Workorder: 490875 Page 2 of 7

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range A	Anlst	Date Time
<b>Perfluorinated Compounds</b> Batch 1921240									
Perfluorononanesulfonic acid (PFNS)	18.7		17.5	ng/L		93	(66%-130%)	JLS	10/02/19 06:05
Perfluorononanoic acid (PFNA)	19.5		21.1	ng/L		108	(66%-134%)		
Perfluorooctanesulfonamide (PFOSA)	19.5		21.5	ng/L		111	(68%-137%)		
Perfluorooctanesulfonic acid (PFOS)	19.5		19.8	ng/L		102	(61%-131%)		
Perfluorooctanoic acid (PFOA)	19.5		18.8	ng/L		97	(63%-145%)		
Perfluoropentanesulfonic acid (PFPeS)	18.3		16.5	ng/L		90	(62%-139%)		
Perfluoropentanoic acid (PFPeA)	19.5		19.3	ng/L		99	(69%-132%)		
Perfluorotetradecanoic acid (PFTeDA)	19.5		22.5	ng/L		115	(65%-143%)		
Perfluorotridecanoic acid (PFTrDA)	19.5		19.9	ng/L		102	(57%-149%)		
Perfluoroundecanoic acid (PFUdA)	19.5		19.1	ng/L		98	(65%-134%)		
QC1204391615 LCSD Fluorotelomer sulfonate 4:2 (4:2 FTS)	17.6		20.5	ng/L	26	116	(0%-35%)		10/02/19 06:14
Fluorotelomer sulfonate 6:2 (6:2 FTS)	17.9		17.6	ng/L	14	98	(0%-36%)		
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.1		19.9	ng/L	13	110	(0%-39%)		
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	18.8		20.1	ng/L	4	107	(0%-25%)		
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	18.8		21.9	ng/L	2	116	(0%-26%)		

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# **QC Summary**

Workorder: 490875 Page 3 of 7

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range Anlst	Date Time
Perfluorinated Compounds Batch 1921240								
Perfluorobutanesulfonic acid (PFBS)	16.7		17.2	ng/L	4	103	(0%-30%) JLS	10/02/19 06:14
Perfluorobutyric acid (PFBA)	18.8		19.3	ng/L	2	102	(0%-30%)	
Perfluorodecanesulfonic acid (PFDS)	18.2		17.2	ng/L	3	95	(0%-28%)	
Perfluorodecanoic acid (PFDA)	18.8		21.1	ng/L	16	112	(0%-29%)	
Perfluorododecanoic acid (PFDoA)	18.8		19.0	ng/L	3	101	(0%-30%)	
Perfluoroheptanesulfonic acid (PFHpS)	17.9		17.7	ng/L	2	99	(0%-30%)	
Perfluoroheptanoic acid (PFHpA)	18.8		19.6	ng/L	9	104	(0%-30%)	
Perfluorohexanesulfonic acid (PFHxS)	17.2		16.8	ng/L	15	98	(0%-30%)	
Perfluorohexanoic acid (PFHxA)	18.8		20.9	ng/L	10	111	(0%-23%)	
Perfluorononanesulfonic acid (PFNS)	18.1		18.2	ng/L	4	101	(0%-27%)	
Perfluorononanoic acid (PFNA)	18.8		18.7	ng/L	12	99	(0%-27%)	
Perfluorooctanesulfonamide (PFOSA)	18.8		20.2	ng/L	6	107	(0%-30%)	
Perfluorooctanesulfonic acid (PFOS)	18.8		19.9	ng/L	1	106	(0%-27%)	
Perfluorooctanoic acid (PFOA)	18.8		18.9	ng/L	0	100	(0%-30%)	
Perfluoropentanesulfonic acid (PFPeS)	17.7		17.3	ng/L	4	98	(0%-29%)	

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# **QC Summary**

Page 4 of 7 QC **Parmname** NOM Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** Batch 1921240 Perfluoropentanoic acid (PFPeA) 18.8 20.0 ng/L 3 106 (0%-30%)JLS 10/02/19 06:14 Perfluorotetradecanoic acid 18.8 20.6 ng/L 9 109 (0%-30%)(PFTeDA) Perfluorotridecanoic acid 18.8 17.7 ng/L 11 94 (0%-35%)(PFTrDA) Perfluoroundecanoic acid (PFUdA) 18.8 21.2 ng/L 10 112 (0%-28%)QC1204391613 MB U Fluorotelomer sulfonate 4:2 (4:2 ND 10/02/19 05:56 ng/L FTS) U Fluorotelomer sulfonate 6:2 (6:2 ND ng/L FTS) U ND Fluorotelomer sulfonate 8:2 (8:2 ng/L FTS) U N-ethylperfluoro-1-ND ng/L octanesulfonamidoacetic acid (N-EtFOSAA) U ND N-methylperfluoro-1ng/L octanesulfonamidoacetic acid (N-MeFOSAA) U ND Perfluorobutanesulfonic acid ng/L (PFBS) Perfluorobutyric acid (PFBA) U ND ng/L U Perfluorodecanesulfonic acid ND ng/L (PFDS) Perfluorodecanoic acid (PFDA) U ND ng/L U ND Perfluorododecanoic acid (PFDoA) ng/L Perfluoroheptanesulfonic acid U ND ng/L (PFHpS)

Workorder:

490875

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# **QC Summary**

Page 5 of 7 NOM QC **Parmname** Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** 1921240 Batch Perfluoroheptanoic acid (PFHpA) U ND ng/L JLS 10/02/19 05:56 U ND Perfluorohexanesulfonic acid ng/L (PFHxS) U Perfluorohexanoic acid (PFHxA) ND ng/L U Perfluorononanesulfonic acid ND ng/L (PFNS) U Perfluorononanoic acid (PFNA) ND ng/L U Perfluorooctanesulfonamide ND ng/L (PFOSA) U Perfluorooctanesulfonic acid ND ng/L (PFOS) U ND Perfluorooctanoic acid (PFOA) ng/L U ND Perfluoropentanesulfonic acid ng/L (PFPeS) Perfluoropentanoic acid (PFPeA) U ND ng/L U ND Perfluorotetradecanoic acid ng/L (PFTeDA) Perfluorotridecanoic acid U ND ng/L (PFTrDA) U ND Perfluoroundecanoic acid (PFUdA) ng/L Semi-Volatile-GC/MS 1919444 QC1204387349 LCS 3.55 \*\*1,4-Dioxane-d8 4.00 ug/L (70%-130%) JMB3 09/24/19 12:24

Workorder:

490875

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# **QC Summary**

Workorder: 490875											Pag	e 6 of 7
Parmname	N	NOM Sar	mple	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS Batch 1919444												
QC1204387350 LCS **1,4-Dioxane-d8	5D 4.0	00			3.18	ug/L		79	(70%-130%)	JMB3	09/24/1	9 12:49
QC1204387348 MB 1,4-Dioxane				U	ND	ug/L					09/24/1	9 11:59
**1,4-Dioxane-d8	4.0	00			3.05	ug/L		76	(70%-130%)			

#### **Notes:**

The Qualifiers in this report are defined as follows:

- \*\* Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B The target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- E Concentration of the target analyte exceeds the instrument calibration range
- H Analytical holding time was exceeded
- J See case narrative for an explanation
- J Value is estimated
- JNX Non Calibrated Compound
- N Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N/A RPD or %Recovery limits do not apply.
- N1 See case narrative
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, the difference is >70%.
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UJ Compound cannot be extracted

Page 10 of 16 SDG: 490875 Rev1

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# **QC Summary**

Page 7 of 7 **Parmname NOM** Sample Qual  $\mathbf{QC}$ Units RPD/D% REC% Range Anlst Date Time

- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y QC Samples were not spiked with this compound

490875

Workorder:

- ٨ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
- h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

- ^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
- \* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Page 11 of 16 SDG: 490875 Rev1

### Technical Case Narrative NWRA - Carolinas Chapter SDG #: 490875

### **GC/MS Semivolatile**

**Product:** Analysis of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas

**Chromatography/Mass Spectrometry** 

**Analytical Method:** SW846 3535A/8270E SIM **Analytical Procedure:** GL-OA-E-073 REV# 2

**Analytical Batch:** 1919444

**Preparation Method:** SW846 3535A

Preparation Procedure: GL-OA-E-073 REV# 2

**Preparation Batch:** 1919441

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
490875001	6204-1
1204387348	Method Blank (MB)
1204387349	Laboratory Control Sample (LCS)
1204387350	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

#### **Quality Control (QC) Information**

#### **Laboratory Control Sample Duplicate (LCSD)**

An LCSD was used in place of matrix QC due to limited sample volume.

#### **Technical Information**

#### **Sample Dilutions**

Sample 490875001 (6204-1) was diluted due to the presence of one or more over-range target analytes.

### **LCMSMS-Misc**

**Product:** The Extraction and Analysis of Per and Polyfluroalkyl Substances Using LCMSMS

Analytical Method: EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15

**Analytical Procedure:** GL-OA-E-076 REV# 7 **Analytical Batches:** 1921240 and 1921239

Page 12 of 16 SDG: 490875 Rev1

The following samples were analyzed using the above methods and analytical procedure(s).

<b>GEL Sample ID#</b>	<b>Client Sample Identification</b>
490875001	6204-1
1204391613	Method Blank (MB)
1204391614	Laboratory Control Sample (LCS

1204391614 Laboratory Control Sample (LCS) 1204391615 Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

### **Technical Information**

#### **Sample Dilutions**

The following samples were diluted to bring the over range concentrations within the calibration range and/or due to matrix interference that caused internal standards recoveries to fall outside the acceptance range. 490875001 (6204-1).

Analysta	490875
Analyte	001
Fluorotelomer sulfonate 4:2 (4:2 FTS)	100X
Fluorotelomer sulfonate 6:2 (6:2 FTS)	100X
Perfluorobutanesulfonate (PFBS)	10X
Perfluorobutyric acid (PFBA)	10X
Perfluorohexanoic acid (PFHxA)	10X
Perfluorooctanoic acid (PFOA)	10X
Perfluoropentanoic acid (PFPeA)	10X
Perfluorotetradecanoic acid (PFTeDA)	10X
Perfluorotridecanoic acid (PFTrDA)	10X

#### **Miscellaneous Information**

#### **Additional Comments**

Additional sample volume was not provided for matrix QC. Also, reduced sample volumes were used for all samples except 490876002 (7607-EB) due to elevated concentrations of target analytes.

#### **Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

Page 13 of 16 SDG: 490875 Rev1

GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407 Phone: (843) 556-8171	Fax: (843) 766-1178	(Fill in the number of containers for each test)	< Preservative Type (6)	pou	A 8270SIM Note: extra sample is	required for sample specific QC						Specify: (Subject to Surcharge)		[]level   []Level 2 []Level 3 []Level 4		[] Yes [] No Cooler Temp:   °C	[ ] Wountain [5, [ ] Omer. [5, 5]		ecal, NeMisal		ii er i erit Eri erit	trave provide any additional actions below regarding handling and/or disposal concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)		
alty Analytics		Sample Analysis Requested (5) (Fill in the		considered: PFAS 21 cmpd list by EPA 537	spai	Society of the state of the sta						TAT Requested: Normal: X Rush:	Fax Results: [ ] Yes [X] No	[ ] QC Summary	Additional Remarks:	Sample Collection Time Zone: IN Bestern [1 Donies   1 Control   1 M	Comman	plicate Sample. G = Grab, C = Composite	t, SL=Sludge, SS=Solid Waste, O=Oil. F=Filter, P=Wipe, U=Urine, F=Fe	874704 - 1). Sodium Thiosulfine Heas movementing to 44 (4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Other	OT= Other / Unknown (i.e.: Highlow pH, asbestos, beryllium, irritants, other misc. health hazards, etc.) Description:		
SECON Chain o	GEL Work Order Number: GEL Project Manager:	n, PC Phonc # 919-847-4241	Fax # 704-586-0007	30 S.	Send Results To:Genna Olson golson@harthickman.com	*Date Collected Collected Collected (Military) QC Field Sample (Imm-dd-yy) (thinum) Code (a) Filtered (b) Matrix (4)	Z					Chain of Custody Signatures	Time	0820 4/14/14 0820	2		The state of the s	QC Codes: N = Normal Sample, TB = Trip Blank. FD = Field Duplicate. EB = Equipment Blank. MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite Field Fillered. For found matrices, indicate with a - Y - for use the sample was field fillered or - N - for example was not field Fillered.	Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Water, W=Water, WL=Mise Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Soild Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Masal	Sample Analysis Requested: Analysical method requested (i.e. 82608,60108/7470A) and number of containers provided for each (i.e. 82608 - 3, 60108/7470A - 1).  Preservative Type: HA = Mythochloric Acid, NI = Nitric Acid, SH = Sadium Hydroxide, SA = Sulfuric Acid, AA = Accordic Acid, HX = Horoculoric Acid, NI = Nitric Acid, SH = Sadium Hydroxide, SA = Sulfuric Acid, AA = Accordic Acid, HX = Horoculoric Acid, NI = Nitric Acid, SH = Sadium Hydroxide, SA = Sulfuric Acid, AA = Accordic Acid, HX = Horoculoric Acid, NI = Nitric Acid, SH = Sadium Hydroxide, SA = Sulfuric Acid, AA = Accordic Acid, HX = Horoculoric Acid, NI = Nitric Acid, SH = Sadium Hydroxide, SA = Sulfuric Acid, AA = Accordic Acid, HX = Horoculoric Acid, NI = Nitric Acid, SH = Sadium Hydroxide, SA = Sulfuric Acid, AA = Accordic Acid, HX = Horoculoric Acid, NI = Nitric Acid, SH = Sadium Hydroxide, SA = Sulfuric Acid, AA = Accordic Acid, HX = Horoculoric Acid, NI = Nitric Acid, SH = Sadium Hydroxide, SA = Sulfuric Acid, AB = Accordic Acid, HX = Horoculoric Acid, AB = Accordic Acid, AB = Accordic Acid, AB = Accordic Acid, ACID	Characteristic Hazards   Listed Waste	FL = Flammable/Ignitable  CO = Corrosive  (F, K, P and U-listed wastes.)  RE = Reactive  Waste code(s):  TSCA Regulated	CB = Polychlorinated biphenyls	
of Double	O Number: NA	lient Name: NWRA c/o Hart & Hickman, PC	roject/Site Name: Uwharrie Environmental Regional Landfill	ddress: Mt Gilead, NC	Collected By: Patrick Stevens	Sample ID $^*For$ composites - indicate start and stop date time	6204-1							- Malul H. Aust 09-18-19 1630		3   For sample shipping and delivery details, see Sample Receipt & Review form (SRR)	Chain of Castody Number = Client Determined	QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Fileded: For Boning marrices, indicate with a - Y - for ves	Matrix Codex; DW=Drinking Water, GW=Groundwater, SW=	Sample Analysis Requested: Analytical method requested (i.e. Preservative Type; HA = Hydrochloric Acid, NI = Ninic Acid.	Are there any known or possible hazards C	ith these samples?  Hg= Mercury Se= Selenium	nium Ag= Silver nium MR= Miscellaneous	= Lead RCRA metals

EEE Laboratories LLO		
101	Th	SAMPLE RECEID

Client: NABA	SAMPLE RECEIPT & REVIEW FORM
Received By: ArA	G/AR/COC/Work Order: 400 40
Da:	te Received: 9/19/19
Carrier and Tracking Number	FedEx Express FedEx Ground UPS Field Services Courier Other 762 7563 2308 -1°, 7762 7563 3418 -1° 762 7563 3290 -1°
Suspected Hazard Information $\frac{3}{2}$ $\frac{2}{2}$ *If No.	let Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
If UN	rd Class Shipped:  UN#:  UN#:    Output
received as radioactive?	notation or radioactive stickers on containers equal client designation.
radioactive?	num Net Counts Observed* (Observed Counts - Assa Park
The the chem designate samples are	otation or hazard labels on containers equal client designation.
E) Did the RSO identify possible hazards?	E is yes, select Hazards below. Flammable Foreign Soil RCRA Asherica D
Sample Receipt Criteria	Comments
Shipping containers received intact and sealed?  Circ with aking the containers received intact and sealed?	Comments/Qualifiers (Required for Non-Conforming Items)  Leaking container Other (describe)
Same t	le Applicable: Client contacted and provided COC COC created upon receipt
Daily check performed to the state of the s	ervation Method: Wet lee Packs Dry ice None Other:
Secon	perature Device Serial #: TR4-16* ndary Temperature Device Serial # (If Applicable):
6 Comples requiring chemical practical	Applicable: Seals broken Damaged contained Leaking container Other (describe)  OH — L (boffle) capreceived cracked  e ID's and Containers Affected:
7 Do any samples require Volatile Analysis?  If Press If Yes, Do liq Are liq Sample	ervation added_Lot# , are Encores or Soil Kits present for solids? YesNoNA (If yes, take to VOA Freezer) puid VOA vials contain acid preservation? YesNoNA (If unknown, select No)  ID's and containers affected:
V Sign	d tests affected:
Date & time and Y	containers affected:
10 Date & time on COC match date & time on bottles?	Applicable: No dates on containers No times on containers COC missing info Other (describe)
number indicated on COC?	applicable: No container count on COC Other (describe)
GEL provided?  COC form is properly signed in	
relinquished/received sections?  Comments (Use Continuation Form if needed):	Other (describe)
PM (or PMA) review: Initials	Date 175 Page of GL-CHL-SR-001 Rev 6

List of current GEL Certifications as of 08 November 2019

State	Certification
Alaska	17-018
Alaska Drinking Water	SC00012
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M-SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122020-1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	2019–165
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-19-15
Utah NELAP	SC000122019-28
Vermont	VT87156
Virginia NELAP	460202
Washington	C780





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PO Box 30712 Charleston, SC 29417 2040 Savage Road Charleston, SC 29407 P 843.556.8171 F 843.766.1178

gel.com

November 08, 2019

Mr. Jim Riley NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804 Arlington, Virginia 22202

Re: Analytical for Great Oak Landfill

Work Order: 490876

Dear Mr. Riley:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 19, 2019. This revised data report has been prepared and reviewed in accordance with GEL's standard operating procedures. This package was revised to include PFPeA and PFOA.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,

Julie Robinson Project Manager

Purchase Order: GELP19-0905

Enclosures

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# Certificate of Analysis Report for

NWRA001 NWRA – Carolinas Chapter Client SDG: 490876 GEL Work Order: 490876

#### The Qualifiers in this report are defined as follows:

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- J See case narrative for an explanation
- J Value is estimated
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Julie Robinson.

