Geosyntec consultants

Geosyntec Consultants of NC, PC

Sediment Characterization Plan

Prepared for

The Chemours Company FC, LLC
1007 Market Street
PO Box 2047
Wilmington, DE 19899

Prepared by

Geosyntec Consultants of NC, P.C.
2501 Blue Ridge Road, Suite 430
Raleigh, NC 27607

Geosyntec Project Number TR0795

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ACRONYMS AND ABBREVIATIONS

ADQM – analytical data quality management

COC – chain of custody

DO – dissolved oxygen

DQOs – data quality objectives

DVM – data verification module

HDPE – high-density polyethylene

LDPE – low-density polyethylene

NCDEQ – North Carolina Department of Environmental Quality

ORP – oxygen/reduction potential

PFAS – per- and polyfluoroalkyl substances

PTFE – polytetrafluoroethylene

QA/QC – quality assurance/quality control

QAPP – quality assurance project plan

RPD – relative percent difference

SOPs – standard operating procedures

USEPA – United States Environmental Protection Agency

"I certify that I am personally familiar with the information contained in this submittal, including any and all supporting documents accompanying this report, and that the material and information contained herein is, to the best of my knowledge and belief, true, accurate and complete."



8/21/2019

Lauren Wellborn

Senior Engineer

Geosyntec Consultants of NC, PC is licensed to practice engineering in North Carolina. The certification number (Firm's License Number) is C-3500.

Geosyntec Consultants of NC, PC is licensed to practice geology in North Carolina. The certification number (Firm's License Number) is C-295.

1. INTRODUCTION

This Characterization plan (the Characterization Plan) was prepared by Geosyntec Consultants of NC, P.C. (Geosyntec) for The Chemours Company FC, LLC (Chemours) to provide a plan for sampling and analysis of sediment in the Cape Fear River. This Characterization Plan has been prepared pursuant to Paragraph 11.2 of the Consent Order (CO) between the North Carolina Department of Environmental Quality (NCDEQ), Cape Fear River Watch and Chemours entered into court on 25 February 2019. This paragraph requires Chemours to develop a plan to assess the nature and extent of per- and polyfluoroalkyl substances (PFAS) sediment contamination in the Cape Fear River originating from the Fayetteville Works (Site) by 26 August 2019.

2. CHARACTERIZATION PLAN

The purpose of this plan is to obtain information regarding concentrations of PFAS in sediment upstream, adjacent to, and downstream of the Site in order to further define the PFAS contributions originating from the Site and PFAS originating from other sources. This sampling may occur in two phases. The first phase described in this Characterization Plan is scheduled, contingent on NCDEQ approval, to be conducted in Fall 2019. Following review of initial sampling data, a second phase of sampling to refine initial findings may be planned, and if needed, an addendum to this Characterization Plan will be prepared (potential timeframe: Spring/Summer 2020). Samples collected will be analyzed for EPA Method 537 Mod and Table 3+ laboratory-specific Standard Operating Procedures (SOPs) as listed in **Table 1**.

2.1 Sampling Locations

Investigative transects are proposed as indicated in **Table 2** and **Figure 1**. The field team may collect samples from different or additional locations depending on field conditions, in-person observations, and/or accessibility considerations upon consultation with the Geosyntec project manager.

Three sediment samples will be collected from each transect: one from the eastern side, one from the western side, and one from a location between the other two samples (conceptual layout provided in **Figure 2**). By collecting samples along a transect from each location, analytical results will be correlated with a range of sediment transport environments (depositional and erosional) and from a range of physical and chemical sediment environments (e.g., potential variation in particle size and organic content to be analyzed according to **Table 3)**. Samples will be collected from upstream locations, locations adjacent to the Site, and downstream locations as shown in **Table 2** and **Figure 1**.

In addition to collecting sediment for analysis, field conditions in each transect location will be recorded. Water depth and velocity will be measured in the same locations where samples are collected from each transect. Sediment will be collected for visual evaluation.

2.2 Sampling Schedule

The proposed sampling associated with this first phase of work will be performed according to the proposed schedule:

- Submission of Characterization Plan;

- NCDEQ Approval (logistical planning to begin within 30 days after approval);
- 0 to 45 days – logistical planning;
- 45 to 75 days – Characterization Plan implementation, provided suitable weather (contingent on NCDEQ approval timing); and
- Reporting within 90 days of receipt of full scope of validated analytical data. If a second phase of sampling is performed, the report will be prepared to include both phases.

2.3 General Sample Collection Considerations

Sediment sample collection considerations are outlined below and summarized in **Table 2**. Samples will be collected in accordance with the PFAS Quality Assurance Project Plan (QAPP; AECOM, 2018).

The sampling team will attempt to collect samples when there has been no precipitation for a minimum of 72 hours to limit the potential for suspended loads associated with rain events to impact the interpretation of data. Where sample locations are within 0.5 miles of each other, work will be conducted from downstream to upstream to the extent possible to avoid disturbing sediment. Whenever possible, sample locations will be approached from a downstream position for this same reason.

All work will be performed in compliance with the project Health and Safety Plan prepared by Parsons (Parsons Health and Safety Plan Chemours Fayetteville Site, 2018). A Plan on Action Discussion and Project Safety Analysis will be held prior to commencing field activities. All work will be performed under Nationwide Permit 6 (USACE, 2017).

The following items are acceptable for use during PFAS sampling:

- High-density polyethylene (HDPE)[1], silicone, acetate, and stainless-steel sampling equipment and materials (e.g., sampling containers and lids, bowls, pans, trays, spoons, trowels);
- Low-density polyethylene (LDPE)[2] materials not in direct contact with the sample (e.g., Ziploc® bags);

[1] HDPE plastics are commonly identified by a recycling symbol with a number 2 inside it.
[2] LDPE plastics are commonly identified by a recycling symbol with a number 4 inside it.

- Plastic sleeves, core liners, and caps that do not contain Teflon™ or other fluoropolymers (e.g., acetate, polyvinyl chloride, polycarbonate);
- Masonite or aluminum clipboards;
- Ballpoint pens;
- Sampling forms, loose paper or field notebooks, chain of custody (COC) record, and sample container labels;
- Alconox®, Liquinox® and Luminox® detergents;
- Paper towels;
- Trash bags;
- HDPE sheeting;
- Hard-shell coolers;
- Shipping and handling labels;
- Regular (wet) ice;
- Bubble wrap; and
- Duct tape and packing tape.

The following products likely contain PFAS and will therefore be avoided during sampling:

- Water-resistant paper, notebooks, and labels (e.g., certain Rite in the Rain® products), due to use of PFAS in water-resistant inks and coatings;
- Sticky notes (e.g., certain Post-It® products), due to potential use of a paper coating product Zonyl™ or similar fluorotelomer compounds;
- Plastic clipboards, binders, and spiral hardcover notebooks;
- Pens with water-resistant ink;
- Felt pens and markers (e.g., certain Sharpie® products) – some PFAS SOPs (e.g., Michigan) specifically allow Fine or Ultra-Fine Point Sharpies® and TestAmerica Laboratories, Inc. routinely uses Sharpies® in the laboratory following

unpublished analytical tests that reportedly showed no impact on PFAS sample results;

- Aluminum foil, as PFAS are sometimes used as a protective layer;
- Decon 90™ liquid detergent, which reportedly contain fluorosurfactants;
- Chemical (e.g., blue) ice packs, unless it is contained in a sealed bag. Blue ice has the potential to be contaminated from previous field sampling events;
- Materials containing polytetrafluoroethylene (PTFE), including Teflon™ and Hostaflon®;
- Equipment with Viton™ components (