Reviewed by

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# **Certificate of Analysis**

Project:

Client ID:

NWRA00119

NWRA001

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forGreat Oak Landfill

Client Sample ID: 7607-1
Sample ID: 490876001
Matrix: Misc Liquid
Collect Date: 17-SEP-19 13:10

Receive Date: 19-SEP-19 Collector: Client

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Anal	yst Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537Mod PFCs by LC	C-MS/MS '	'As Received"										
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N EtFOSAA)	J	15.6	13.2	40.0	ng/L	0.200	1	JLS	10/04/19	1052	1921240	1
N-methylperfluoro-1- octanesulfonamidoacetic acid (N MeFOSAA)	1-	42.4	13.2	40.0	ng/L	0.200	1					
Perfluorobutanesulfonic acid (PI	FBS)	72.2	6.60	17.8	ng/L	0.200	1					
Perfluorobutyric acid (PFBA)		303	6.60	20.0	ng/L	0.200	1					
Perfluorodecanesulfonic acid (PFDS)	J	7.10	6.60	19.4	ng/L	0.200	1					
Perfluorodecanoic acid (PFDA)	J	18.5	7.80	20.0	ng/L	0.200	1					
Perfluorododecanoic acid (PFDo	oA) U	ND	6.60	20.0	ng/L	0.200	1					
Perfluoroheptanesulfonic acid (PFHpS)	U	ND	6.60	19.0	ng/L	0.200	1					
Perfluoroheptanoic acid (PFHpA	<b>A</b> )	68.4	6.60	20.0	ng/L	0.200	1					
Perfluorohexanesulfonic acid (PFHxS)		59.1	6.60	18.2	ng/L	0.200	1					
Perfluorohexanoic acid (PFHxA)	)	449	6.60	20.0	ng/L	0.200	1					
Perfluorononanesulfonic acid (PFNS)	U	ND	7.00	19.2	ng/L	0.200	1					
Perfluorononanoic acid (PFNA)		32.8	6.60	20.0	ng/L	0.200	1					
Perfluorooctanesulfonamide (PFOSA)	J	8.75	6.60	18.6	ng/L	0.200	1					
Perfluorooctanesulfonic acid (PF	FOS)	83.9	8.00	20.0	ng/L	0.200	1					
Perfluorooctanoic acid (PFOA)		108	7.00	20.0	ng/L	0.200						
Perfluoropentanesulfonic acid (PFPeS)	J	10.3	6.60	18.8	ng/L	0.200	1					
Perfluoropentanoic acid (PFPeA		159	6.60	20.0	ng/L	0.200						
Perfluoroundecanoic acid (PFUd	,	7.44	6.60	20.0	ng/L	0.200						
Fluorotelomer sulfonate 8:2 (8:2 FTS)	U	ND	132	384	ng/L	0.200	10	JLS	10/02/19	0740	1921240	2
Perfluorotetradecanoic acid (PFTeDA)	U	ND	66.0	200	ng/L	0.200	10					
Perfluorotridecanoic acid (PFTrI	DA) U	ND	66.0	200	ng/L	0.200	10					
Fluorotelomer sulfonate 4:2 (4:2 FTS)	U	ND	1320	3760	ng/L	0.200	100	JLS	10/02/19	1143	1921240	3
Fluorotelomer sulfonate 6:2 (6:2 FTS)	U	ND	1320	3800	ng/L	0.200	100					
The following Prep Metho	ods were pe	erformed:										

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**Certificate of Analysis** 

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forGreat Oak Landfill

Client Sample ID: 7607-1 Project: NWRA00119 Sample ID: 490876001 Client ID: NWRA001

Parameter	Qualifier	Result	DL	RL	Units I	PF DF	Analyst Date	Time Batch	Method
The following Prep Methods were performed:									
Method	Description	n		Analyst	Date	Time	Prep Batch		
EPA 537.1 Mod, PFA	S, Compl PFCs Extract	ion in Liquid		LM1	09/27/19	0830	1921239		
The following A	nalytical Methods v	vere performed	:						

MethodDescriptionAnalyst Comments1EPA 537.1 Mod, PFAS, Compliant with QSM Table B-152EPA 537.1 Mod, PFAS, Compliant with QSM Table B-153EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15

#### **Notes:**

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

MDA: Minimum Detectable Activity

Lc/LC: Critical Level

PF: Prep Factor

RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

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Project:

Client ID:

NWRA00119

NWRA001

# **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forGreat Oak Landfill

Client Sample ID: 7607-EB
Sample ID: 490876002
Matrix: Misc Liquid
Collect Date: 17-SEP-19 12:40

Receive Date: 19-SEP-19 Collector: Client

Parameter Quali	fier	Result	DL	RL	Units	PF	DF	Anal	yst Date	Time	e Batch	Method
LCMSMS PFCs												
EPA 537Mod PFCs by LC-MS/MS "As Received"												
Fluorotelomer sulfonate 4:2 (4:2 FTS)	U	ND	1.15	3.29	ng/L	0.0175	1	JLS	10/02/19	0941	1921240	1
Fluorotelomer sulfonate 6:2 (6:2 FTS)	U	ND	1.15	3.32	ng/L	0.0175	1					
Fluorotelomer sulfonate 8:2 (8:2 FTS)	U	ND	1.15	3.36	ng/L	0.0175	1					
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	U	ND	1.15	3.50	ng/L	0.0175	1					
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	U	ND	1.15	3.50	ng/L	0.0175	1					
Perfluorobutanesulfonic acid (PFBS)	U	ND	0.577	1.56	ng/L	0.0175	1					
Perfluorobutyric acid (PFBA)	J	1.12	0.577	1.75	ng/L	0.0175	1					
Perfluorodecanesulfonic acid (PFDS)	U	ND	0.577	1.70	ng/L	0.0175	1					
Perfluorodecanoic acid (PFDA)	U	ND	0.682	1.75	ng/L	0.0175	1					
Perfluorododecanoic acid (PFDoA)	U	ND	0.577	1.75	ng/L	0.0175	1					
Perfluoroheptanesulfonic acid (PFHpS)	U	ND	0.577	1.66	ng/L	0.0175	1					
Perfluoroheptanoic acid (PFHpA)	U	ND	0.577	1.75	ng/L	0.0175	1					
Perfluorohexanesulfonic acid (PFHxS)	U	ND	0.577	1.59	ng/L	0.0175	1					
Perfluorohexanoic acid (PFHxA)	U	ND	0.577	1.75	ng/L	0.0175	1					
Perfluorononanesulfonic acid (PFNS)	U	ND	0.612	1.68	ng/L	0.0175	1					
Perfluorononanoic acid (PFNA)	U	ND	0.577	1.75	ng/L	0.0175	1					
Perfluorooctanesulfonamide (PFOSA)	U	ND	0.577	1.63	ng/L	0.0175						
Perfluorooctanesulfonic acid (PFOS)	U	ND	0.699	1.75	ng/L	0.0175	1					
Perfluorooctanoic acid (PFOA)	U	ND	0.612	1.75	ng/L	0.0175	1					
Perfluoropentanesulfonic acid (PFPeS)	U	ND	0.577	1.64	ng/L	0.0175	1					
Perfluoropentanoic acid (PFPeA)	U	ND	0.577	1.75	ng/L	0.0175	1					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	0.577	1.75	ng/L	0.0175	1					
Perfluorotridecanoic acid (PFTrDA)	U	ND	0.577	1.75	ng/L	0.0175	1					
Perfluoroundecanoic acid (PFUdA)	U	ND	0.577	1.75	ng/L	0.0175	1					
The following Prep Methods w	ere pe	erformed:										

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# **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forGreat Oak Landfill

Client Sample ID: 7607-EB Project: NWRA00119 Sample ID: 490876002 Client ID: NWRA001

Parameter	Qualifier	Result	DL	RL	Units	PF D	F Analyst Date	Time Batch	Method	
The following Prep M	ethods were p	erformed:								
Method	Descriptio	n	A	Analyst	Date	Tiı	ne Prep Batch	ı		
EPA 537.1 Mod, PFAS, Compl PFCs Extraction in Liquid			I	LM1	09/27/19	083	0 1921239			
The following Analyt	The following Analytical Methods were performed:									
Method	thod Description Analyst Comments									

EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15

#### **Notes:**

Column headers are defined as follows:

DF: Dilution Factor Lc/LC: Critical Level PF: Prep Factor DL: Detection Limit MDA: Minimum Detectable Activity RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

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# **QC Summary**

NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804

Arlington, Virginia Mr. Jim Riley

Workorder: 490876

**Contact:** 

Report Date: November 8, 2019

Page 1 of 6

Parmname	NOM	Sample Q	ual QC	Units R	PD/D% REC%	Range Anlst	Date Time
Perfluorinated Compounds Batch 1921240							
QC1204391614 LCS Fluorotelomer sulfonate 4:2 (4:2 FTS)	18.2		15.7	ng/L	86	(60%-145%) JL	S 10/02/19 06:05
Fluorotelomer sulfonate 6:2 (6:2 FTS)	18.5		20.4	ng/L	110	(56%-143%)	
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.7		17.5	ng/L	94	(57%-138%)	
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	19.5		19.3	ng/L	99	(63%-131%)	
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	19.5		21.5	ng/L	111	(62%-133%)	
Perfluorobutanesulfonic acid (PFBS)	17.2		16.6	ng/L	96	(68%-136%)	
Perfluorobutyric acid (PFBA)	19.5		19.7	ng/L	101	(70%-133%)	
Perfluorodecanesulfonic acid (PFDS)	18.8		16.8	ng/L	89	(53%-142%)	
Perfluorodecanoic acid (PFDA)	19.5		18.0	ng/L	93	(62%-135%)	
Perfluorododecanoic acid (PFDoA)	19.5		19.5	ng/L	100	(66%-131%)	
Perfluoroheptanesulfonic acid (PFHpS)	18.5		18.1	ng/L	98	(66%-138%)	
Perfluoroheptanoic acid (PFHpA)	19.5		17.9	ng/L	92	(67%-135%)	
Perfluorohexanesulfonic acid (PFHxS)	17.7		14.5	ng/L	82	(64%-137%)	
Perfluorohexanoic acid (PFHxA)	19.5		18.9	ng/L	97	(67%-133%)	

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# **QC Summary**

Workorder: 490876 Page 2 of 6

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range A	Anlst	Date Time
<b>Perfluorinated Compounds</b> Batch 1921240									
Perfluorononanesulfonic acid (PFNS)	18.7		17.5	ng/L		93	(66%-130%)	JLS	10/02/19 06:05
Perfluorononanoic acid (PFNA)	19.5		21.1	ng/L		108	(66%-134%)		
Perfluorooctanesulfonamide (PFOSA)	19.5		21.5	ng/L		111	(68%-137%)		
Perfluorooctanesulfonic acid (PFOS)	19.5		19.8	ng/L		102	(61%-131%)		
Perfluorooctanoic acid (PFOA)	19.5		18.8	ng/L		97	(63%-145%)		
Perfluoropentanesulfonic acid (PFPeS)	18.3		16.5	ng/L		90	(62%-139%)		
Perfluoropentanoic acid (PFPeA)	19.5		19.3	ng/L		99	(69%-132%)		
Perfluorotetradecanoic acid (PFTeDA)	19.5		22.5	ng/L		115	(65%-143%)		
Perfluorotridecanoic acid (PFTrDA)	19.5		19.9	ng/L		102	(57%-149%)		
Perfluoroundecanoic acid (PFUdA)	19.5		19.1	ng/L		98	(65%-134%)		
QC1204391615 LCSD Fluorotelomer sulfonate 4:2 (4:2 FTS)	17.6		20.5	ng/L	26	116	(0%-35%)		10/02/19 06:14
Fluorotelomer sulfonate 6:2 (6:2 FTS)	17.9		17.6	ng/L	14	98	(0%-36%)		
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.1		19.9	ng/L	13	110	(0%-39%)		
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	18.8		20.1	ng/L	4	107	(0%-25%)		
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	18.8		21.9	ng/L	2	116	(0%-26%)		

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# **QC Summary**

Workorder: 490876 Page 3 of 6

								Page 3 of 6
Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range Anlst	Date Time
Perfluorinated Compounds Batch 1921240								
Perfluorobutanesulfonic acid (PFBS)	16.7		17.2	ng/L	4	103	(0%-30%) JLS	10/02/19 06:14
Perfluorobutyric acid (PFBA)	18.8		19.3	ng/L	2	102	(0%-30%)	
Perfluorodecanesulfonic acid (PFDS)	18.2		17.2	ng/L	3	95	(0%-28%)	
Perfluorodecanoic acid (PFDA)	18.8		21.1	ng/L	16	112	(0%-29%)	
Perfluorododecanoic acid (PFDoA)	18.8		19.0	ng/L	3	101	(0%-30%)	
Perfluoroheptanesulfonic acid (PFHpS)	17.9		17.7	ng/L	2	99	(0%-30%)	
Perfluoroheptanoic acid (PFHpA)	18.8		19.6	ng/L	9	104	(0%-30%)	
Perfluorohexanesulfonic acid (PFHxS)	17.2		16.8	ng/L	15	98	(0%-30%)	
Perfluorohexanoic acid (PFHxA)	18.8		20.9	ng/L	10	111	(0%-23%)	
Perfluorononanesulfonic acid (PFNS)	18.1		18.2	ng/L	4	101	(0%-27%)	
Perfluorononanoic acid (PFNA)	18.8		18.7	ng/L	12	99	(0%-27%)	
Perfluorooctanesulfonamide (PFOSA)	18.8		20.2	ng/L	6	107	(0%-30%)	
Perfluorooctanesulfonic acid (PFOS)	18.8		19.9	ng/L	1	106	(0%-27%)	
Perfluorooctanoic acid (PFOA)	18.8		18.9	ng/L	0	100	(0%-30%)	
Perfluoropentanesulfonic acid (PFPeS)	17.7		17.3	ng/L	4	98	(0%-29%)	

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# **QC Summary**

Workorder: 490876 Page 4 of 6 QC **Parmname** NOM Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** Batch 1921240 Perfluoropentanoic acid (PFPeA) 18.8 20.0 ng/L 3 106 (0%-30%)JLS 10/02/19 06:14 Perfluorotetradecanoic acid 18.8 20.6 ng/L 9 109 (0%-30%)(PFTeDA) Perfluorotridecanoic acid 18.8 17.7 ng/L 11 94 (0%-35%)(PFTrDA) Perfluoroundecanoic acid (PFUdA) 18.8 21.2 ng/L 10 112 (0%-28%)QC1204391613 MB U Fluorotelomer sulfonate 4:2 (4:2 ND 10/02/19 05:56 ng/L FTS) U Fluorotelomer sulfonate 6:2 (6:2 ND ng/L FTS) U ND Fluorotelomer sulfonate 8:2 (8:2 ng/L FTS) U N-ethylperfluoro-1-ND ng/L octanesulfonamidoacetic acid (N-EtFOSAA) U ND N-methylperfluoro-1ng/L octanesulfonamidoacetic acid (N-MeFOSAA) U ND Perfluorobutanesulfonic acid ng/L (PFBS) Perfluorobutyric acid (PFBA) U ND ng/L U Perfluorodecanesulfonic acid ND ng/L (PFDS) Perfluorodecanoic acid (PFDA) U ND ng/L U ND Perfluorododecanoic acid (PFDoA) ng/L Perfluoroheptanesulfonic acid U ND ng/L (PFHpS)

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# **QC Summary**

Workorder: 490876 Page 5 of 6 NOM QC **Parmname** Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** 1921240 Batch Perfluoroheptanoic acid (PFHpA) U ND ng/L JLS 10/02/19 05:56 U ND Perfluorohexanesulfonic acid ng/L (PFHxS) U Perfluorohexanoic acid (PFHxA) ND ng/L U Perfluorononanesulfonic acid ND ng/L (PFNS) U ND Perfluorononanoic acid (PFNA) ng/L U Perfluorooctanesulfonamide ND ng/L (PFOSA) U Perfluorooctanesulfonic acid ND ng/L (PFOS) U ND Perfluorooctanoic acid (PFOA) ng/L U ND Perfluoropentanesulfonic acid ng/L (PFPeS) Perfluoropentanoic acid (PFPeA) U ND ng/L U ND Perfluorotetradecanoic acid ng/L (PFTeDA) Perfluorotridecanoic acid U ND ng/L (PFTrDA)

U

ND

ng/L

#### **Notes:**

The Qualifiers in this report are defined as follows:

\*\* Analyte is a surrogate compound

Perfluoroundecanoic acid (PFUdA)

- < Result is less than value reported
- > Result is greater than value reported

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## **QC Summary**

Page 6 of 6 Sample Qual Parmname **NOM** OC Units RPD/D% REC% Range Anlst Date Time Α The TIC is a suspected aldol-condensation product В The target analyte was detected in the associated blank. C Analyte has been confirmed by GC/MS analysis

- D Results are reported from a diluted aliquot of the sample
- E Concentration of the target analyte exceeds the instrument calibration range
- H Analytical holding time was exceeded

490876

- J See case narrative for an explanation
- J Value is estimated

Workorder:

- JNX Non Calibrated Compound
- N Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- $\ensuremath{N/A}$   $\ensuremath{\mbox{ RPD}}$  or %Recovery limits do not apply.
- N1 See case narrative
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, the difference is >70%.
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UJ Compound cannot be extracted
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y QC Samples were not spiked with this compound
- ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
- h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.  $^{\circ}$  The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of  $^{+/-}$  the RL is used to evaluate the DUP result.

\* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

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### LCMSMS-Misc Technical Case Narrative NWRA - Carolinas Chapter SDG #: 490876

**Product:** The Extraction and Analysis of Per and Polyfluroalkyl Substances Using LCMSMS

Analytical Method: EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15

**Analytical Procedure:** GL-OA-E-076 REV# 7 **Analytical Batches:** 1921240 and 1921239

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
490876001	7607-1
490876002	7607-EB
1204391613	Method Blank (MB)
1204391614	Laboratory Control Sample (LCS)
1204391615	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

#### **Technical Information**

#### **Sample Dilutions**

The following samples were diluted to bring the over range concentrations within the calibration range and/or due to matrix interference that caused internal standards recoveries to fall outside the acceptance range. 490876001 (7607-1).

Amalasta	490876
Analyte	001
Fluorotelomer sulfonate 4:2 (4:2 FTS)	100X
Fluorotelomer sulfonate 6:2 (6:2 FTS)	100X
Fluorotelomer sulfonate 8:2 (8:2 FTS)	10X
Perfluorotetradecanoic acid (PFTeDA)	10X
Perfluorotridecanoic acid (PFTrDA)	10X

#### **Miscellaneous Information**

#### **Additional Comments**

Additional sample volume was not provided for matrix QC. Also, reduced sample volumes were used for all samples except 490876002(7607-EB) (7607-EB) due to elevated concentrations of target analytes. PFBA was detected in the following samples above the MDL but less than LOQ. The sample is identified as Field Reagent Blanks (FRB). All samples associated with these blanks contained PFBA concentrations greater than 10 times that found in the blank. 490876002 (7607-EB).

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### **Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

Page 14 of 17 SDG: 490876 Rev1

GEL Laboratories, LLC 2040 Savage Road	Charleston, SC 29407 Phone: (843) 556-8171	Fax: (843) 766-1178	(Fill in the number of containers for each test)	< Preservative Type (6)		70SIM Note: extra sample is								cify: (Subject to Surcharge)		Level 2   Level 3   Level 4		s [] No Cooler Temp:C	Company of the compan			Nasal		Please provide any additional details below regarding handling andor disposal	concerns. (i.e.: Origin of sample(s), type of site collected from odd matrices etc.)			
	alty Analytics		Sample Analysis Requested (3) (Fill in the numb	\$33	PFAS 21 cmpd list by EPA 537 mod	Ι	Fotal number	+-	× × × ×					TAT Requested: Normal: X Rush: Specify:	Fax Results: [ ] Yes [X] No		Additional Remarks:	For Lab Receiving Use Only: Custody Seal Intact? [ ] Yes	Sample Concetton time Zone; M. Eastennage J. Facines: [1] Central [1] Mountain and J. Other.	e. G = Grab, C = Composite		4.) Matrix Codes: DW=Drinking Water. GW=Groundwater, SW=Surface Water, WW=Waste Water, W=Water, WL=Miter. JW=Nasal SD=Sediment, SJ=Sediment, SJ=Shidge, SS=Solid Waste. O=Oil. F=Filter. P=Wipe. U=Urine. F=Fecal, N=Nasal S.) Sample Analysis Requested: Analytical method requested (i.e. 82608.601087/470A) and number of containers provided for each (i.e. 82608 - 3, 601087470A - 1).	ulfate. If no preservative is added = leave field blank	Other OT= Other / Unknown	(i.e.: Highlow pH, asbestos, beryllium, irritants, other misc. health hazards, etc.)	Description:		
ries III (	stry i Radiobioas nalytical R	anager:		Should this	sample be considered:	com	Radioaciive Solopie info Radioaciive								Fax R	Select	Addin	For L	Time Zone. I	: Duplicate Sample		ment, SL=Sludge, 010B/74704 - 1).	T = Sodium Thios	Other OT= (	(i.e.: I misc.)	Descr		
_ Laboratories LL	gelcom   Chemistry   Radiochemistry   Radiobipassay   Speci Chain of Custody and Analytical Request	GEL Project Manager:	919-847-4241	704-586-0007		Send Results To:Genna Olson golson@harthickman	QC Field Sample Code (2) Filtered (3) Matrix (4)	z	EB N ML						Date Time	0820 61/61		Sample Collection	Sample Concention	pike Sample, MSD = Matrix Spike	s not field filtered.	"Misc Liquid, SO=Soil, SD=Sedi rovided for each (i.e. 8260B - 3, 6	= Ascorbic Acid, HX = Hexane, S	Waste Listed Waste	(F,K,P and U-listed wastes.) Waste code(s):			
			Phone # 9	Fax # 7		ia Olson gol	*Time ed Collected (Military) (thum)	ļ. 	9 1240					res		6		ram (SBB)	(awa)	ink, MS = Matrix S	- N - for sample wa	ater, W=Water, ML nber of containers pr	Sulfuric Acid, AA =	Listed V LW= L	(F.K.P o			
	0 \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	GEL Work Order Number:	n, PC			end Results To;Genn	*Date Collected  (mm-dd-yy)	0	09-17-19					Chain of Custody Signatures	Received by (signed)	8		3 Appenies & Reviews for	af various in distance of	Juplicate, <b>EB</b> = Equipment Bla	the sample was field filtered or	Surface Water, WW=Waste W: 8260B, 6010B/7470A) and nun	SH = Sodium Hydroxide, SA =	Characteristic Hazards FL = Flammable/Ignitable	CO = Corrosive RE = Reactive	Frysland VO	PCB = Polychlorinated	biphenyls
NWA-001		NA	Client Name: NWRA c/o Hart & Hickman, PC	Project/Site Name: Great Oak Landfill	Address: Randleman, NC	Collected By: Patrick Stevens S	Sample ID * For composites - indicate start and stop datetime	7607-1	7607-EB						1 1	- Maria H. Jours 09-18-19 1630		3  For summle whitning and delivery details, see Sannile Receipt & Review form (SPR)	1.) Chain of Custody Number = Client Determined	2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite	3.) Field Fithered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered.	<ol> <li>Matrix Codes: DW=Drnking Water, GW=Groundwater, SW=Surface Water, WW=Water, W=Water, ML=Mise Liquid, SO=Soil, SD=Sediment, SL=Sludge,</li> <li>Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B7/470A) and number of containers provided for each (i.e. 8260B - 3, 6010B7/470A - 1).</li> </ol>	6.) Preservative Type: HA = Hydrochloric Acid, NI = Niric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid. HX = Hexane, ST = Sodium Thiosulfare, If no preservative is added = leave field blank	7.) Are there any known or possible hazards associated with these samples?	5	$As = Arsenic$ $Hg = Mercury$ $Ra = Ranium$ $C_0 = Colonium$	Ag= Silver	Cr = Chromium MR= Miscellaneous Pb = Lead RCRA metals

CEE Laboratories (19)	
Client: NNBA	SAMPLE RECEIPT & REVIEW FORM
Received By:	SDG/AloCOC/Work Order: US 0
	Date Received: 9/19/19
Carrier and Tracking Number	Circle Applicable:  7762 7563 2308 -1, 7762 7563 3418-1°  7762 7563 2764-1, 7762 7563 3290-1°
Suspected Hazard Information $\stackrel{3}{>} \stackrel{2}{\sim} \stackrel{4}{\sim}$	If Net Counts > 100cpm on counts
A)Shipped as a DOT Hazardous?	If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
B) Did the client designate the causel	UN#: UN2910, Is the Radioactive Shipment Survey Compliant? Yes No  OC notation or radioactive stickers on containers equal client designation.
C) Did the RSO classify the samples as radioactive?	aximum Net Counts Observed* (Observed Counts - Area Background Counts):CPM / mR/Hr assified as: Rad 1
	C notation or hazard labels on containers equal client designation.
E) Did the RSO identify possible hazards?	or E is yes, select Hazards below.
Sample Receipt Criteria	Associates Beryllium Other:
1 Shipping containers received intact and sealed?	Comments/Qualifiers (Required for Non-Conforming Items)  Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
with shipment?	Circle Applicable: Client contacted and provided COC COC created upon receipt
3 Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	Preservation Method: Wet to Ice Packs Dry ice None Other:
temperature gun?	Femperature Device Serial #: \(\frac{TR4-LB}{Apple 11}\) secondary Temperature Device Serial # (If Apple 11)
Sample containers intact and sealed?	ricie Applicable: Sealsbroken Damaged contained Leaking coptainer Other (describe)
V	proper ID's and Containers Affected:  Preservation added, Lot#
7 Do any samples require Volatile Analysis?	Yes, are Encores or Soil Kits present for solids? YesNo NA (If yes, take to VOA Freezer) o liquid VOA vials contain acid preservation? YesNo NA (If unknown, select No) nple ID's and containers affected:
8 Samples received within holding time? / ID's	s and tests affected:
V 1988	and containers affected:
Date & time on COC match date & time on bottles?	le Applicable: No dates on containers No times on containers COC missing info Other (describe)
number indicated on COC?	le Applicable: No container count on COC Other (describe)
Are sample containers identifiable as GEI. provided?  COC form is properly signed in Circle	
relinquished/received sections?  Comments (Use Continuation Form if needed):	e Applicable: Not relinquished Other (describe)
PM (or PMA) review; Initials	VOX Date 122 1 A

Page 16 of 17 SDG: 490876 Rev1

GL-CHL-SR-001 Rev 6

List of current GEL Certifications as of 08 November 2019

5-00253
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3











PO Box 30712 Charleston, SC 29417 2040 Savage Road Charleston, SC 29407 P 843.556.8171 F 843.766.1178

gel.com

November 08, 2019

Mr. Jim Riley NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804 Arlington, Virginia 22202

Re: Analytical for East Carolina Reginal Landfill

a member of The GEL Group INC

Work Order: 490877

Dear Mr. Riley:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 20, 2019. This revised data report has been prepared and reviewed in accordance with GEL's standard operating procedures. This package was revised to include PFPeA and PFOA.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,

Julie Robinson Project Manager

Purchase Order: GELP19-0905

Enclosures

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# Certificate of Analysis Report for

NWRA001 NWRA – Carolinas Chapter Client SDG: 490877 GEL Work Order: 490877

#### The Qualifiers in this report are defined as follows:

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- J See case narrative for an explanation
- J Value is estimated
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Julie Robinson.

Reviewed by

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# **Certificate of Analysis**

Project:

Client ID:

NWRA00119

NWRA001

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical for East Carolina Reginal Landfill

Client Sample ID: 0803-1
Sample ID: 490877001
Matrix: Misc Liquid

Collect Date: 19-SEP-19 10:35
Receive Date: 20-SEP-19
Collector: Client

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Anal	yst Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537Mod PFCs by LO	C-MS/MS '	'As Received"										
Fluorotelomer sulfonate 4:2 (4:2		ND	13.2	37.6	ng/L	0.200	1	JLS	10/02/19	0950	1921240	1
FTS)					C							
N-ethylperfluoro-1-	_	237	13.2	40.0	ng/L	0.200	1					
octanesulfonamidoacetic acid (N	<b>1</b> -											
EtFOSAA) N-methylperfluoro-1-		230	13.2	40.0	ng/L	0.200	1					
octanesulfonamidoacetic acid (N	J_	230	13.2	40.0	lig/L	0.200	1					
MeFOSAA)	•											
Perfluorodecanesulfonic acid	U	ND	6.60	19.4	ng/L	0.200	1					
(PFDS)												
Perfluorodecanoic acid (PFDA)		90.8	7.80	20.0	ng/L	0.200						
Perfluorododecanoic acid (PFDe		ND	6.60	20.0	ng/L	0.200						
Perfluoroheptanesulfonic acid	J	9.39	6.60	19.0	ng/L	0.200	1					
(PFHpS) Perfluoroheptanoic acid (PFHpA	()	689	6.60	20.0	ng/L	0.200	1					
Perfluorohexanesulfonic acid	1)	536	6.60	18.2	ng/L ng/L	0.200						
(PFHxS)		550	0.00	16.2	ng/L	0.200	1					
Perfluorononanesulfonic acid	U	ND	7.00	19.2	ng/L	0.200	1					
(PFNS)		00.0		20.0	7	0.200						
Perfluorononanoic acid (PFNA)		89.0	6.60	20.0	ng/L	0.200						
Perfluorooctanesulfonamide (PFOSA)	J	17.3	6.60	18.6	ng/L	0.200	1					
Perfluorooctanesulfonic acid (Pl	FOS)	402	8.00	20.0	ng/L	0.200	1					
Perfluorooctanoic acid (PFOA)	(05)	1640	7.00	20.0	ng/L	0.200						
Perfluoropentanesulfonic acid		54.7	6.60	18.8	ng/L	0.200						
(PFPeS)		31.7	0.00	10.0	1.6, 2	0.200	•					
Perfluoropentanoic acid (PFPeA	.)	1220	6.60	20.0	ng/L	0.200	1					
Perfluoroundecanoic acid (PFU	dA) U	ND	6.60	20.0	ng/L	0.200	1					
Perfluorobutanesulfonic acid (P	FBS)	3850	66.0	178	ng/L	0.200	10	JLS	10/02/19	0749	1921240	2
Perfluorobutyric acid (PFBA)		650	66.0	200	ng/L	0.200	10					
Perfluorohexanoic acid (PFHxA	.)	3610	66.0	200	ng/L	0.200	10					
Perfluorotetradecanoic acid (PFTeDA)	U	ND	66.0	200	ng/L	0.200	10					
Perfluorotridecanoic acid (PFTr	DA) U	ND	66.0	200	ng/L	0.200	10					
Fluorotelomer sulfonate 6:2 (6:2 FTS)	2 U	ND	1320	3800	ng/L	0.200	100	JLS	10/02/19	1151	1921240	3
Fluorotelomer sulfonate 8:2 (8:2 FTS)	2 U	ND	1320	3840	ng/L	0.200	100					

Semi-Volatile-GC/MS

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## **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical for East Carolina Reginal Landfill

Client Sample ID: 0803-1 Project: NWRA00119 Sample ID: 490877001 Client ID: NWRA001

Parameter	Qualifier	Result	DL	RL	Units	PF DF	Analyst Date	Time Batch	Method
Semi-Volatile-GC	/MS								
SW846 8270 SIM	1,4-Dioxane in Li	quid "As Received"							
1,4-Dioxane		157	4.00	8.00	ug/L	0.200 4	JMB3 09/24/19	1919 1919444	4
The following Pre	p Methods were pe	erformed:							
Method	Description	1		Analyst	Date	Time	e Prep Batch		
EPA 537.1 Mod, PFAS	S, Compl PFCs Extracti	on in Liquid		LM1	09/27/19	0830	1921239		
SW846 3535A	SW8270E SII	M Prep 1,4-Dioxane		SJW1	09/23/19	1200	1919441		
FF1 C 11	1 . 13 . 1								

### The following Analytical Methods were performed:

Description

Michiga	Description	1	mary st Con	IIIICIIC		
1	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15					
2	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15					
3	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15					
4	SW846 3535A/8270E SIM					
Surrogate/Tracer Recove	ary Test	Regult	Nominal	Recovery%	Acceptable Limits	

Analyst Comments

Surrogate/Tracer Recovery	Test	Result	Nominal	Recovery%	Acceptable Limits
1,4-Dioxane-d8	SW846 8270 SIM 1,4-Dioxane in Liquid "As Received"	27.3 ug/L	40.0	68*	(70%-130%)

# Notes:

Method

### Column headers are defined as follows:

DF: Dilution Factor Lc/LC: Critical Level
DL: Detection Limit PF: Prep Factor
MDA: Minimum Detectable Activity RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

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# **QC Summary**

NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804

Arlington, Virginia

**Contact:** Mr. Jim Riley

Workorder: 490877

Report Date: November 8, 2019

Page 1 of 7

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Perfluorinated Compounds Batch 1921240 ———											
QC1204391614 LCS Fluorotelomer sulfonate 4:2 (4:2 FTS)	18.2			15.7	ng/L		86	(60%-145%)	) JLS	10/02/1	9 06:05
Fluorotelomer sulfonate 6:2 (6:2 FTS)	18.5			20.4	ng/L		110	(56%-143%)	)		
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.7			17.5	ng/L		94	(57%-138%)	)		
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	19.5			19.3	ng/L		99	(63%-131%)	)		
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	19.5			21.5	ng/L		111	(62%-133%)	)		
Perfluorobutanesulfonic acid (PFBS)	17.2			16.6	ng/L		96	(68%-136%)	)		
Perfluorobutyric acid (PFBA)	19.5			19.7	ng/L		101	(70%-133%)	)		
Perfluorodecanesulfonic acid (PFDS)	18.8			16.8	ng/L		89	(53%-142%)	)		
Perfluorodecanoic acid (PFDA)	19.5			18.0	ng/L		93	(62%-135%)	)		
Perfluorododecanoic acid (PFDoA)	19.5			19.5	ng/L		100	(66%-131%)	)		
Perfluoroheptanesulfonic acid (PFHpS)	18.5			18.1	ng/L		98	(66%-138%)	)		
Perfluoroheptanoic acid (PFHpA)	19.5			17.9	ng/L		92	(67%-135%)	)		
Perfluorohexanesulfonic acid (PFHxS)	17.7			14.5	ng/L		82	(64%-137%)	)		
Perfluorohexanoic acid (PFHxA)	19.5			18.9	ng/L		97	(67%-133%)	)		

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# **QC Summary**

Workorder: 490877 Page 2 of 7

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst		Time
Perfluorinated Compounds		•						.,			
Batch 1921240											
Perfluorononanesulfonic acid (PFNS)	18.7			17.5	ng/L		93	(66%-130%)	) JLS	10/02/1	9 06:05
Perfluorononanoic acid (PFNA)	19.5			21.1	ng/L		108	(66%-134%	)		
Perfluorooctanesulfonamide (PFOSA)	19.5			21.5	ng/L		111	(68%-137%	)		
Perfluorooctanesulfonic acid (PFOS)	19.5			19.8	ng/L		102	(61%-131%)	)		
Perfluorooctanoic acid (PFOA)	19.5			18.8	ng/L		97	(63%-145%	)		
Perfluoropentanesulfonic acid (PFPeS)	18.3			16.5	ng/L		90	(62%-139%)	)		
Perfluoropentanoic acid (PFPeA)	19.5			19.3	ng/L		99	(69%-132%	)		
Perfluorotetradecanoic acid (PFTeDA)	19.5			22.5	ng/L		115	(65%-143%)	)		
Perfluorotridecanoic acid (PFTrDA)	19.5			19.9	ng/L		102	(57%-149%	)		
Perfluoroundecanoic acid (PFUdA)	19.5			19.1	ng/L		98	(65%-134%	)		
QC1204391615 LCSD Fluorotelomer sulfonate 4:2 (4:2 FTS)	17.6			20.5	ng/L	26	116	(0%-35%)	)	10/02/1	9 06:14
Fluorotelomer sulfonate 6:2 (6:2 FTS)	17.9			17.6	ng/L	14	98	(0%-36%)	)		
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.1			19.9	ng/L	13	110	(0%-39%)	)		
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	18.8			20.1	ng/L	4	107	(0%-25%)	)		
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	18.8			21.9	ng/L	2	116	(0%-26%)	)		

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# **QC Summary**

Workorder: 490877 Page 3 of 7

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range Anlst	Date Time
Perfluorinated Compounds	110111	Sumple Quar	<u> </u>	CIIII	10 2/2 /0	ILLE 70	Tunge Time	Dute Time
Batch 1921240								
Perfluorobutanesulfonic acid (PFBS)	16.7		17.2	ng/L	4	103	(0%-30%) JLS	10/02/19 06:14
Perfluorobutyric acid (PFBA)	18.8		19.3	ng/L	2	102	(0%-30%)	
Perfluorodecanesulfonic acid (PFDS)	18.2		17.2	ng/L	3	95	(0%-28%)	
Perfluorodecanoic acid (PFDA)	18.8		21.1	ng/L	16	112	(0%-29%)	
Perfluorododecanoic acid (PFDoA)	18.8		19.0	ng/L	3	101	(0%-30%)	
Perfluoroheptanesulfonic acid (PFHpS)	17.9		17.7	ng/L	2	99	(0%-30%)	
Perfluoroheptanoic acid (PFHpA)	18.8		19.6	ng/L	9	104	(0%-30%)	
Perfluorohexanesulfonic acid (PFHxS)	17.2		16.8	ng/L	15	98	(0%-30%)	
Perfluorohexanoic acid (PFHxA)	18.8		20.9	ng/L	10	111	(0%-23%)	
Perfluorononanesulfonic acid (PFNS)	18.1		18.2	ng/L	4	101	(0%-27%)	
Perfluorononanoic acid (PFNA)	18.8		18.7	ng/L	12	99	(0%-27%)	
Perfluorooctanesulfonamide (PFOSA)	18.8		20.2	ng/L	6	107	(0%-30%)	
Perfluorooctanesulfonic acid (PFOS)	18.8		19.9	ng/L	1	106	(0%-27%)	
Perfluorooctanoic acid (PFOA)	18.8		18.9	ng/L	0	100	(0%-30%)	
Perfluoropentanesulfonic acid (PFPeS)	17.7		17.3	ng/L	4	98	(0%-29%)	

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# **QC Summary**

Workorder: 490877 Page 4 of 7 QC **Parmname** NOM Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** Batch 1921240 Perfluoropentanoic acid (PFPeA) 18.8 20.0 ng/L 3 106 (0%-30%)JLS 10/02/19 06:14 Perfluorotetradecanoic acid 18.8 20.6 ng/L 9 109 (0%-30%)(PFTeDA) Perfluorotridecanoic acid 18.8 17.7 ng/L 11 94 (0%-35%)(PFTrDA) Perfluoroundecanoic acid (PFUdA) 18.8 21.2 ng/L 10 112 (0%-28%)QC1204391613 MB U Fluorotelomer sulfonate 4:2 (4:2 ND 10/02/19 05:56 ng/L FTS) U Fluorotelomer sulfonate 6:2 (6:2 ND ng/L FTS) U ND Fluorotelomer sulfonate 8:2 (8:2 ng/L FTS) U N-ethylperfluoro-1-ND ng/L octanesulfonamidoacetic acid (N-EtFOSAA) U ND N-methylperfluoro-1ng/L octanesulfonamidoacetic acid (N-MeFOSAA) U ND Perfluorobutanesulfonic acid ng/L (PFBS) Perfluorobutyric acid (PFBA) U ND ng/L U Perfluorodecanesulfonic acid ND ng/L (PFDS) Perfluorodecanoic acid (PFDA) U ND ng/L U ND Perfluorododecanoic acid (PFDoA) ng/L Perfluoroheptanesulfonic acid U ND ng/L (PFHpS)

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# **QC Summary**

Page 5 of 7 NOM QC **Parmname** Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** 1921240 Batch Perfluoroheptanoic acid (PFHpA) U ND ng/L JLS 10/02/19 05:56 U ND Perfluorohexanesulfonic acid ng/L (PFHxS) U Perfluorohexanoic acid (PFHxA) ND ng/L U Perfluorononanesulfonic acid ND ng/L (PFNS) U Perfluorononanoic acid (PFNA) ND ng/L U Perfluorooctanesulfonamide ND ng/L (PFOSA) U Perfluorooctanesulfonic acid ND ng/L (PFOS) U ND Perfluorooctanoic acid (PFOA) ng/L U ND Perfluoropentanesulfonic acid ng/L (PFPeS) Perfluoropentanoic acid (PFPeA) U ND ng/L U ND Perfluorotetradecanoic acid ng/L (PFTeDA) Perfluorotridecanoic acid U ND ng/L (PFTrDA) U ND Perfluoroundecanoic acid (PFUdA) ng/L Semi-Volatile-GC/MS 1919444 QC1204387349 LCS 3.55 \*\*1,4-Dioxane-d8 4.00 ug/L (70%-130%) JMB3 09/24/19 12:24

Workorder:

490877

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### **QC Summary**

Workorder: 490877									Page 6	of 7
Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date Ti	ne
Semi-Volatile-GC/MS Batch 1919444										
QC1204387350 LCSD **1,4-Dioxane-d8	4.00		3.18	ug/L		79	(70%-130%)	JMB3	09/24/19 1	2:49
QC1204387348 MB 1,4-Dioxane		U	ND	ug/L					09/24/19 1	1:59
**1,4-Dioxane-d8	4.00		3.05	ug/L		76	(70%-130%)			

#### **Notes:**

The Qualifiers in this report are defined as follows:

- \*\* Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B The target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- E Concentration of the target analyte exceeds the instrument calibration range
- H Analytical holding time was exceeded
- J See case narrative for an explanation
- J Value is estimated
- JNX Non Calibrated Compound
- N Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N/A RPD or %Recovery limits do not apply.
- N1 See case narrative
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, the difference is >70%.
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UJ Compound cannot be extracted

Page 10 of 17 SDG: 490877 Rev1

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### **QC Summary**

Workorder: 490877

Parmname NOM Sample Qual QC Units RPD/D% REC% Range Anlst Date Time

- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y QC Samples were not spiked with this compound
- ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
- h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

- ^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
- \* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Page 11 of 17 SDG: 490877 Rev1

### Technical Case Narrative NWRA - Carolinas Chapter SDG #: 490877

### **GC/MS Semivolatile**

**Product:** Analysis of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas

**Chromatography/Mass Spectrometry** 

**Analytical Method:** SW846 3535A/8270E SIM **Analytical Procedure:** GL-OA-E-073 REV# 2

**Analytical Batch:** 1919444

**Preparation Method:** SW846 3535A

**Preparation Procedure:** GL-OA-E-073 REV# 2

**Preparation Batch:** 1919441

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
490877001	0803-1
1204387348	Method Blank (MB)
1204387349	Laboratory Control Sample (LCS)
1204387350	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

### **Quality Control (QC) Information**

### **Surrogate Recoveries**

Sample (See Below) did not meet surrogate recovery acceptance criteria. The sample was analyzed at a dilution. As a result, one or more surrogates were diluted out of the acceptance limits.

Sample	Analyte	Value
490877001 (0803-1)	1, 4-Dioxane-d8	68* (70%-130%)

### **Laboratory Control Sample Duplicate (LCSD)**

An LCSD was used in place of matrix QC due to limited sample volume.

### **Technical Information**

### **Sample Dilutions**

Sample 490877001 (0803-1) was diluted due to the presence of one or more over-range target analytes.

Page 12 of 17 SDG: 490877 Rev1

### **LCMSMS-Misc**

**Product:** The Extraction and Analysis of Per and Polyfluroalkyl Substances Using LCMSMS

Analytical Method: EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15

**Analytical Procedure:** GL-OA-E-076 REV# 7 **Analytical Batches:** 1921240 and 1921239

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID# Client Sample Identification

490877001 0803-1

1204391613 Method Blank (MB)

1204391614 Laboratory Control Sample (LCS)

1204391615 Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

### **Technical Information**

### **Sample Dilutions**

The following samples were diluted to bring the over range concentrations within the calibration range and/or due to matrix interference that caused internal standards recoveries to fall outside the acceptance range. 490877001 (0803-1).

Analysta	490877
Analyte	001
Fluorotelomer sulfonate 6:2 (6:2 FTS)	100X
Fluorotelomer sulfonate 8:2 (8:2 FTS)	100X
Perfluorobutanesulfonate (PFBS)	10X
Perfluorobutyric acid (PFBA)	10X
Perfluorohexanoic acid (PFHxA)	10X
Perfluorotetradecanoic acid (PFTeDA)	10X
Perfluorotridecanoic acid (PFTrDA)	10X

### **Miscellaneous Information**

### **Additional Comments**

Additional sample volume was not provided for matrix QC. Also, reduced sample volumes were used for all samples except 490876002 (7607-EB) due to elevated concentrations of target analytes.

#### **Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

Page 13 of 17 SDG: 490877 Rev1

Jo		GEL Laboratories, LLC
General Control Contro	ILC	2040 Savage Road
	iobioassay i Specialty Analytics Cal Request	Charleston, SC 29407 Phone: (843) 556-8171
ber:	" Julie Robinson	Fax: (843) 766-1178
Glent Name: NWRA clo Hart & Hickman, P.C. Phone # 919-847- 4241	sted (5)	(Fill in the number of containers for each test)
Fax#	Should this 2 N	Preservative Type (6)
Realistican Pood, Automoter, NC 27805	sample be	
Send Results Topenna Olenn 30 King britishing	r of co	Comments Note: extra sample is
Sample ID	) Known ol ossible haza ローウンエ	required for sample specific QC
0803-1 OR-19-19 1035 6 N ML	16	
Chain of Custody Signatures	TAT Requested: Normal: Kush:	Specify: (Subject to Surcharge)
Relinquished By (Signod) Date Time Received by (signed) Date Time	Fax Results: [ ] Yes   XNo	
1 14WHEL 2-19-19 1700 1 FERBX, 9-19-19, 1700		level 1   Level 2   Level 3   Level 4
2 9 Monday 400119 8:55	Additional Remarks:	
2. Or sample Supplies and actively details, see Jampie Receipt & Review Jorn (SAR.) Sample Collection Time 2. <ol> <li>Chain of Castody Number = Clien Determined.</li> </ol>	Sample Collection Time Zone: [   Eastern   ] Pacific     Central     Mountain	ountain   1 Other:
2) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite	e Sample, $G = Grab$ , $C = Composite$	
3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered.		
4.) Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Waster, W=Water, WM=Water, ML=Misc Liquid, SO=Soil, SD=Sediment, SL=Shudge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Nasal	Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=	ccal, N=Nasal
<ul> <li>Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1).</li> <li>Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfate, If no preservative is added = leave field blank</li> </ul>	$0.4 \cdot 1$ ). Thiosulfate, If no preservative is added = leave field blank	
7) Are there any known or possible hazards   Characteristic Hazards   Listed Waste associated with these samples?   LW=Listed Waste	Other Other/Unknown	Please provide any additional details
CO = Corrosive (F.K.P and t RE = Reactive Waste codet	(i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards erc.)	concerns (i.e.: Origin of sample(s), type  of with collected from old mension also
· 	Description:	of sue conceed from, our mannes, etc.)
m Ag= Silver PCB=		
Cr = Caromium   Mr = Miscellaneous biphenyls   Pb = Lead   RCRA metals   Pc = Caromium   Pc =		

GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407 Phone: (843) 556-8171 Fax: (843) 766-1178	(Fill in the number of containers for each text)  Preservative Type (6)	Note: extra sample is required for sample specific QC			Specify: (Subject to Surcharge)	[ ] Level 2 [ ] Level 3 [ ]	Mcuntain [ ] Other.  F-Fecal, N=Nasal	Please provide any additional details below regarding handling and/or disposal other concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)
Laboratories LLC Chemistry I Radiobioassay I Specialty Analytics  Foustody and Analytical Request  GEL Project Munager:	Sample Analysis Requested 63 he contained 2 N contained contained 2 N contained contai	oversolbest address scools of the address of the ad	3		TAT Requested: Normal: Kush: Fax Results: [] Yes [] No	Select Deliverable: [ ] C of A [ ] QC Summary [ ] level 1  SS Additional Remarks:	For Lab Receiving Use Only: Custody Seal Intact? [ ] Yes [   Sample Collection Time Zone [ ] Eastern [ ] Pacific [ ] Central [ ] Mountain [ ] mple, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite eld filtered.  Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Soild Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Nasal 1 for each (i.e. 8260B - 3, 6010B/74704 - 1).	Other  Other  Other / Unknown  (i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards, etc.)  Description:
Chain of Custody and Analytical Request	Phone # <b>9.9 – 6.4</b> Pax # BOS	Send Results To: From A size Prothydeuman - tunn A size Prothydeuman - tunn A Time Collected Collected Collected Collected (Military) Code (I Field Sample (Military) Code (I Filed Sample 1 A A 1 Military)			Chain of Custody Signatures ine Received by (signed) Date Time		For Lab Receiving Use Only: Custody Seal In.	Characteristic Hazards FL = Flammable/Ignitable CO = Corrosive RE = Reactive Waste code(s): Waste code(s): FSCA Regulated PCB = Polychlorinated biphenyls
Perect 190472 Nurth cown GEL Quote #: Nurth Quote Color Number (1): NA PORIMINER PORIMINER 13: N 45 NURA GE	Hant Polina	Sample ID  Somple ID  Somple ID  Somple ID  Some - indicate start and stop datent			Chain o Relinquished By (Signed) Date Time	1 talled for 2 min 1700	3   Sample Shipping and delivery details, see Sample Receipt & Review form (SRR.)   Sample 1.) Chain of Custody Number = Client Determined   Sample Receipt & Review form (SRR.)     2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSI     3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered     4.) Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Waste Water, W=Water, ML=Misc Liquid, SO     5.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e.) Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascerbic Acid, I.e.	7) Are there any known or possible hazards  associated with these samples?  CO-  RCRA Metals  As = Arsenic Hg= Mercury  Ba = Barium Se= Selenium  Cd = Cadmium Ag= Silver  Cr = Chromium MR= Miscellaneous  PCB  PCB  PCB  PCB  PCB  PCB  PCB  PC

	CEL Laboratories (13)				
[	lient: MWA	JF	L	To	SAMPLE RECEIPT & REVIEW FORM
	cceived By: ATA				DG/AR/COC/Work Order: 490877
ľ	y/C	***************************************		7	Circle Applicable:  FedEx Express FedEx Ground UPS Field Services Courier Other
	Carrier and Tracking Number				7762 8638 8788
Si	spected Hazard Information	Yes	Š		7762 8638 8034
$\vdash$		+>	2	<del> </del> ,-	f Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
A	Shipped as a DOT Hazardous?	_	1	IF I	ızırıd Class Shipped: UN#: UN2910, Is the Radioactive Shipment Survey Compliant? Yes No
B) rec	Did the client designate the samples are to be eived as radioactive?		/	CC	DC notation or radioactive stickers on containers equal client designation.
C)	Did the RSO classify the samples as ioactive?		/	Ma Cli	aximum Net Counts Observed* (Observed Counts - Area Background Counts):CPM / mR/Hr assified as: Rad 1
D) ha:	Did the client designate samples are arcardous?			1	OC notation or hazard labels on containers equal client designation.
E)	Did the RSO identify possible hazards?		/	PC.	O or E is yes, select Hazards below. B's Flammable Foreign Soil RCRA Asbestos Beryllium Other:
_	Sample Receipt Criteria	Yes	ź	ž	
1	Shipping containers received intact and sealed?	1			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Chain of custody documents included with shipment?				Circle Applicable: Client contacted and provided COC COC created upon receipt
3	Samples requiring cold preservation within $(0 \le 6 \text{ deg. C})$ ?*				Preservation Method: Wet Ice Ice Packs Dry Ice None Other: *all temperatures are recorded in Celsius TEMP:
4	Daily check performed and passed on IR temperature gun?				Temperature Device Serial #: <u>FR4 - L6</u> * Secondary Temperature Device Serial # (If Applicable):
5	Sample containers intact and sealed?				Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6	Samples requiring chemical preservation at proper pH?				Sample ID's and Containers Affected:
7	Do any samples require Volatile Analysis?				If Preservation added, Lot#  If Yes, are Encores or Soil Kits present for solids? Yes No NA (If yes, take to VOA Freezer)  Do liquid VOA vials contain acid preservation? Yes No NA (If unknown, select No)  Are liquid VOA vials free of headspace? Yes No NA  Sample ID's and containers affected:
8	Samples received within holding time?	1			ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?	/			ID's and containers affected:
10	Date & time on COC match date & time on bottles?				Circle Applicable: No dates on containers No times on containers COC missing info Other (describe)
11	Number of containers received match number indicated on COC?				Circle Applicable: No container count on COC Other (describe)
	Are sample containers identifiable as GEL provided?				·
13	COC form is properly signed in relinquished/received sections? AA 9/3 ments (Use Continuation Form if weded):	M		$\sqrt{}$	Circle Applicable: Not relinquished Other (describe)
	(33 Communon Point it needed);	······································			A/A (1100 1100 1

List of current GEL Certifications as of 08 November 2019

State	Certification
Alaska	17–018
Alaska Drinking Water	SC00012
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M-SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122020-1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	2019–165
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-19-15
Utah NELAP	SC000122019–28
Vermont	VT87156
Virginia NELAP	460202
Washington	C780
TT USITING TOTAL	2700









PO Box 30712 Charleston, SC 29417 2040 Savage Road Charleston, SC 29407 P 843.556.8171 F 843.766.1178

gel.com

November 08, 2019

Mr. Jim Riley NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804 Arlington, Virginia 22202

Re: Analytical for Upper Piedmont Regional Landfill

a member of The GEL Group INC

Work Order: 490879

Dear Mr. Riley:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 19, 2019 and September 20, 2019. This revised data report has been prepared and reviewed in accordance with GEL's standard operating procedures. This package was revised to include PFPeA and PFOA.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,

Julie Robinson Project Manager

Purchase Order: GELP19-0905

Enclosures

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# Certificate of Analysis Report for

NWRA001 NWRA – Carolinas Chapter Client SDG: 490879 GEL Work Order: 490879

### The Qualifiers in this report are defined as follows:

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- J See case narrative for an explanation
- J Value is estimated
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Julie Robinson.

Reviewed by

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical for Upper Piedmont Regional Landfill

Client Sample ID: 7304-1 Project: NWRA00119 Sample ID: 490879001 Client ID: NWRA001

Matrix: Misc Liquid
Collect Date: 17-SEP-19 15:25
Receive Date: 19-SEP-19
Collector: Client

Parameter (	Qualifier	Result	DL	RL	Units	PF	DF	Anal	yst Date	Time	Batch	Method
LCMSMS PFCs												
EPA 537Mod PFCs by LC	C-MS/MS	"As Received"										
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N EtFOSAA)	·-	48.7	13.2	40.0	ng/L	0.200	1	JLS	10/04/19	1100	1921240	1
N-methylperfluoro-1- octanesulfonamidoacetic acid (N MeFOSAA)	-	106	13.2	40.0	ng/L	0.200	1					
Perfluorobutanesulfonic acid (PF	FBS)	1420	6.60	17.8	ng/L	0.200	1					
Perfluorodecanesulfonic acid (PFDS)	J	14.9	6.60	19.4	ng/L	0.200	1					
Perfluorodecanoic acid (PFDA)		48.0	7.80	20.0	ng/L	0.200	1					
Perfluorododecanoic acid (PFDo	A) U	ND	6.60	20.0	ng/L	0.200	1					
Perfluoroheptanesulfonic acid (PFHpS)	U	ND	6.60	19.0	ng/L	0.200	1					
Perfluoroheptanoic acid (PFHpA	.)	344	6.60	20.0	ng/L	0.200	1					
Perfluorohexanesulfonic acid (PFHxS)		190	6.60	18.2	ng/L	0.200	1					
Perfluorononanesulfonic acid (PFNS)	J	13.4	7.00	19.2	ng/L	0.200	1					
Perfluorononanoic acid (PFNA)		44.1	6.60	20.0	ng/L	0.200	1					
Perfluorooctanesulfonamide (PFOSA)	U	ND	6.60	18.6	ng/L	0.200	1					
Perfluorooctanesulfonic acid (PF	OS)	254	8.00	20.0	ng/L	0.200						
Perfluorooctanoic acid (PFOA)		884	7.00	20.0	ng/L	0.200	1					
Perfluoropentanesulfonic acid (PFPeS)		28.1	6.60	18.8	ng/L	0.200	1					
Perfluoropentanoic acid (PFPeA)	)	621	6.60	20.0	ng/L	0.200						
Perfluoroundecanoic acid (PFUd	A) U	ND	6.60	20.0	ng/L	0.200						
Fluorotelomer sulfonate 8:2 (8:2 FTS)	U	ND	132	384	ng/L	0.200		JLS	10/02/19	0757	1921240	2
Perfluorobutyric acid (PFBA)		743	66.0	200	ng/L	0.200						
Perfluorohexanoic acid (PFHxA)	)	2350	66.0	200	ng/L	0.200						
Perfluorotetradecanoic acid (PFTeDA)	U	ND	66.0	200	ng/L	0.200	10					
Perfluorotridecanoic acid (PFTrI	DA) U	ND	66.0	200	ng/L	0.200	10					
Fluorotelomer sulfonate 4:2 (4:2 FTS)	U	ND	1320	3760	ng/L	0.200	100	JLS	10/02/19	1200	1921240	3
Fluorotelomer sulfonate 6:2 (6:2 FTS)	U	ND	1320	3800	ng/L	0.200	100					
The following Prep Metho	ods were p	erformed:										

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# **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical for Upper Piedmont Regional Landfill

Client Sample ID: 7304-1 Project: NWRA00119 Sample ID: 490879001 Client ID: NWRA001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst Date	Time Batch	Method
The following Pr	ep Methods were pe	erformed:								
Method	Description	n		Analyst	Date	]	Гime	Prep Batch		
EPA 537.1 Mod, PFA	AS, Compl PFCs Extract		LM1	09/27/19	C	0830	1921239			
The following A	nalytical Methods v	were performed:								
Method	Description	1			A	nalyst	Con	nments		
1	EDA 537 1 M	od DEAS Compliant w	ith OSM Table B 15			-				

EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15
EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15
EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15
EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15

### **Notes:**

Column headers are defined as follows:

DF: Dilution Factor Lc/LC: Critical Level
DL: Detection Limit PF: Prep Factor
MDA: Minimum Detectable Activity RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

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# **Certificate of Analysis**

Project:

Client ID:

**Analyst Comments** 

NWRA00119

NWRA001

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical for Upper Piedmont Regional Landfill

Client Sample ID: 7304-1
Sample ID: 490879002
Matrix: Misc Liquid
Collect Date: 17-SEP-19 15:25

Receive Date: 20-SEP-19 Collector: Client

	nalyst Date Time Batch Method
--	-------------------------------

Semi-Volatile-GC/MS

SW846 8270 SIM 1,4-Dioxane in Liquid "As Received"

1,4-Dioxane 177 5.00 10.0 ug/L 0.200 5 JMB3 09/24/19 1945 1919444 1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3535A	SW8270E SIM Prep 1,4-Dioxane	SJW1	09/23/19	1200	1919441

The following Analytical Methods were performed:

Description

SW846 3535A/8270E SIM

Surrogate/Tracer Recovery Test Result Nominal Recovery% Acceptable Limits 1,4-Dioxane-d8 SW846 8270 SIM 1,4-Dioxane in Liquid "As 24.2 ug/L 40.0 61\* (70%-130%)

Received"

### **Notes:**

Method

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

MDA: Minimum Detectable Activity

Lc/LC: Critical Level

PF: Prep Factor

RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

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# **QC Summary**

NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804

Arlington, Virginia Mr. Jim Riley

Workorder: 490879

**Contact:** 

Report Date: November 8, 2019

Page 1 of 7

Parmname	NOM	Sample Qual	QC	Units R	PD/D% REC%	Range	Anlst	Date	Time
Perfluorinated Compounds Batch 1921240 ———									
QC1204391614 LCS Fluorotelomer sulfonate 4:2 (4:2 FTS)	18.2		15.7	ng/L	86	(60%-145%)	JLS	10/02/19	9 06:05
Fluorotelomer sulfonate 6:2 (6:2 FTS)	18.5		20.4	ng/L	110	(56%-143%)			
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.7		17.5	ng/L	94	(57%-138%)			
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	19.5		19.3	ng/L	99	(63%-131%)			
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	19.5		21.5	ng/L	111	(62%-133%)			
Perfluorobutanesulfonic acid (PFBS)	17.2		16.6	ng/L	96	(68%-136%)			
Perfluorobutyric acid (PFBA)	19.5		19.7	ng/L	101	(70%-133%)			
Perfluorodecanesulfonic acid (PFDS)	18.8		16.8	ng/L	89	(53%-142%)			
Perfluorodecanoic acid (PFDA)	19.5		18.0	ng/L	93	(62%-135%)			
Perfluorododecanoic acid (PFDoA)	19.5		19.5	ng/L	100	(66%-131%)			
Perfluoroheptanesulfonic acid (PFHpS)	18.5		18.1	ng/L	98	(66%-138%)			
Perfluoroheptanoic acid (PFHpA)	19.5		17.9	ng/L	92	(67%-135%)			
Perfluorohexanesulfonic acid (PFHxS)	17.7		14.5	ng/L	82	(64%-137%)			
Perfluorohexanoic acid (PFHxA)	19.5		18.9	ng/L	97	(67%-133%)			

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# **QC Summary**

Workorder: 490879 Page 2 of 7

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range A	Anlst	Date Time
<b>Perfluorinated Compounds</b> Batch 1921240									
Perfluorononanesulfonic acid (PFNS)	18.7		17.5	ng/L		93	(66%-130%)	JLS	10/02/19 06:05
Perfluorononanoic acid (PFNA)	19.5		21.1	ng/L		108	(66%-134%)		
Perfluorooctanesulfonamide (PFOSA)	19.5		21.5	ng/L		111	(68%-137%)		
Perfluorooctanesulfonic acid (PFOS)	19.5		19.8	ng/L		102	(61%-131%)		
Perfluorooctanoic acid (PFOA)	19.5		18.8	ng/L		97	(63%-145%)		
Perfluoropentanesulfonic acid (PFPeS)	18.3		16.5	ng/L		90	(62%-139%)		
Perfluoropentanoic acid (PFPeA)	19.5		19.3	ng/L		99	(69%-132%)		
Perfluorotetradecanoic acid (PFTeDA)	19.5		22.5	ng/L		115	(65%-143%)		
Perfluorotridecanoic acid (PFTrDA)	19.5		19.9	ng/L		102	(57%-149%)		
Perfluoroundecanoic acid (PFUdA)	19.5		19.1	ng/L		98	(65%-134%)		
QC1204391615 LCSD Fluorotelomer sulfonate 4:2 (4:2 FTS)	17.6		20.5	ng/L	26	116	(0%-35%)		10/02/19 06:14
Fluorotelomer sulfonate 6:2 (6:2 FTS)	17.9		17.6	ng/L	14	98	(0%-36%)		
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.1		19.9	ng/L	13	110	(0%-39%)		
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	18.8		20.1	ng/L	4	107	(0%-25%)		
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	18.8		21.9	ng/L	2	116	(0%-26%)		

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# **QC Summary**

Workorder: 490879 Page 3 of 7

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range Anlst	Date Time
Perfluorinated Compounds	110111	Sumple Quar	<u> </u>	CIIII	10 2/2 /0	ILLE 70	Tunge Time	Dute Time
Batch 1921240								
Perfluorobutanesulfonic acid (PFBS)	16.7		17.2	ng/L	4	103	(0%-30%) JLS	10/02/19 06:14
Perfluorobutyric acid (PFBA)	18.8		19.3	ng/L	2	102	(0%-30%)	
Perfluorodecanesulfonic acid (PFDS)	18.2		17.2	ng/L	3	95	(0%-28%)	
Perfluorodecanoic acid (PFDA)	18.8		21.1	ng/L	16	112	(0%-29%)	
Perfluorododecanoic acid (PFDoA)	18.8		19.0	ng/L	3	101	(0%-30%)	
Perfluoroheptanesulfonic acid (PFHpS)	17.9		17.7	ng/L	2	99	(0%-30%)	
Perfluoroheptanoic acid (PFHpA)	18.8		19.6	ng/L	9	104	(0%-30%)	
Perfluorohexanesulfonic acid (PFHxS)	17.2		16.8	ng/L	15	98	(0%-30%)	
Perfluorohexanoic acid (PFHxA)	18.8		20.9	ng/L	10	111	(0%-23%)	
Perfluorononanesulfonic acid (PFNS)	18.1		18.2	ng/L	4	101	(0%-27%)	
Perfluorononanoic acid (PFNA)	18.8		18.7	ng/L	12	99	(0%-27%)	
Perfluorooctanesulfonamide (PFOSA)	18.8		20.2	ng/L	6	107	(0%-30%)	
Perfluorooctanesulfonic acid (PFOS)	18.8		19.9	ng/L	1	106	(0%-27%)	
Perfluorooctanoic acid (PFOA)	18.8		18.9	ng/L	0	100	(0%-30%)	
Perfluoropentanesulfonic acid (PFPeS)	17.7		17.3	ng/L	4	98	(0%-29%)	

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# **QC Summary**

Workorder: 490879 Page 4 of 7 QC **Parmname** NOM Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** Batch 1921240 Perfluoropentanoic acid (PFPeA) 18.8 20.0 ng/L 3 106 (0%-30%)JLS 10/02/19 06:14 Perfluorotetradecanoic acid 18.8 20.6 ng/L 9 109 (0%-30%)(PFTeDA) Perfluorotridecanoic acid 18.8 17.7 ng/L 11 94 (0%-35%)(PFTrDA) Perfluoroundecanoic acid (PFUdA) 18.8 21.2 ng/L 10 112 (0%-28%)QC1204391613 MB U Fluorotelomer sulfonate 4:2 (4:2 ND 10/02/19 05:56 ng/L FTS) U Fluorotelomer sulfonate 6:2 (6:2 ND ng/L FTS) U ND Fluorotelomer sulfonate 8:2 (8:2 ng/L FTS) U N-ethylperfluoro-1-ND ng/L octanesulfonamidoacetic acid (N-EtFOSAA) U ND N-methylperfluoro-1ng/L octanesulfonamidoacetic acid (N-MeFOSAA) U ND Perfluorobutanesulfonic acid ng/L (PFBS) Perfluorobutyric acid (PFBA) U ND ng/L U Perfluorodecanesulfonic acid ND ng/L (PFDS) Perfluorodecanoic acid (PFDA) U ND ng/L U ND Perfluorododecanoic acid (PFDoA) ng/L Perfluoroheptanesulfonic acid U ND ng/L (PFHpS)

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# **QC Summary**

Workorder: 490879				<u>•/_</u>				
	NOM			TI '4 DDD/D/	DECO/	, D		Page 5 of 7
Parmname Perfluorinated Compounds	NOM	Sample Qual	QC	Units RPD/D	% REC%	Range	Anlst	Date Time
Batch 1921240								
Perfluoroheptanoic acid (PFHpA)		U	ND	ng/L			JLS	10/02/19 05:56
Perfluorohexanesulfonic acid (PFHxS)		U	ND	ng/L				Į
Perfluorohexanoic acid (PFHxA)		U	ND	ng/L				
Perfluorononanesulfonic acid (PFNS)		U	ND	ng/L				
Perfluorononanoic acid (PFNA)		U	ND	ng/L				
Perfluorooctanesulfonamide (PFOSA)		U	ND	ng/L				
Perfluorooctanesulfonic acid (PFOS)		U	ND	ng/L				
Perfluorooctanoic acid (PFOA)		U	ND	ng/L				
Perfluoropentanesulfonic acid (PFPeS)		U	ND	ng/L				
Perfluoropentanoic acid (PFPeA)		U	ND	ng/L				
Perfluorotetradecanoic acid (PFTeDA)		U	ND	ng/L				
Perfluorotridecanoic acid (PFTrDA)		U	ND	ng/L				
Perfluoroundecanoic acid (PFUdA	4)	U	ND	ng/L				
Semi-Volatile-GC/MS Batch 1919444 -								
QC1204387349 LCS **1,4-Dioxane-d8	4.00		3.55	ug/L	89	(70%-130%	) JMB3	09/24/19 12:24

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### **QC Summary**

Workorder: 490879									Page 6 of 7	
Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date Time	
Semi-Volatile-GC/MS Batch 1919444										
QC1204387350 LCSD **1,4-Dioxane-d8	4.00		3.18	ug/L		79	(70%-130%)	JMB3	09/24/19 12:49	
QC1204387348 MB 1,4-Dioxane		U	ND	ug/L					09/24/19 11:59	
*1,4-Dioxane-d8	4.00		3.05	ug/L		76	(70%-130%)			

#### **Notes:**

The Qualifiers in this report are defined as follows:

- \*\* Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B The target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- E Concentration of the target analyte exceeds the instrument calibration range
- H Analytical holding time was exceeded
- J See case narrative for an explanation
- J Value is estimated
- JNX Non Calibrated Compound
- N Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N/A RPD or %Recovery limits do not apply.
- N1 See case narrative
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, the difference is >70%.
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UJ Compound cannot be extracted

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### **QC Summary**

490879 Page 7 of 7 **Parmname NOM** Sample Qual  $\mathbf{QC}$ Units RPD/D% REC% Range Anlst Date Time

- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y QC Samples were not spiked with this compound

Workorder:

- ٨ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
- h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

- ^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
- \* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

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### Technical Case Narrative NWRA - Carolinas Chapter SDG #: 490879

### **GC/MS Semivolatile**

**Product:** Analysis of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas

**Chromatography/Mass Spectrometry** 

**Analytical Method:** SW846 3535A/8270E SIM **Analytical Procedure:** GL-OA-E-073 REV# 2

**Analytical Batch:** 1919444

**Preparation Method:** SW846 3535A

**Preparation Procedure:** GL-OA-E-073 REV# 2

**Preparation Batch:** 1919441

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
490879002	7304-1
1204387348	Method Blank (MB)
1204387349	Laboratory Control Sample (LCS)
1204387350	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

### **Quality Control (QC) Information**

### **Surrogate Recoveries**

Sample (See Below) did not meet surrogate recovery acceptance criteria. The sample was analyzed at a dilution. As a result, one or more surrogates were diluted out of the acceptance limits.

Sample	Analyte	Value
490879002 (7304-1 )	1, 4-Dioxane-d8	61* (70%-130%)

### **Laboratory Control Sample Duplicate (LCSD)**

An LCSD was used in place of matrix QC due to limited sample volume.

### **Technical Information**

### **Sample Dilutions**

Sample 490879002 (7304-1) was diluted due to the presence of one or more over-range target analytes.

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### **LCMSMS-Misc**

**Product:** The Extraction and Analysis of Per and Polyfluroalkyl Substances Using LCMSMS

Analytical Method: EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15

**Analytical Procedure:** GL-OA-E-076 REV# 7 **Analytical Batches:** 1921240 and 1921239

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID# Client Sample Identification

490879001 7304-1

1204391613 Method Blank (MB)

1204391614 Laboratory Control Sample (LCS)

1204391615 Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

### **Technical Information**

### **Sample Dilutions**

The following samples were diluted to bring the over range concentrations within the calibration range and/or due to matrix interference that caused internal standards recoveries to fall outside the acceptance range. 490879001 (7304-1).

Amalysta	490879
Analyte	001
Fluorotelomer sulfonate 4:2 (4:2 FTS)	100X
Fluorotelomer sulfonate 6:2 (6:2 FTS)	100X
Fluorotelomer sulfonate 8:2 (8:2 FTS)	10X
Perfluorobutyric acid (PFBA)	10X
Perfluorohexanoic acid (PFHxA)	10X
Perfluorotetradecanoic acid (PFTeDA)	10X
Perfluorotridecanoic acid (PFTrDA)	10X

### **Miscellaneous Information**

### **Additional Comments**

Additional sample volume was not provided for matrix QC. Also, reduced sample volumes were used for all samples except 490876002 (7607-EB) due to elevated concentrations of target analytes.

#### **Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

Page 14 of 19 SDG: 490879 Rev1

GEL Laboratories, LLC 2040 Savage Road	Charleston, SC 29407 Phone: (843) 556-8171	Fax: (843) 766-1178	(Fill in the number of containers for each test)	< Preservative Type (6)	537 mod	Comments Note: extra sample is	required for sample specific QC				Note that you will receive a separate cooler — 0/20/10 with bottles for 1.4 discons analysis—	for this site. It is OK to include those in the	same lab report as these samples.	Specify: (Subject to Surcharge)		el [ ] Level 2 [ ] Level 3 [ ] Level 4			in [ ] Other:			√=Nasal	The state of the s	ricase provide any douttonal defaits below regarding handling and/or disposal concerns, (i.e.: Oriem of sample(s) time	of site collected from, odd matrices, etc.)			
	aity Analytics		Sample Analysis Requested (5) (Fill in the num	\$3.5	PFAS 21 cmpd list by EPA	Τ	Total number	2 X			Note that you will	for this site. It is	same lab report	TAT Requested: Normal: X Rush: Spe	[V] Mo		Additional Remarks:	For Lab Receiving Use Only: Custody Seal Intact? [ ] Yes	Sample Collection Time Zone: K] Eastern [ ] Pacific [ ] Central [ ] Mountain	le, G = Grab, C = Composite		4.) Mairix t odes: UN=Drinking Water, UN=String Water, WW=Waste Water, WW=Waste Wigner, WS-Sedment, 3D=Sedment, 3D=Sedment, 3D=Sedment, SS-Solid Waste. O=(0). F=Filter, F=Wipe, U=Urine, F=Feerl, N=Nasal S.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1).	= Ascorbic Acid, BA = Betane, S1 = Sottum Thosulate, II no preservative is added = Jeave field blank.  Waste   Other	OT= Other / Unknown f(e.: High/low pH. asbestos, berylliun, irritants, other	misc. health hazards, etc.) Description:	X		
EL Laboratories Lo	getcom 1 Chemistry   Radiothemistry   Radiothioassay   Specially Analytics Chain of Custody and Analytical Request	GEL Project Manager:	Phonc # 919-847-4241	704-586-0007	sample be considered:	Olson golson@harthickman.com	*Time Collected (Alittary) COC Field Sample haza Radioactive Radioactive Cococo Differed Differed Differed (Alittary) Cococo Differed Diff	N W Z							Date Time	9 19 19 08 570 Select	Additi			= Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, $G$ = Grab, $C$ = Composite	sample was not field filtered.	<ol> <li>Mairix (odes: DW=Drinking Wader, CW=Groundwader, SW=Surface Water, WW=Watte Water, W=Water, WE=Water, SU=Mil, SU=Statinge, SU=Surface, SU=Surface, SU=Surface, SU=Water, SU=Surface, Surphe Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1).</li> </ol>		aste listed wastes.)	code(s):			
5 0 7 7001		GEL Work Order Number:		nt Regional Landfill Fax#	U	Send Results To:Genna Olsc	*Date Collected (mm-dd-yy)	09-17-19						Chain of Custody Signatures	Time Received by (signed)	1630 190	2 . (	3	> For sample shipping and delivery details, see Sample Receipt & Review form (SRK), 1.) Chain of Custody Number = Client Determined	2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix	3.) Field Filtered. For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered.	midwater, 5M=Surface (Water, WW=Waste Water, WW=Wr requested (i.e. 8260B, 6010B/7470A) and number of co	Nime Acid, SH = Sodium Hydroxide, SA = Suttune [Characteristic Hazards	FL = Flammable/Ignitable CO = Corrosive		TSCA Regulated	biphenyls	
	GEL Quote #: INVKA QUOTE COC Number (1): NA	PO Number: NA	Client Name: NWRA c/o Hart & Hickman, PC	Project/Site Name: Upper Piedmont Regional Landfill	Address: Rougemont, NC	Collected By: Patrick Stevens	Sample ID * For composites - indicate start and stop date time	7304-1							Relinquished By (Signed) Date	1 Janua H. Aust 09-18-19	2	3	> For sample shipping and delivery deta  1) Chain of Custody Number = Client Determined	<ol> <li>QC Codes: N = Normal Sample, TB = Trip Blar</li> </ol>	3.) Field Filtered: For liquid matrices, indicate with	Aldina Codes: DW=Drinking Water, CW=Crool     Sample Analysis Requested: Analytical method	6.) Preservative Lype: HA ** Hydrochlone Acid, NL ** 7.) Are there any known or possible hazards	associated with these samples?	RCRA Metals As = Arsenic Hg= Mercury	Ba = Barium Se= Selenium	F-4	

Page of least Property Number Const.	GEL Laboratories Balinchinasay I Specialty Analytics		GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407
	Ghain of Custody and Analytical Request  GEL Work Order Number: GEL Project Manager: Julia	Vasc	Phone: (843) 556-8171 Fax: (843) 766-1178
TRAT	Phone # QQQ - B	Sample Analysis Requested (5)	(Fill in the number of containers for each ass)
me: Open Piechwert	Fax#	***	C. Presenance Type (6)
	7572		
ected By: P. Struens	Son golsene morthicums. Com	ards a to as	Note: extra sample is
Sample ID	ed QC Field	) Known o Stal mumb 4 - D's MA BJZ	required for sample specific QC
4304-1	× / / ×	1 CS	
Chain	Chain of Custody Signatures	TAT Requested: Normal: 🗲 Rush:	Specify: (Subject to Surcharge)
Relinquished By (Signed) Date Time	Received by (signed) Date Time	Fax Results: [ ] Yes 'KNo	
Hallerthan 9-1919 1700	1 Tradex 9-19-19, FADO	Select Deliverable: [ ] C of A [ ] QC Summary [ ] level 1	level 1 [ ] Level 2 [ ] Level 3 [ ] Level 4
2	2 11-100mm 9120119 8:55	Additional Remarks:	
3		ing Use Only:	
For sample shipping and definery details, see Sample Receipt & Review form (SRR.) 1.) Chain of Casarda Mumber - Clear Determined	e Receipt & Review form (SRR.) Sample Collection Time Zone: [ ] Eastern	one [ ] Eastern [ ] Pacific [ ] Central [ ] Mountain	nain [] Other
2) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Du	2.) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite	te Sample, $\mathbf{G} = \operatorname{Grab}$ , $\mathbf{C} = \operatorname{Composite}$	
3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered.	sample was field filtered or - N - for sample was not field filtered.		
4.) Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Waste Water, W=Water, ML=Misc	face Water, WW=Waste Water, W=Water, ML=Misc Liquid, SO=Soil, SD=Sediment, SL	Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Nasal	al, N=Nasal
<ol> <li>Sample Analysis Requested: Analytical method requested (i.e., 8260B, 6010B/7476A) and number of containers provided</li> <li>Decompting Types, 11A = Undeed byte Acid NI = Nitric Acid SH = Sodium Fudervide SA = Sulfure Acid AA = Accord</li> </ol>	5.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6016B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1).	70A - 1). rm Thiosuffate. If no preservative is added ≈ leave field blank	
7) Are there any known or possible hazards Chi	Characteristic Hazards   Listed Waste	Other	Please provide any additional details
•	/Ignitable	OT=Other/Unknown	
8	CO = COTOSIVE (F.A.F and O-HSICA WASIES.)  RE = Reactive Waste code(s):	(t.e.: rugn/tow pri, asoestos, oeryanum, artuants, omer misc. health hazards, etc.)	concerns, (i.e., Origin of sample(s), type of site collected from, odd matrices, etc.)
As = Arsenic Hg= Mercury  Ba = Barium Sa= Salenium [TS]	CA Regulated	Description:	
Ag= Silver	PCB = Polychlorinated		
Cr = Chromium MR= Miscellaneous Pb = Lead RCRA metals	biphenyls		

Client: NWRA			SDG/AR/COC/Work Order: HOLD CALV HOLD TO
Received By: ATA			Date Received: 9/19/19
Carrier and Tracking Number			Fedex Express Fedex Ground UPS Field Services Courier Other 7762 7563 2308 -1, 7762 7563 3418-4 7762 7563 1764-1, 7762 7563 3290-1
uspected Hazard Information	Yes	ž	*If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investig
Shipped as a DOT Hazardous?		/	Hazard Class Shipped: UN#: If UN2910, Is the Radioactive Shipment Survey Compliant? Yes No
) Did the client designate the samples are to be serived as radioactive?		/	COC notation or radioactive stickers on containers equal client designation.
) Did the RSO classify the samples as dioactive?		/	Maximum Net Counts Observed* (Observed Counts - Area Background Counts):CPM / mR/Hr Classified as: Rad 1
) Did the client designate samples are izardous?	1	/	COC notation or hazard labels on containers equal client designation.
Did the RSO identify possible hazards?		1	f D or E is yes, select Hazards below. PCB's Flammable Foreign Soil RCRA Asbestos Beryllium Other:
Sample Receipt Criteria	Yes	Y.	Comments/Qualifiers (Required for Non-Conforming Items)
Shipping containers received intact and sealed?			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
Chain of custody documents included with shipment?	$\sqrt{}$		Circle Applicable: Client contacted and provided COC COC created upon receipt
Samples requiring cold preservation within (0 ≤ 6 deg. C)?*			Preservation Method: Wet less lee Packs Dry ice None Other: *all temperatures are recorded in Celsius TEMP:
Daily check performed and passed on IR temperature gun?			Temperature Device Serial #: <u>TR4-16</u> Secondary Temperature Device Serial # (If Applicable):
Sample containers intact and sealed?			Circle Applicable: Seals broken Dampaged contained Leaking container Other (describe)  6204-1 (1boffle) capreceived cracked
Samples requiring chemical preservation at proper pH?		/	Sample ID's and Containers Affected:  If Preservation added, Lot#:
Do any samples require Volatile Analysis?			If Yes, are Encores or Soil Kits present for solids? Yes No NA (If yes, take to VOA Freezer)  Do liquid VOA vials contain acid preservation? Yes No NA (If unknown, select No)  Are liquid VOA vials free of headspace? Yes No NA  Sample ID's and containers affected:
Samples received within holding time?			ID's and tests affected:
Sample ID's on COC match ID's on bottles?			ID's and containers affected:
Date & time on COC match date & time on bottles?	1	200963	Circle Applicable: No dates on containers No times on containers COC missing info Other (describe)
Number of containers received match number indicated on COC?	/		Circle Applicable: No container count on COC Other (describe)
Are sample containers identifiable as GEL provided?	$\sqrt{}$		
COC form is properly signed in			Circle Applicable: (Not relinquished Other (describe)
relinquished/received sections? nments (Use Continuation Form if needed):	<b>k</b>		

Laborationes Ltd	JA	L		SAMPLE RECEIPT & REVIEW FORM
Client: MWNA			SI	OG/AR/COC/Work Orger: 40879
Received By:		<del></del>	D:	ate Received: 4/20/14
Carrier and Tracking Number				Fedex Express Fedex Ground UPS Field Services Courier Other  7762 8639 8734  7762 8639 8034
Suspected Hazard Information	Yes	ź	*16	Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
A)Shipped as a DOT Hazardous?		1	IHa	zard Class Shipped: UN#; UN2910, Is the Radioactive Shipment Survey Compliant? YesNo
B) Did the client designate the samples are to be received as radioactive?		/	co	OC notation or radioactive stickers on containers equal client designation.
C) Did the RSO classify the samples as radioactive?		Ż	Ma Cla	nximum Net Counts Observed* (Observed Counts - Area Background Counts):CPM / mR/Hr
D) Did the client designate samples are hazardous?		/	co	C notation or hazard labels on containers equal client designation.
E) Did the RSO identify possible hazards?	,	/	If E PCI	O or E is yes, select Hazards below. B's Flammable Foreign Soil RCRA Asbestos Beryllium Other:
Sample Receipt Criteria	Yes	ź	ů	Comments/Qualifiers (Required for Non-Conforming Items)
Shipping containers received intact and sealed?	1			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2 Chain of custody documents included with shipment?				Circle Applicable: Client contacted and provided COC COC created upon receipt
Samples requiring cold preservation within $(0 \le 6 \text{ deg. C})$ ?*		CONTRACTOR OF		Preservation Method Wet lee lee Packs Dry ice None Other: *all temperatures are recorded in Celsius TEMP:
Daily check performed and passed on IR temperature gun?	$ \sqrt{ }$			Temperature Device Serial #: TB4-16 Secondary Temperature Device Serial # (If Applicable):
5 Sample containers intact and sealed?				Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6 Samples requiring chemical preservation at proper pH?		J		Sample ID's and Containers Affected:  If Preservation added, Lot#:
7 Do any samples require Volatile Analysis?			$ \sqrt{ }$	If Yes, are Encores or Soil Kits present for solids? Yes No NA (If yes, take to VOA Freezer)  Do liquid VOA vials contain acid preservation? Yes No NA (If unknown, select No)  Are liquid VOA vials free of headspace? Yes No NA  Sample ID's and containers affected:
8 Samples received within holding time?	7			ID's and tests affected:
9 Sample ID's on COC match ID's on bottles?	/			ID's and containers affected:
Date & time on COC match date & time on bottles?				Circle Applicable: No dates on containers No times on containers COC missing info Other (describe)
Number of containers received match number indicated on COC?	$\Delta$			Circle Applicable: No container count on COC Other (describe)
Are sample containers identifiable as GEL provided?	$\Delta$			AND PROSPECTOR
COC form is properly signed in relinquished/received sections?	M		$\sqrt{}$	Circle Applicable: dot relinquished Y Other (describe)
Comments (Use Continuation Form if meded):				4a alazta
PM (or PM	A) rev	view	: Initi	Date Page of GL-CHL-SR-001 Rev 6

List of current GEL Certifications as of 08 November 2019

State	Certification
Alaska	17–018
Alaska Drinking Water	SC00012
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M-SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122020-1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	2019–165
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-19-15
Utah NELAP	SC000122019-28
Vermont	VT87156
Virginia NELAP	460202
Washington	C780
6	









PO Box 30712 Charleston, SC 29417 2040 Savage Road Charleston, SC 29407 P 843.556.8171 F 843.766.1178

gel.com

November 08, 2019

Mr. Jim Riley NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804 Arlington, Virginia 22202

Re: Analytical for Sampson County Disposal, LLC

a member of The GEL Group INC

Work Order: 490881

Dear Mr. Riley:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 19, 2019 and September 20, 2019. This revised data report has been prepared and reviewed in accordance with GEL's standard operating procedures. This package was revised to include PFPeA and PFOA.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,

Julie Robinson Project Manager

Purchase Order: GELP19-0905

Enclosures

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# Certificate of Analysis Report for

NWRA001 NWRA – Carolinas Chapter Client SDG: 490881 GEL Work Order: 490881

### The Qualifiers in this report are defined as follows:

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- J See case narrative for an explanation
- J Value is estimated
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Julie Robinson.

Reviewed by

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Project:

Client ID:

NWRA00119

NWRA001

# **Certificate of Analysis**

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forSampson County Disposal, LLC

Client Sample ID: 8202-1 Sample ID: 490881001

Matrix: Misc Liquid
Collect Date: 18-SEP-19 12:20
Receive Date: 19-SEP-19
Collector: Client

Parameter Q	ualifier	Result	DL	RL	Units	PF	DF	Anal	lyst Date	Time	e Batch	Method
LCMSMS PFCs												
EPA 537Mod PFCs by LC-	MS/MS '	'As Received"										
Fluorotelomer sulfonate 4:2 (4:2	U	ND	13.2	37.6	ng/L	0.200	1	JLS	10/02/19	1007	1921240	1
FTS) N-ethylperfluoro-1-		43.8	13.2	40.0	ng/L	0.200	1					
octanesulfonamidoacetic acid (N-		13.0	13.2			0.200	•					
EtFOSAA)		104	12.2	40.0	/T	0.200	1					
N-methylperfluoro-1- octanesulfonamidoacetic acid (N-		104	13.2	40.0	ng/L	0.200	1					
MeFOSAA)												
Perfluorodecanesulfonic acid	U	ND	6.60	19.4	ng/L	0.200	1					
(PFDS) Perfluorodecanoic acid (PFDA)		90.9	7.80	20.0	ng/L	0.200	1					
Perfluorododecanoic acid (PFDoA)	) J	9.17	6.60	20.0	ng/L ng/L	0.200						
Perfluoroheptanesulfonic acid	, J U	ND	6.60	19.0	ng/L ng/L	0.200						
(PFHpS)	C	1,2	0.00	17.0	119, 2	0.200	-					
Perfluorohexanesulfonic acid		424	6.60	18.2	ng/L	0.200	1					
(PFHxS) Perfluorononanesulfonic acid	U	ND	7.00	19.2	ng/L	0.200	1					
(PFNS)	U	ND	7.00	19.2	ng/L	0.200	1					
Perfluorononanoic acid (PFNA)		128	6.60	20.0	ng/L	0.200	1					
Perfluorooctanesulfonamide	U	ND	6.60	18.6	ng/L	0.200	1					
(PFOSA)	C)	222	9.00	20.0	/T	0.200	1					
Perfluorooctanesulfonic acid (PFO Perfluorooctanoic acid (PFOA)	3)	1790	8.00 7.00	20.0 20.0	ng/L ng/L	0.200 0.200						
Perfluoropentanesulfonic acid		61.0	6.60	18.8	ng/L ng/L	0.200						
(PFPeS)		01.0	0.00	10.0	ng/L	0.200	1					
Perfluoroundecanoic acid (PFUdA)	) J	10.2	6.60	20.0	ng/L	0.200	1					
2,3,3,3-Tetrafluoro-2-		10800	330	1000	ng/L	0.200	50	JLS	10/02/19	0806	1921240	2
(1,1,2,2,3,3,3-heptafluoropropoxy)	-											
propanoic acid (PFPrOPrA) Fluorotelomer sulfonate 8:2 (8:2	U	ND	660	1920	ng/L	0.200	50					
FTS)	C	112	000	1,720	ng/L	0.200	50					
Perfluorobutanesulfonic acid (PFB	S)	7530	330	890	ng/L	0.200						
Perfluorobutyric acid (PFBA)		4770	330	1000	ng/L	0.200						
Perfluoroheptanoic acid (PFHpA)		5520	330	1000	ng/L	0.200						
Perfluorohexanoic acid (PFHxA)		6730	330	1000	ng/L	0.200						
Perfluorotetradecanoic acid (PFTeDA)	U	ND	330	1000	ng/L	0.200						
Perfluorotridecanoic acid (PFTrDA	,	ND	330	1000	ng/L	0.200						
Fluorotelomer sulfonate 6:2 (6:2 FTS)	U	ND	1320	3800	ng/L	0.200	100	JLS	10/02/19	1209	1921240	3

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**Certificate of Analysis** 

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forSampson County Disposal, LLC

Client Sample ID: 8202-1 Project: NWRA00119 Sample ID: 490881001 Client ID: NWRA001

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analyst Date	Time Batch	Method
LCMSMS PFCs										
EPA 537Mod PFCs by I	LC-MS/MS "	As Received"								
Perfluoropentanoic acid (PFPe	eA)	86400	660	2000	ng/L	0.200	100			

The following Prep Methods were performed:MethodDescriptionAnalystDateTimePrep BatchEPA 537.1 Mod, PFAS, Compl PFCs Extraction in LiquidLM109/27/1908301921239

The following Analytical Methods were performed:

Method	Description	Analyst Comments	
1	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15		
2	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15		
3	EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15		

### **Notes:**

Column headers are defined as follows:

DF: Dilution Factor Lc/LC: Critical Level
DL: Detection Limit PF: Prep Factor
MDA: Minimum Detectable Activity RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

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# **Certificate of Analysis**

Project:

Client ID:

**Analyst Comments** 

NWRA00119

NWRA001

Report Date: November 8, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forSampson County Disposal, LLC

Client Sample ID: 8202-1
Sample ID: 490881002
Matrix: Misc Liquid
Collect Date: 18-SEP-19 12:20

Receive Date: 20-SEP-19 Collector: Client

Parameter	Qualifier	Result	DL	RL	Units	PF	DF Analyst Date	Time Batch	Method

Semi-Volatile-GC/MS

SW846 8270 SIM 1,4-Dioxane in Liquid "As Received"

1,4-Dioxane 184 5.00 10.0 ug/L 0.200 5 JMB3 09/24/19 2011 1919444

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3535A	SW8270E SIM Prep 1,4-Dioxane	SJW1	09/23/19	1200	1919441

The following Analytical Methods were performed:

Description

SW846 3535A/8270E SIM

Surrogate/Tracer Recovery Test Result Nominal Recovery% Acceptable Limits 1,4-Dioxane-d8 SW846 8270 SIM 1,4-Dioxane in Liquid "As 27.7 ug/L 40.0 69\* (70%-130%)

Received"

#### **Notes:**

Method

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

MDA: Minimum Detectable Activity

Lc/LC: Critical Level

PF: Prep Factor

RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

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# **QC Summary**

NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804

Arlington, Virginia Mr. Jim Riley

Workorder: 490881

**Contact:** 

Report Date: November 8, 2019

Page 1 of 7

Parmname	NOM	Sample Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Perfluorinated Compounds Batch 1921240 ———										
QC1204391614 LCS 2,3,3,3-Tetrafluoro-2- (1,1,2,2,3,3,3- heptafluoropropoxy)-propanoic acid (PFPrOPrA)	19.5		17.1	ng/L		88	(70%-137%)	JLS	10/02/	19 06:05
Fluorotelomer sulfonate 4:2 (4:2 FTS)	18.2		15.7	ng/L		86	(60%-145%)	)		
Fluorotelomer sulfonate 6:2 (6:2 FTS)	18.5		20.4	ng/L		110	(56%-143%)	)		
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.7		17.5	ng/L		94	(57%-138%)	•		
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	19.5		19.3	ng/L		99	(63%-131%)	1		
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	19.5		21.5	ng/L		111	(62%-133%)	)		
Perfluorobutanesulfonic acid (PFBS)	17.2		16.6	ng/L		96	(68%-136%)	)		
Perfluorobutyric acid (PFBA)	19.5		19.7	ng/L		101	(70%-133%)	)		
Perfluorodecanesulfonic acid (PFDS)	18.8		16.8	ng/L		89	(53%-142%)	)		
Perfluorodecanoic acid (PFDA)	19.5		18.0	ng/L		93	(62%-135%)	)		
Perfluorododecanoic acid (PFDoA)	19.5		19.5	ng/L		100	(66%-131%)	)		
Perfluoroheptanesulfonic acid (PFHpS)	18.5		18.1	ng/L		98	(66%-138%)	)		
Perfluoroheptanoic acid (PFHpA)	19.5		17.9	ng/L		92	(67%-135%)	)		

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# **QC Summary**

Workorder: 490881

Page 2 of 7

Parmname NOM Sample Qual OC Units RPD/D% REC% Range Anlst Date Time

Parmname	NOM	Sample Qual	QC	Units 1	RPD/D%	REC%	Range Anl	st Date Time
<b>Perfluorinated Compounds</b> Batch 1921240								
Perfluorohexanesulfonic acid (PFHxS)	17.7		14.5	ng/L		82	(64%-137%)	JLS 10/02/19 06:05
Perfluorohexanoic acid (PFHxA)	19.5		18.9	ng/L		97	(67%-133%)	
Perfluorononanesulfonic acid (PFNS)	18.7		17.5	ng/L		93	(66%-130%)	
Perfluorononanoic acid (PFNA)	19.5		21.1	ng/L		108	(66%-134%)	
Perfluorooctanesulfonamide (PFOSA)	19.5		21.5	ng/L		111	(68%-137%)	
Perfluorooctanesulfonic acid (PFOS)	19.5		19.8	ng/L		102	(61%-131%)	
Perfluorooctanoic acid (PFOA)	19.5		18.8	ng/L		97	(63%-145%)	
Perfluoropentanesulfonic acid (PFPeS)	18.3		16.5	ng/L		90	(62%-139%)	
Perfluoropentanoic acid (PFPeA)	19.5		19.3	ng/L		99	(69%-132%)	
Perfluorotetradecanoic acid (PFTeDA)	19.5		22.5	ng/L		115	(65%-143%)	
Perfluoroundecanoic acid (PFUdA)	19.5		19.1	ng/L		98	(65%-134%)	
QC1204391615 LCSD 2,3,3,3-Tetrafluoro-2- (1,1,2,2,3,3,3- heptafluoropropoxy)-propanoic	18.8		18.1	ng/L	5	96	(0%-30%)	10/02/19 06:14
acid (PFPrOPrA) Fluorotelomer sulfonate 4:2 (4:2 FTS)	17.6		20.5	ng/L	26	116	(0%-35%)	
Fluorotelomer sulfonate 6:2 (6:2 FTS)	17.9		17.6	ng/L	14	98	(0%-36%)	
Fluorotelomer sulfonate 8:2 (8:2 FTS)	18.1		19.9	ng/L	13	110	(0%-39%)	

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# **QC Summary**

Workorder: 490881

Parmname

NOM Sample Qual QC Units RPD/D% REC% Range Anlst Date Time

Parmname	NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range Anlst	Date Time
<b>Perfluorinated Compounds</b> Batch 1921240									
N-ethylperfluoro-1- octanesulfonamidoacetic acid (N- EtFOSAA)	18.8			20.1	ng/L	4	107	(0%-25%) JLS	10/02/19 06:14
N-methylperfluoro-1- octanesulfonamidoacetic acid (N- MeFOSAA)	18.8			21.9	ng/L	2	116	(0%-26%)	
Perfluorobutanesulfonic acid (PFBS)	16.7			17.2	ng/L	4	103	(0%-30%)	
Perfluorobutyric acid (PFBA)	18.8			19.3	ng/L	2	102	(0%-30%)	
Perfluorodecanesulfonic acid (PFDS)	18.2			17.2	ng/L	3	95	(0%-28%)	
Perfluorodecanoic acid (PFDA)	18.8			21.1	ng/L	16	112	(0%-29%)	
Perfluorododecanoic acid (PFDoA)	18.8			19.0	ng/L	3	101	(0%-30%)	
Perfluoroheptanesulfonic acid (PFHpS)	17.9			17.7	ng/L	2	99	(0%-30%)	
Perfluoroheptanoic acid (PFHpA)	18.8			19.6	ng/L	9	104	(0%-30%)	
Perfluorohexanesulfonic acid (PFHxS)	17.2			16.8	ng/L	15	98	(0%-30%)	
Perfluorohexanoic acid (PFHxA)	18.8			20.9	ng/L	10	111	(0%-23%)	
Perfluorononanesulfonic acid (PFNS)	18.1			18.2	ng/L	4	101	(0%-27%)	
Perfluorononanoic acid (PFNA)	18.8			18.7	ng/L	12	99	(0%-27%)	
Perfluorooctanesulfonamide (PFOSA)	18.8			20.2	ng/L	6	107	(0%-30%)	
Perfluorooctanesulfonic acid (PFOS)	18.8			19.9	ng/L	1	106	(0%-27%)	

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# **QC Summary**

Workorder: 490881 Page 4 of 7 QC **Parmname** NOM Sample Qual Units RPD/D% REC% Range Anlst Date Time **Perfluorinated Compounds** Batch 1921240 Perfluorooctanoic acid (PFOA) 18.8 18.9 ng/L 0 100 (0%-30%)JLS 10/02/19 06:14 Perfluoropentanesulfonic acid 17.7 17.3 ng/L 98 (0%-29%)4 (PFPeS) Perfluoropentanoic acid (PFPeA) 18.8 20.0 ng/L 3 106 (0%-30%)18.8 9 109 Perfluorotetradecanoic acid 20.6 ng/L (0%-30%)(PFTeDA) Perfluoroundecanoic acid (PFUdA) 18.8 21.2 ng/L 10 112 (0%-28%)QC1204391613 MB U 10/02/19 05:56 2,3,3,3-Tetrafluoro-2-ND ng/L (1,1,2,2,3,3,3heptafluoropropoxy)-propanoic acid (PFPrOPrA) U Fluorotelomer sulfonate 4:2 (4:2 ND ng/L FTS) U ng/L Fluorotelomer sulfonate 6:2 (6:2 ND FTS) U ND Fluorotelomer sulfonate 8:2 (8:2 ng/L FTS) U N-ethylperfluoro-1-ND ng/L octanesulfonamidoacetic acid (N-EtFOSAA) U N-methylperfluoro-1-ND ng/L octanesulfonamidoacetic acid (N-MeFOSAA) U ND Perfluorobutanesulfonic acid ng/L (PFBS) U ND Perfluorobutyric acid (PFBA) ng/L Perfluorodecanesulfonic acid U ND ng/L (PFDS) U ND Perfluorodecanoic acid (PFDA) ng/L

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# **QC Summary**

Workorder: 490881 Page 5 of 7 NOM QC RPD/D% REC% **Parmname** Sample Qual Units Range Anlst Date Time **Perfluorinated Compounds** 1921240 Batch U Perfluorododecanoic acid (PFDoA) ND ng/L JLS 10/02/19 05:56 U ND Perfluoroheptanesulfonic acid ng/L (PFHpS) U Perfluoroheptanoic acid (PFHpA) ND ng/L U Perfluorohexanesulfonic acid ND ng/L (PFHxS) U ND Perfluorohexanoic acid (PFHxA) ng/L Perfluorononanesulfonic acid U ND ng/L (PFNS) U Perfluorononanoic acid (PFNA) ND ng/L U ND Perfluorooctanesulfonamide ng/L (PFOSA) U ND Perfluorooctanesulfonic acid ng/L (PFOS) Perfluorooctanoic acid (PFOA) U ND ng/L U ND Perfluoropentanesulfonic acid ng/L (PFPeS) Perfluoropentanoic acid (PFPeA) U ND ng/L U ND Perfluorotetradecanoic acid ng/L (PFTeDA) U ND

ng/L

Perfluoroundecanoic acid (PFUdA)

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# **QC Summary**

			_	_		<u>•/</u>						
Workorder: 49	0881										Pag	e 6 of 7
Parmname		NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/MS Batch 1919												
QC1204387349 **1,4-Dioxane-d8	LCS	4.00			3.55	ug/L		89	(70%-130%)	JMB3	09/24/1	19 12:24
QC1204387350 **1,4-Dioxane-d8	LCSD	4.00			3.18	ug/L		79	(70%-130%)	)	09/24/	19 12:49
QC1204387348 1,4-Dioxane	MB			U	ND	ug/L					09/24/1	19 11:59
**1,4-Dioxane-d8		4.00			3.05	ug/L		76	(70%-130%)	)		

#### **Notes:**

The Qualifiers in this report are defined as follows:

Analyte is a surrogate compound

- Result is less than value reported <
- Result is greater than value reported >
- Α The TIC is a suspected aldol-condensation product
- В The target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- Е Concentration of the target analyte exceeds the instrument calibration range
- Η Analytical holding time was exceeded
- J See case narrative for an explanation
- Value is estimated
- JNX Non Calibrated Compound
- Ν Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N/A RPD or %Recovery limits do not apply.
- N1 See case narrative
- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, the difference is >70%.
- One or more quality control criteria have not been met. Refer to the applicable narrative or DER. Q

Page 11 of 20 SDG: 490881 Rev1

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# **QC Summary**

Workorder: 490881

Page 7 of 7

Parmname NOM Sample Qual QC Units RPD/D% REC% Range Anlst Date Time

- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UJ Compound cannot be extracted
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y QC Samples were not spiked with this compound
- ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
- h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.

- ^ The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.
- \* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Page 12 of 20 SDG: 490881 Rev1

# Technical Case Narrative NWRA - Carolinas Chapter SDG #: 490881

# **GC/MS Semivolatile**

**Product:** Analysis of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas

**Chromatography/Mass Spectrometry** 

**Analytical Method:** SW846 3535A/8270E SIM **Analytical Procedure:** GL-OA-E-073 REV# 2

**Analytical Batch:** 1919444

**Preparation Method:** SW846 3535A

**Preparation Procedure:** GL-OA-E-073 REV# 2

**Preparation Batch:** 1919441

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
490881002	8202-1
1204387348	Method Blank (MB)
1204387349	Laboratory Control Sample (LCS)
1204387350	Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

## **Quality Control (QC) Information**

#### **Surrogate Recoveries**

Sample (See Below) did not meet surrogate recovery acceptance criteria. The sample was analyzed at a dilution. As a result, one or more surrogates were diluted out of the acceptance limits.

Sample	Analyte	Value
490881002 (8202-1)	1, 4-Dioxane-d8	69* (70%-130%)

#### **Laboratory Control Sample Duplicate (LCSD)**

An LCSD was used in place of matrix QC due to limited sample volume.

## **Technical Information**

#### **Sample Dilutions**

Sample 490881002 (8202-1) was diluted due to the presence of one or more over-range target analytes.

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# **LCMSMS-Misc**

**Product:** The Extraction and Analysis of Per and Polyfluroalkyl Substances Using LCMSMS

Analytical Method: EPA 537.1 Mod, PFAS, Compliant with QSM Table B-15

<u>Analytical Procedure:</u> GL-OA-E-076 REV# 7 <u>Analytical Batches:</u> 1921240 and 1921239

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID# Client Sample Identification

490881001 8202-1

1204391613 Method Blank (MB)

1204391614 Laboratory Control Sample (LCS)

1204391615 Laboratory Control Sample Duplicate (LCSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

#### **Technical Information**

## **Sample Dilutions**

The following samples were diluted to bring the over range concentrations within the calibration range and/or due to matrix interference that caused internal standards recoveries to fall outside the acceptance range. 490881001 (8202-1).

Anches	490881
Analyte	001
2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid (PFPrOPrA)	50X
Fluorotelomer sulfonate 6:2 (6:2 FTS)	100X
Fluorotelomer sulfonate 8:2 (8:2 FTS)	50X
Perfluorobutanesulfonate (PFBS)	50X
Perfluorobutyric acid (PFBA)	50X
Perfluoroheptanoic acid (PFHpA)	50X
Perfluorohexanoic acid (PFHxA)	50X
Perfluoropentanoic acid (PFPeA)	100X
Perfluorotetradecanoic acid (PFTeDA)	50X
Perfluorotridecanoic acid (PFTrDA)	50X

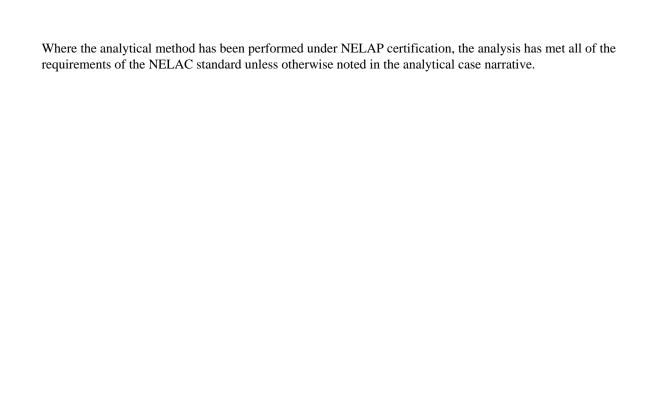
## **Miscellaneous Information**

#### **Additional Comments**

Additional sample volume was not provided for matrix QC. Also, reduced sample volumes were used for all samples except 490876002 (7607-EB) due to elevated concentrations of target analytes.

## **Certification Statement**

Page 14 of 20 SDG: 490881 Rev1



GEL Laboratories, LLC	2040 Savage Road Charleston, SC 29407	Phone: (843) 556-8171	Fax: (843) 766-1178	(Fill in the number of containers for each test)	< Preservative Type (6)	EPA 537 mod	Note: extra sample is required for sample specific QC				Note that you will receive a separate cooler	9/zu/19 with bottles for 1,4-dioxane analysis— for this site. It is OK to include those in the	same lab report as these samples.	Specify:	(Subject to Surcharge)	[ ] level     Level 2     Level 3		Yes           No         Cooler Temp:         °C           ain           Other:           Other		N≕Nasal		Please provide any additional details below regarding handling and/or disposal	concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)			
	aty Analytics		Committee A destruction	Sample Analysis Requested		isidered: PFAS 21 cmpd list by	otal number of GenX by EPA 537	di )			Note that you	9/20/19 with be	same lab repo	TAT Requested: Normal: X Rush; S	[X] No	C of A [ 10C Summary	Additional Remarks:	For Lab Receiving Use Only: Custody Seal Intact? [] Yes 2 Zone: K] Eastern [] Pacific [] Central [] Mountain	icate Sumple, $G = Grab$ , $C = Composite$	Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Water, W=Water, ML=Mise Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Soild Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Feerl, N=Nasal Sample Analysis Requested: Analytical method requested (i.e. 82608, 60108/7470A) and number of containers provided for each (i.e. 82608, 3. 80108/7470A).	= Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfate, If no preservative is added = leave field blank	Other OT= Other / Unknown	misc. health hazards, etc.)  Description:			
	gel.com	Number: GEI Project Manager:	hone # 919_847		1000-000-00	Send Results To:Genna Olson golson@harthickman.com	Sadioactive	Z						latures	Date	assa vivil		For Lab Receivin w form (SRR.)   Sample Collection Time Zone:   Eastern	QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite Field Filtered: For fiquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered.	Matrix ( odes: DW*Drinking Water, GW*Groundwater, SW*Surface Water, WW*Water, W*WWWWater, ML*Mise Liquid, SO*Soil, SO*Sediment, SL*Sludge, Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each it o. 8260B, 3 2010B/7470A) and number of containers provided for each it o. 8260B, 3 2010B/7470A) and number of containers provided for each it o. 8260B, 3 2010B/7470A) and number of containers provided for each it o. 8260B.	SA = Sulfurie Acid, AA = Ascorbic Acid, HX = Hexane, ST = Soc	7.				
	GEL Quote #: NWRA Quote COC Number (1); NA	NA GEL Work Order Number:	NWRA c/o Hart & Hickman. PC	Project/Site Name: Sampson County Disposal 11.0	Roseboro, NC	Patrick Stevens Send Results To:G	*Date:  **For composites - indicate start and stop datertime (mm.	8202-1 09-1						Chain of Custod	Date Time	1030	7 2 2	For sumple shipping and delivery details, see Sample Receipt & Review form (SRR.) Chain of Custody Number = Client Determined	QC Codes: N = Normal Sample, TB * Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSI Field Filtered. For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered.	nking Water, GW=Groundwater, SW=Surface Water, WW=Was ted: Analytical method requested (i.e. 82608, 60108/7470A) an	Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA  Are there any known or possible hazards   Characteristic Hazards   11 : 1. 1.		Hg= Mercury So= Solonium	Age Silver PCB = Polychlormated	- Miscenaricous biphenyls RCRA metals	THE PARTY OF THE P

GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407 Phone: (843) 556-8171 Fax: (843) 766-1178 Fig. 10, the number of containers for each test)	Comments  Note: extra sample is required for sample specific QC	Specify: (Subject to Surcharge)	[ ] level 1 [ ] Level 2 [ ] Level 3 [ ] Level 4  ?? [ ] Yes [ ] No Cooler Temp: ] °C  Mountain [ ] Other	, N=Nasai	Please provide any additional details below regarding handling and/or disposal concerns, (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)
alty Analytics  Rect Analysis Reconstred (5)	The continuous of the continuo	TAT Requested: Normal: Kush:	Time Fax Results: [ ] Yes Mos  [ 7405 Select Deliverable: [ ] C of A [ ] QC Summary [ ] level  [ 4 6:55 Additional Remarks:	icate Sample, G = Grab, C = Composite  SL=Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Feca 7470A - 1).	Other OT= Other / Unknown (i.e.: High/low pH, asbestos, beryllium, irritants, other misc. health hazards, etc.) Description:
CHELLON GRICON Chain of Phone # Canal	Fax #  LV 28382  LV 28382  All 2015: John Charle Walnickwom  And Olse John Code Collected (Mitthery) (Collected Collected Coll	dy Signatures	Pate 9-19-19	Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Dupli field filtered or - N - for sample was not field filtered.  WW=:Waste Water, W=:Water, ML=:Misc Liquid, SO=:Soil, SD=:Sediment, (7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/) sydoxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = So	ic Hazards Listed Waste LW= Listed Waste LW= Listed Waste (F,K,P and U-listed wastes.)  Waste code(s):  ated  ated  anyls
\(\frac{1}{2}\)	Merican Sample ID  Sam	Chain of Custody Signatures	Relinquished By (Signed)  1	1.) Chain of Custody Number = Client Determined 2.) QC Codes: N = Normal Sample, TB = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite 3.) Field Filtered: For liquid matrices, indicate with a - Y - for yes the sample was field filtered or - N - for sample was not field filtered. 4.) Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Waste Water, M=Water, MI=Misc Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Nasal 5.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1). 6.) Preservative Type: HA = Hydrochloric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfate, If no preservative is added = leave field blank	7.) Are there any known or possible hazards associated with these samples?  RCRA Metals  As = Arsenic Hg= Mercury  Ba = Barium Se= Selenium Cd = Cadmium Ag= Silver Cr = Chromium MR= Miscellaneous PD = Lead RCRA metals  Cr = Chromium MR= Miscellaneous  Possible hazards  RCB = Fammable/Ignitable  CO = Corrosive  RE = Feactive  RE = Feactive  RCB = Polychlorinated  FCB = Polychlorinated  FCB = Polychlorinated  FCB = Polychlorinated  FCB = Folychlorinated  FC

Client: NARA		Th	<del>-</del>	SAMPLE RECEIPT & REVIEW FORM
7 1 1			T	OG/AR/COC/Work Order: 10850/W 1088
Received By:			7	ate Received: 9/19/19 V Circle Applicable:
Carrier and Tracking Number			7	Fedex Express Fedex Ground UPS Field Services Courier Other 4762 7563 2308 -1", 7762 7563 3418-1" 762 7563 3290-1"
Suspected Hazard Information	Yes	å	*16	Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
A)Shipped as a DOT Hazardous?		1		zard Class Shipped: UN#: JN2910, Is the Radioactive Shipment Survey Compliant? YesNo
B) Did the client designate the samples are to be received as radioactive?		/	СО	C notation or radioactive stickers on containers equal client designation.
C) Did the RSO classify the samples as radioactive?		/	Ma Cla	ximum Net Counts Observed* (Observed Counts - Area Background Counts):CPM / mR/Hr assified as: Rad 1
D) Did the client designate samples are hazardous?		/		C notation or hazard labels on containers equal client designation.
E) Did the RSO identify possible hazards?		<b>V</b>	PCI	O or E is yes, select Hazards below. B's Flammable Foreign Soil RCRA Asbestos Beryllium Other:
Sample Receipt Criteria	Yes	×	ž	1 Villa Contact thing rection
Shipping containers received intact and sealed?				Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2 Chain of custody documents included with shipment?	V			Circle Applicable: Client contacted and provided COC COC created upon receipt  Preservation Method: Wet low Ice Packs Dry ice None Other:
3 Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	/	Prince.		*all temperatures are recorded in Celsius TEMP:
Daily check performed and passed on IR temperature gun?	/		Ŀ	Temperature Device Serial #: \( \frac{TB4 - I6^2}{Secondary Temperature Device Serial # (If Applicable):}\)
5 Sample containers intact and sealed?			$\sqrt{}$	Circle Applicable: Seals broken Damaged contained Leaking container Other (describe) 6204-1 (1boffle) capreceived cracked
6 Samples requiring chemical preservation at proper pH?		$\checkmark$		Sample ID's and Containers Affected:  If Preservation added, Lot#:
7 Do any samples require Volatile Analysis?			√ <u>.</u>	If Yes, are Encores or Soil Kits present for solids? Yes No NA (If yes, take to VOA Freezer)  Do liquid VOA vials contain acid preservation? Yes No NA (If unknown, select No)  Are liquid VOA vials free of headspace? Yes No NA  Sample ID's and containers affected:
8 Samples received within holding time?	/			ID's and tests affected:
9 Sample ID's on COC match ID's on bottles?	1			ID's and containers affected:
Date & time on COC match date & time on bottles?	$\sqrt{}$	,		Circle Applicable: No dates on containers No times on containers COC missing info Other (describe)
Number of containers received match number indicated on COC?	$\checkmark$			Circle Applicable: No container count on COC Other (describe)
Are sample containers identifiable as GEL provided?  COC form is properly signed in	1		_	Circle Applicable: Not relinquished Other (describe)
relinquished/received sections?			<b>/</b>	Circle Application (describe)
Comments (Use Continuation Form if needed):				
PM (or PA	lA) re	view	; Init	Date Date Page of GL-CHL-SR-001 Rev 6

Γ	Laboratories (b)	JA	l		SAMPLE RECEIPT & REVIEW FORM
CI	ent: MWNA			SI	DG/AR/COC/Work Orger: 40088
Re	ceived By:			D	ate Received: 9/20/14
	Carrier and Tracking Number				Fedex Express Fedex Ground UPS Field Services Courier Other  FFG X 8638 8788  FFG X 8638 8034
Sus	pected Hazard Information	Yes	ž	*11	Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
A)S	nipped as a DOT Hazardous?		/	Yila	zard Class Shipped: UN#: JN2910, Is the Radioactive Shipment Survey Compliant? Yes No
B) E rece	id the client designate the samples are to be ved as radioactive?		/	1	C notation or radioactive stickers on containers equal client designation.
C) D	id the RSO classify the samples as active?			Ma Cl:	ximum Net Counts Observed* (Observed Counts - Area Background Counts):CPM / mR/Hr ssified as: Rad 1
D) C haza	id the client designate samples are dous?				C notation or hazard labels on containers equal elient designation.
E) D	id the RSO identify possible hazards?			If C PCI	) or E is yes, select Hazards below. B's Flammable Foreign Soil RCRA Asbestos Beryllium Other:
	Sample Receipt Criteria	Yes	ź	Š	Comments/Qualifiers (Required for Non-Conforming Items)
	Shipping containers received intact and scaled?	1			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Chain of custody documents included with shipment?	/			Circle Applicable: Client contacted and provided COC COC created upon receipt
_	Samples requiring cold preservation within $(0 \le 6 \text{ deg. C})$ ?*				Preservation Method: Wet Ice   Ice Packs   Dry ice   None Other: **all temperatures are recorded in Celsius   TEMP:
	Daily check performed and passed on IR emperature gun?		1		Temperature Device Serial #: <u>IR4 - L6</u> Secondary Temperature Device Serial # (If Applicable):
5	Sample containers intact and sealed?				Circle Applicable: Scals broken Damaged container Leaking container Other (describe)
	Samples requiring chemical preservation at proper pH?				Sample ID's and Containers Affected:  If Preservation added, Lat#
7	Do any samples require Volatile Analysis?				If Yes, are Encores or Soil Kits present for solids? Yes No NA (If yes, take to VOA Freezer)  Do liquid VOA vials contain acid preservation? Yes No NA (If unknown, select No)  Are liquid VOA vials free of headspace? Yes No NA  Sample ID's and containers affected:
8 5	amples received within holding time?				ID's and tests affected:
	ample ID's on COC match ID's on ottles?	/			ID's and containers affected:
	ate & time on COC match date & time n bottles?				Circle Applicable: No dates on containers No times on containers COC missing info Other (describe)
	lumber of containers received match umber indicated on COC?				Circle Applicable: No container count on COC Other (describe)
- 19	re sample containers identifiable as EL provided? OC form is properly signed in				
13 1	ents (Use Continuation Form if needed):	X		<b>√</b>	Circle Applicable: Not relinquished Other (describe)
	(See Section of Form II needed).				
					* * * * * * * * * * * * * * * * * * *

List of current GEL Certifications as of 08 November 2019

State	Certification
Alaska	17-018
Alaska Drinking Water	SC00012
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M-SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122020-1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	2019–165
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-19-15
Utah NELAP	SC000122019-28
Vermont	VT87156
Virginia NELAP	460202
Washington	C780











PO Box 30712 Charleston, SC 29417 2040 Savage Road Charleston, SC 29407 P 843.556.8171 F 843.766.1178

gel.com

October 14, 2019

Mr. Jim Riley NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804 Arlington, Virginia 22202

Re: Analytical for Great Oak Landfill

Work Order: 491597

Dear Mr. Riley:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on October 01, 2019. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,

Julie Robinson Project Manager

Purchase Order: GELP19-0905

Enclosures

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# Certificate of Analysis Report for

NWRA001 NWRA – Carolinas Chapter Client SDG: 491597 GEL Work Order: 491597

## The Qualifiers in this report are defined as follows:

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Julie Robinson.

	Julie	Robinson
Reviewed by		

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

Project:

Client ID:

**Analyst Comments** 

NWRA00119

NWRA001

**Certificate of Analysis** 

Report Date: October 14, 2019

Company: NWRA - Carolinas Chapter Address: 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact: Mr. Jim Riley

Project: Analytical forGreat Oak Landfill

Client Sample ID: 7607-EB
Sample ID: 491597001
Matrix: Misc Liquid
Collect Date: 30-SEP-19 09:55

Receive Date: 01-OCT-19 Collector: Client

Parameter	Qualifier	Result	DL	RL	Units	PF	DF Analyst Date	Time Batch	Method

Semi-Volatile-GC/MS

SW846 8270 SIM 1,4-Dioxane in Liquid "As Received"

1,4-Dioxane U ND 0.100 0.400 ug/L 0.020 1 JMB3 10/08/19 1130 1924252 1

The following Prep Methods were performed:

Method	Description	Analyst	Date	Time	Prep Batch
SW846 3535A	SW8270E SIM Prep 1,4-Dioxane	SJ	10/07/19	1230	1924251

The following Analytical Methods were performed:

Description

1 SW846 3535A/8270E SIM

Surrogate/Tracer Recovery Test Result Nominal Recovery% Acceptable Limits 1,4-Dioxane-d8 SW846 8270 SIM 1,4-Dioxane in Liquid "As 3.43 ug/L 4.00 86 (70%-130%)

Received"

#### **Notes:**

Method

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

MDA: Minimum Detectable Activity

Lc/LC: Critical Level

PF: Prep Factor

RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# **Certificate of Analysis**

Report Date: October 14, 2019

Company: Address:

NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact:

Mr. Jim Riley

Project:

Analytical forGreat Oak Landfill

Client Sample ID:

7607-2

Sample ID: Matrix:

491597002

Collect Date:

Misc Liquid 30-SEP-19 10:35

Receive Date:

01-OCT-19

Collector:

Client

Parameter	Qualifier	Result	DL	RL	Units	PF	DF	Analy	st Date	Time Batch	Method
Semi-Volatile-GC/	MS										
SW846 8270 SIM 1	1,4-Dioxane in Liqu	iid "As Received"									
1,4-Dioxane		469	20.0	40.0	ug/L	0.200	20	JMB3	10/08/19	1154 1924252	1
The following Prep	Methods were perf	formed:									
Method	Description		Α	Analyst	Date		Time	e Pr	ep Batch		

SJ

SW8270E SIM Prep 1,4-Dioxane SW846 3535A The following Analytical Methods were performed:

Method Description

SW846 3535A/8270E SIM

Surrogate/Tracer Recovery 1,4-Dioxane-d8

Test SW846 8270 SIM 1,4-Dioxane in Liquid "As

Result 47.1 ug/L

10/07/19

Nominal 40.0

Project:

Client ID:

Recovery%

1924251

118

1230

**Analyst Comments** 

NWRA00119

NWRA001

Acceptable Limits (70%-130%)

Received"

#### **Notes:**

Column headers are defined as follows:

DF: Dilution Factor DL: Detection Limit Lc/LC: Critical Level PF: Prep Factor **RL**: Reporting Limit

MDA: Minimum Detectable Activity MDC: Minimum Detectable Concentration

SQL: Sample Quantitation Limit

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

# **QC Summary**

NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804

Arlington, Virginia
Mr. Jim Riley

\_\_\_

Workorder: 491597

**Contact:** 

Parmname			NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
Semi-Volatile-GC/M Batch 192	S 4252												
QC1204398479 **1,4-Dioxane-d8	LCS		4.00			3.61	ug/L		90	(70%-130%)	JMB3	10/08/1	9 11:05
QC1204398478 1,4-Dioxane	MB				U	ND	ug/L					10/08/	9 10:40
**1,4-Dioxane-d8			4.00			4.22	ug/L		105	(70%-130%)			
QC1204398483 **1,4-Dioxane-d8	491597002	MS	40.0	47.1		42.2	ug/L		106	(70%-130%)		10/08/1	9 12:19
QC1204398484 **1,4-Dioxane-d8	491597002	MSD	40.0	47.1		35.1	ug/L		88	(70%-130%)		10/08/	9 12:44

#### Notes:

The Qualifiers in this report are defined as follows:

- \*\* Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B The target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- E Concentration of the target analyte exceeds the instrument calibration range
- H Analytical holding time was exceeded
- J See case narrative for an explanation
- J Value is estimated
- JNX Non Calibrated Compound
- N Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor

Page 5 of 11 SDG: 491597

Page 1 of 2

Report Date: October 14, 2019

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

# **QC Summary**

Parmname NOM Sample Qual QC Units RPD/D% REC% Range AnIst Date Time

N/A RPD or %Recovery limits do not apply.

491597

N1 See case narrative

Workorder:

- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, the difference is >70%.
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UJ Compound cannot be extracted
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y QC Samples were not spiked with this compound
- ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
- h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.  $^{\circ}$  The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of  $^{+/-}$  the RL is used to evaluate the DUP result.

\* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

# GC/MS Semivolatile Technical Case Narrative NWRA - Carolinas Chapter SDG #: 491597

**Product:** Analysis of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas

**Chromatography/Mass Spectrometry** 

**Analytical Method:** SW846 3535A/8270E SIM **Analytical Procedure:** GL-OA-E-073 REV# 2

**Analytical Batch:** 1924252

**Preparation Method:** SW846 3535A

**Preparation Procedure:** GL-OA-E-073 REV# 2

**Preparation Batch:** 1924251

The following samples were analyzed using the above methods and analytical procedure(s).

Client Sample Identification
7607-EB
7607-2
Method Blank (MB)
Laboratory Control Sample (LCS)
491597002(7607-2) Matrix Spike (MS)
491597002(7607-2) Matrix Spike Duplicate (MSD)

The samples in this SDG were analyzed on an "as received" basis.

## **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

#### **Quality Control (QC) Information**

#### **Spike Recovery Statement**

The MS and MSD (See Below) spike recoveries were not within the acceptance limits. There was a detected presence of 1,4-Dioxane above the reporting limits in the un-spike parent sample that caused a biased calculated spike recovery result in the MS and MSD. The data results have been reported.

Sample	Analyte	Value
1204398483 (7607-2MS)	1, 4-Dioxane	0* (70%-130%)
1204398484 (7607-2MSD)	1, 4-Dioxane	0* (70%-130%)

## **Technical Information**

#### **Sample Dilutions**

Samples 1204398483 (7607-2MS), 1204398484 (7607-2MSD) and 491597002 (7607-2) were diluted due to the presence of non-target analytes. The data from the dilutions are reported. Samples 1204398483 (7607-2MS), 1204398484 (7607-2MSD) and 491597002 (7607-2) were diluted due to the presence of one or more over-range

target analytes.

# **Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407 Phone: (843) 556-8171	Fax: (843) 766-1178 (Fill in the number of contamer, for each test)	-Preservative Type (63		Note: evino cannie is	required for sample specific QC							Specify: (Subject to Surcharge)		level 1 [ ] Level 2 [ ] Level 4		] Yes [ ] No Cooler Temp: °C	ntain [ ] Other:		N=Nacs		Please provide any additional details	betow regarding nanding and/or disposal concerns. (i.e.: Origin of sample(s), type	of site collected from, odd matrices, etc.)			
Chain of Custody and Analytical Request	4 Holynon, PC. Phone # 919 - 847 - 4201	Fax#	The sample be	on go a span	- a	1 M N BA 556 b	うるプラ					TAT Requested: Normal: K Rush:	ĺ	Select Deliverable: [ ] C of A [ ] QC Summary [ ] level 1	0	For Lab Receiving Use Only: (	& Review form (SRR.)   Sample Collection Time Zone.   Eastern   Pacific     Central   Mountain	) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD = Matrix Spike Duplicate Sample, G = Grab, C = Composite    Field Filtered - For liquid matrices indicate with a - V - for use the essemble uses fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use fadd filtered as - N - for use the essemble use the essemble use - N - for use the essemble use the essemble use - N - for use	Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Waste Water, WL=Mider, WL=Mider, SD=Sediment, SL=Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=Urine, F=Fecal, N=Nasel	Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1).  Preservative Type: HA = Hydrochloric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascorbic Acid, HX = Hexane, ST = Sodium Thiosulfate. If no preservative is added = Irany field blank.	Characteristic Hazards         Listed Waste         Other           FL = Flammable/Ignitable         LW= Listed Waste         OT= Other / Unknown	(F,K,P and U-listed wastes.)	waste code(s): misc. health hazards, etc.)  Description:	lated Incininated	myls	
1995. 10 of NW A-OC L 3EQuote #: NW P-A Quere	With Go Have ?	me: Grocet Gar Le	7 Old (Colar Palls)	0535A	Sample ID	7607- E3	7607-2			,			Reinquished By (Signed) Date Time	14/1/1/1/1/1/2 9/20/19 1600			FOR SAMPLE SHIPPING AND DETECTS DETAILS, SEE SAMPLE RECEIPS & REVIEW JOYNE (SRR.) Chain of Custody Number = Client Determined	) QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field Duplicate, EB = Equipment Blank, MS = Matrix Spike Sample, MSD   Field Filtered - For limit matrices indicate with aV. for use the complete was field filtered for N. for complete with aV. for use the complete was field filtered for N. for complete with aV. for use the complete was first filtered.	Matrix Codes: DW-Drinking Water, GW-Groundwater, SW-Surface Water,	) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided ) Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid, SH = Sodium Hydroxide, SA = Sulfuric Acid, AA = Ascort	) Are there any known or possible hazards  associated with these samples? FL = Flammable/Ignitable	CO = Corrosive	Hg= Mercury	a = Barnum       Se= Selennum       TSCA Regulated $d = Cadmium$ Ag= Silver       PCB = Polychlorinated	r = Chromium MR= Miscellaneous biphenyls h = 1 end RCRA metrals	

	Laboratories : ::				SAMPLE DECEMPE & DEVINEY PORTS
C	lient:			Ţ	SAMPLE RECEIPT & REVIEW FORM  SDG/AR/COC/Work Order:
R	eccived By:	~~~	•		Date Received:
	Carrier and Tracking Number				Circle Applicable: FedEx Express FedEx Ground UPS Field Services Courier Other
L				ŀ	7763 8929 7266
St	spected Hazard Information	Yes	ź	1	If Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.
<u>A)</u>	Shipped as a DOT Hazardous?			11	azard Class Shipped: UN#: UN2910, Is the Radioactive Shipment Survey Compliant? Yes No
B) red	Did the client designate the samples are to be eived as radioactive?		1	6	OC notation or radioactive stickers on containers equal client designation.
C)	Did the RSO classify the samples as lioactive?			/c	aximum Net Counts Observed* (Observed Counts - Area Background Counts): CPM / mR/Hr lassified as: Rad 1 Rad 2 Rad 3
D) ha:	Did the client designate samples are eardous?		v		OC notation or hazard labels on containers equal client designation.
E)	Did the RSO identify possible hazards?		J	P	D or E is yes, select Hazards below. B's Flammable Foreign Soil RCRA Asbestos Beryllium Other:
_	Sample Receipt Criteria	Yes	ź	ź	Comments/Qualifiers (Required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	V		7	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
2	Chain of custody documents included with shipment?	V		-	Circle Applicable: Client contacted and provided COC COC created upon receipt
3	Samples requiring cold preservation within (0 ≤ 6 deg. C)?*	V			Preservation Method Wet Ice Ice Packs Dry Ice None Other:  *all temperatures are recorded in Celsius  TEMP
4	Daily check performed and passed on IR temperature gun?	V			Temperature Device Serial # (if Applicable):
5	Sample containers intact and sealed?	1			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)
6	Samples requiring chemical preservation at proper pH?		wii V	7	Sample (D's and Containers Affected:
7	Do any samples require Volatile Analysis?		Elika Ulia agua		If Preservation added, Lot#:  If Yes, are Encores or Soil Kits present for solids? Yes No NA (If yes, take to VOA Freezer)  Do liquid VOA vials contain acid preservation? Yes No NA (If unknown, select No)  Are liquid VOA vials free of headspace? Yes No NA Sample ID's and containers affected:
8	Samples received within holding time?				ID's and tests affected:
9	Sample ID's on COC match ID's on bottles?		26.1		fD's and containers affected:
	Date & time on COC match date & time on bottles?		/		Circle Applicable: No dates on containers No times on containers COC missing info Other (describe)
	Number of containers received match number indicated on COC?	J			Circle Applicable: No container count on COC Other (describe)
12	Are sample containers identifiable as GEL provided?				
13	COC form is properly signed in relinquished/received sections?		7		Circle Applicable: Not relinquished Other (describe)
Coin	ments (Use Continuation Form if needed):				

List of current GEL Certifications as of 14 October 2019

State	Certification
Alaska	17-018
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M-SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122020-1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	2019–165
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-19-15
Utah NELAP	SC000122019-28
Vermont	VT87156
Virginia NELAP	460202
Washington	C780



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PO Box 30712 Charleston, SC 29417 2040 Savage Road Charleston, SC 29407 P 843.556.8171 F 843.766.1178

gel.com

December 19, 2019

Mr. Jim Riley NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804 Arlington, Virginia 22202

Re: Analytical for CMS Landfill

Work Order: 498420

Dear Mr. Riley:

GEL Laboratories, LLC (GEL) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on December 05, 2019. This original data report has been prepared and reviewed in accordance with GEL's standard operating procedures.

Test results for NELAP or ISO 17025 accredited tests are verified to meet the requirements of those standards, with any exceptions noted. The results reported relate only to the items tested and to the sample as received by the laboratory. These results may not be reproduced except as full reports without approval by the laboratory. Copies of GEL's accreditations and certifications can be found on our website at www.gel.com.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at (843) 556-8171, ext. 4289.

Sincerely,

Julie Robinson Project Manager

Purchase Order: GELP19-0905

Enclosures

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# Certificate of Analysis Report for

NWRA001 NWRA – Carolinas Chapter Client SDG: 498420 GEL Work Order: 498420

## The Qualifiers in this report are defined as follows:

- \* A quality control analyte recovery is outside of specified acceptance criteria
- \*\* Analyte is a Tracer compound
- \*\* Analyte is a surrogate compound
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

The designation ND, if present, appears in the result column when the analyte concentration is not detected above the limit as defined in the 'U' qualifier above.

This data report has been prepared and reviewed in accordance with GEL Laboratories LLC standard operating procedures. Please direct any questions to your Project Manager, Julie Robinson.

	Irlie	Robinson
Reviewed by		

2040 Savage Road Charleston SC 29407 - (843) 556-8171 - www.gel.com

# **Certificate of Analysis**

Project:

Client ID:

**Analyst Comments** 

NWRA00119

NWRA001

Report Date: December 19, 2019

Company: Address:

NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804

Arlington, Virginia 22202

Contact:

Mr. Jim Riley

Project:

Analytical forCMS Landfill

Client Sample ID: Sample ID: 1, 1A, 2, 2A 498420001

Matrix:

Water

Collect Date:

04-DEC-19 13:30

Receive Date:

05-DEC-19

Collector:

Client

Parameter	Qualifier Result	DL	RL	Units	PF D	F Ar	nalyst Date	Time	Batch	Method
Semi-Volatile-GC/	/MS									
SW846 8270 SIM	1,4-Dioxane in Liquid "As Received"									
1,4-Dioxane	214	4.00	8.00	ug/L	0.200	4 JM	IB3 12/11/19	0925	1947214	1
The following Prep	p Methods were performed:									
Method	Description		Analyst	Date	Ti	me	Prep Batch			
SW846 3535A	SW8270E SIM Prep 1,4-Dioxane		SJ	12/10/19	080	00	1947213			<del></del>
The following An	alytical Methods were performed:									

The following Analytical Methods were performed:

Description

1 SW846 3535A/8270E SIM				
Surrogate/Tracer Pacovery Test	Pacult	Nominal	Pacovary%	Acceptable Limits

Surrogate/Tracer Recovery Test Result Nominal Recovery% Acceptable Limits 1,4-Dioxane-d8 SW846 8270 SIM 1,4-Dioxane in Liquid "As 25.3 ug/L 40.0 63\* (70%-130%)

Received"

## Notes:

Method

Column headers are defined as follows:

DF: Dilution Factor

DL: Detection Limit

MDA: Minimum Detectable Activity

Lc/LC: Critical Level

PF: Prep Factor

RL: Reporting Limit

MDC: Minimum Detectable Concentration SQL: Sample Quantitation Limit

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

# **QC Summary**

Report Date: December 19, 2019

Page 1 of 2

NWRA - Carolinas Chapter 1550 Crystal Drive, Suite 804

Arlington, Virginia Mr. Jim Riley

Workorder: 498420

**Contact:** 

Parmname		NOM	Sample	Qual	QC	Units	RPD/D%	REC%	Range	Anlst	Date	Time
<b>Semi-Volatile-GC/M</b> Batch 194	S 7214											
QC1204451621 **1,4-Dioxane-d8	LCS	4.00			3.18	ug/L		79	(70%-130%)	JMB3	12/10/1	19 15:57
QC1204451620 1,4-Dioxane	MB			U	ND	ug/L					12/10/1	19 15:33
**1,4-Dioxane-d8		4.00			3.48	ug/L		87	(70%-130%)			
QC1204451622 **1,4-Dioxane-d8	498420001	40.0	25.3		25.0	ug/L		63*	(70%-130%)		12/11/	19 09:50
QC1204451623 **1,4-Dioxane-d8	498420001	40.0	25.3		28.0	ug/L		70	(70%-130%)		12/11/1	19 10:13

#### Notes:

The Qualifiers in this report are defined as follows:

- \*\* Analyte is a surrogate compound
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B The target analyte was detected in the associated blank.
- C Analyte has been confirmed by GC/MS analysis
- D Results are reported from a diluted aliquot of the sample
- E Concentration of the target analyte exceeds the instrument calibration range
- H Analytical holding time was exceeded
- J See case narrative for an explanation
- J Value is estimated
- JNX Non Calibrated Compound
- N Organics--Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor
- N Presumptive evidence based on mass spectral library search to make a tentative identification of the analyte (TIC). Quantitation is based on nearest internal standard response factor

2040 Savage Road Charleston, SC 29407 - (843) 556-8171 - www.gel.com

# **QC Summary**

Page 2 of 2

Parmname NOM Sample Qual QC Units RPD/D% REC% Range Anlst Date Time

N/A RPD or %Recovery limits do not apply.

498420

N1 See case narrative

Workorder:

- ND Analyte concentration is not detected above the detection limit
- NJ Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- P Organics--The concentrations between the primary and confirmation columns/detectors is >40% different. For HPLC, the difference is >70%.
- Q One or more quality control criteria have not been met. Refer to the applicable narrative or DER.
- R Sample results are rejected
- U Analyte was analyzed for, but not detected above the MDL, MDA, MDC or LOD.
- UJ Compound cannot be extracted
- X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
- Y QC Samples were not spiked with this compound
- ^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL. Qualifier Not Applicable for Radiochemistry.
- h Preparation or preservation holding time was exceeded

N/A indicates that spike recovery limits do not apply when sample concentration exceeds spike conc. by a factor of 4 or more or %RPD not applicable.  $^{\circ}$  The Relative Percent Difference (RPD) obtained from the sample duplicate (DUP) is evaluated against the acceptance criteria when the sample is greater than five times (5X) the contract required detection limit (RL). In cases where either the sample or duplicate value is less than 5X the RL, a control limit of +/- the RL is used to evaluate the DUP result.

\* Indicates that a Quality Control parameter was not within specifications.

For PS, PSD, and SDILT results, the values listed are the measured amounts, not final concentrations.

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the QC Summary.

Page 5 of 10 SDG: 498420

# GC/MS Semivolatile Technical Case Narrative NWRA - Carolinas Chapter SDG #: 498420

**Product:** Analysis of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas

**Chromatography/Mass Spectrometry** 

**Analytical Method:** SW846 3535A/8270E SIM **Analytical Procedure:** GL-OA-E-073 REV# 2

**Analytical Batch:** 1947214

**Preparation Method:** SW846 3535A

**Preparation Procedure:** GL-OA-E-073 REV# 2

**Preparation Batch:** 1947213

The following samples were analyzed using the above methods and analytical procedure(s).

GEL Sample ID#	Client Sample Identification
498420001	1, 1A, 2, 2A
1204451620	Method Blank (MB)
1204451621	Laboratory Control Sample (LCS)
1204451622	498420001(1, 1A, 2, 2A) Matrix Spike (MS)
1204451623	498420001(1, 1A, 2, 2A) Matrix Spike Duplicate (MSD)

The samples in this SDG were analyzed on an "as received" basis.

#### **Data Summary:**

All sample data provided in this report met the acceptance criteria specified in the analytical methods and procedures for initial calibration, continuing calibration, instrument controls and process controls where applicable, with the following exceptions.

## **Quality Control (QC) Information**

#### **Surrogate Recoveries**

Samples (See Below) did not meet surrogate recovery acceptance criteria. Since the parent sample and associated MS/MSD pair displayed similar recoveries, the failures were attributed to matrix interference and the data results are reported.

Sample	Analyte	Value
1204451622 (1, 1A, 2, 2AMS)	1, 4-Dioxane-d8	63* (70%-130%)
498420001 (1, 1A, 2, 2A)	1, 4-Dioxane-d8	63* (70%-130%)

## **Spike Recovery Statement**

The MS or MSD (See Below) recovered spiked analytes outside of the established acceptance limits. As similar recoveries were displayed in the MS and MSD, the failures were attributed to sample matrix interference and the data were reported.

Sample	Analyte	Value
--------	---------	-------

1204451622 (1, 1A, 2, 2AMS)	1, 4-Dioxane	0* (70%-130%)
1204451623 (1, 1A, 2, 2AMSD)	1, 4-Dioxane	30* (70%-130%)

# **Technical Information**

## **Sample Dilutions**

Samples 1204451622 (1, 1A, 2, 2AMS), 1204451623 (1, 1A, 2, 2AMSD) and 498420001 (1, 1A, 2, 2A) were diluted due to the presence of one or more over-range target analytes.

# **Miscellaneous Information**

## **Manual Integrations**

Sample (See Below) required manual integration in order to properly identify one or more peaks and/or to correctly position the baseline as set in the calibration standard injections.

Sample	Analyte	Value
498420001 (1, 1A, 2, 2A)	Tetrahydrofuran-d8	Result 400ug/L

## **Certification Statement**

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless otherwise noted in the analytical case narrative.

GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407	Phone: (843) 556-8171	(Fill in the number of containers for each test)	< Preservative Type (6)		Note: extra sample is	required for sample specific QC						Rush: Specify: (Subject to Surcharge)		nnary [ ] level 1 [ ] Level 2 [ ] Level 4		Custody Seal Intact? [ ] Yes [ ] No Cooler Temp: °C	84	=Urine, F=Fecal, N≃Nasal	blank	Please provide any additional details below regarding handling and/or disposal concerns. (i.e.: Origin of sample(s), type of site collected from, odd matrices, etc.)
Laboratories LLC Chemistry I Radiobioassay I Specially Analytics	Chain of Custody and Analytical Request	Sample Analysis Requested (5)		77	r spar	Admix and the first of the firs		7				TAT Requested: Normal: R	Fax Results: [] Yes [] No	Select Deliverable: [ ] C of A [ ] QC Summary	Additional Remarks:	For Lab Receiving Use Unity: Custody Sea		SD=Scdiment, SL=Sludge, SS=Solid Waste, O=Oil, F=Filter, P=Wipe, U=B-3, 6010B/7470A-1).	zxane, ST = Sodium Thiosulfate, If no preservative is added = leave field b	Other OT=Other / Unknown (i.e.: Highlow pH, asbestos, beryllium, irritants, other misc. health hazards, etc.) Description:
GEL Labora	Ghain of Custody a Chain of Custody a GEL Work Order Number:	Phone #	Fax #		Send Results To:	*Date Collected Collected Collected (Military) QC Field (Military) Code (2) Field (Military)	12-64-19 13:30					Chain of Custody Signatures	Received by (signed) Date Time	16:14 Marin 12/5/14	2		atrix Spike Samp	4.) Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=Surface Water, WW=Water, W=Water, ML=Misc Liquid, SO=Soil, SD=Sediment, SL=Sludge, SS=Solid Waste, O=Oil, F=Filler, P=Wipe, U=Urine, F=Fecal, N=Nasal S.) Sample Analysis Requested: Analytical method requested (i.e. 8260B, 6010B/7470A) and number of containers provided for each (i.e. 8260B - 3, 6010B/7470A - 1).	= Sulfuric	Characteristic Hazards
Page: of Page: NWAH political Control of Con	COC Number (1);		Poset/Site Name:	A∰ress:	CM lected By:	Sample ID  * For composites - indicate start and stop dateitime	7	 28	XX				Relinquished By (Signed) Date Time		2	> For sumple shipping and delivery details, see Sample Receipt & Review form (SRR.)	<ol> <li>Chain of Custody Number = Client Determined</li> <li>QC Codes: N = Normal Sample, TB = Trip Blank, FD = Field</li> <li>Field Filtered: For Itouid matrices, indicate with a - Y - for yes</li> </ol>	<ol> <li>Matrix Codes: DW=Drinking Water, GW=Groundwater, SW=5.) Sample Analysis Requested: Analytical method requested (i.e.</li> </ol>	6.) Preservative Type: HA = Hydrochloric Acid, NI = Nitric Acid,	1.) Are there any known or possible hazards associated with these samples?  RCRA Metals As = Arsenic Hg= Mercury Ba = Barium Se= Selenium Cd = Cadmium Ag= Silver Cr = Chromium MR= Miscellaneous

	Cal Laboratories		ΓĿ		SAMPLE RECEIPT & REVIEW FORM 494 420								
	Client: NWA		1_2	7	SDG/AR/COC/Work Order;								
1	Received By: ATA				Date Received: 12/5/19								
Carrier and Tracking Number					FedEx Express FedEx Ground UPS Field Services Courier Other  LLL 635 635 6000								
S	uspected Hazard Information	Yes	ź	2 *1	f Net Counts > 100cpm on samples not marked "radioactive", contact the Radiation Safety Group for further investigation.								
A	)Shipped as a DOT Hazardous?		1	Åн	-lazard Class Shipped:  f UN2910, Is the Radioactive Shipment Survey Compliant? YesNo								
B) rei	Did the client designate the samples are to be seived as radioactive?		V	100	OC notation or radioactive stickers on containers equal client designation.								
rac	Did the RSO classify the samples as lioactive?	_	/	CI	aximum Net Counts Observed* (Observed Counts - Area Background Counts): CPM / mR/Hr assified as: Rad 1 Rad 2 Rad 3								
D) ha:	Did the client designate samples are zardous?	-	$\bigvee$	1	OC notation or hazard labels on containers equal client designation.  O or E is yes, select Hazards below.								
E)	Did the RSO identify possible hazards?	S	1	PC	B's Flammable Foreign Soil RCRA Asbestos Beryllium Other:								
	Shipping containers received intact and												
2	sealed?  Chain of custody documents included	/			Circle Applicable: Seals broken Damaged container Leaking container Other (describe)								
	with shipment?			1	Circle Applicable: Client contacted and provided COC Created upon receipt								
3	Samples requiring cold preservation within $(0 \le 6 \text{ deg. C})$ ?*				Preservation Method Wet Ice 'Jee Packs Dry ice None Other: *all temperatures are recorded in Celsius TEMP:								
4	Daily check performed and passed on IR temperature gun?				Temperature Device Serial #: TB4-L6* Secondary Temperature Device Serial # (If Applicable):								
5	Sample containers intact and sealed?		was.	-	Circle Applicable: Seals broken Damaged container Leaking container Other (describe)								
6	Samples requiring chemical preservation at proper pH?				Sample ID's and Containers Affected:								
7	Do any samples require Volatile Analysis?				If Preservation added, Lot#  If Yes, are Encores or Soil Kits present for solids? Yes No NA (If yes, take to VOA Freezer)  Do liquid VOA vials contain acid preservation? Yes No NA (If unknown, select No)  Are liquid VOA vials free of headspace? Yes No NA  Sample ID's and containers affected:								
8	Samples received within holding time?	7			ID's and tests affected:								
	Sample ID's on COC match ID's on bottles?	1			ID's and containers affected:								
4	Date & time on COC match date & time on bottles?	N			Circle Applicable: No dates on containers No times on containers COC missing info Other (describe)								
_	Number of containers received match number indicated on COC?			Circle Applicable: No container count on COC Other (describe)									
_	Are sample containers identifiable as GEL provided?												
	COC form is properly signed in relinquished/received sections? nents (Use Continuation Form if needed):	$\Delta$			Circle Applicable: Not relinquished Other (describe)								
	(viii ii needed);												

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PM (or PMA) review: Initials

List of current GEL Certifications as of 19 December 2019

State	Certification
Alaska	17-018
Alaska Drinking Water	SC00012
Arkansas	88-0651
CLIA	42D0904046
California	2940
Colorado	SC00012
Connecticut	PH-0169
DoD ELAP/ ISO17025 A2LA	2567.01
Florida NELAP	E87156
Foreign Soils Permit	P330-15-00283, P330-15-00253
Georgia	SC00012
Georgia SDWA	967
Hawaii	SC00012
Idaho	SC00012
Illinois NELAP	200029
Indiana	C-SC-01
Kansas NELAP	E-10332
Kentucky SDWA	90129
Kentucky Wastewater	90129
Louisiana Drinking Water	LA024
Louisiana NELAP	03046 (AI33904)
Maine	2019020
Maryland	270
Massachusetts	M-SC012
Massachusetts PFAS Approv	Letter
Michigan	9976
Mississippi	SC00012
Nebraska	NE-OS-26-13
Nevada	SC000122020-1
New Hampshire NELAP	2054
New Jersey NELAP	SC002
New Mexico	SC00012
New York NELAP	11501
North Carolina	233
North Carolina SDWA	45709
North Dakota	R-158
Oklahoma	2019–165
Pennsylvania NELAP	68-00485
Puerto Rico	SC00012
S. Carolina Radiochem	10120002
Sanitation Districts of L	9255651
South Carolina Chemistry	10120001
Tennessee	TN 02934
Texas NELAP	T104704235-19-15
Utah NELAP	SC000122019-29
Vermont	VT87156
Virginia NELAP	460202
Washington	C780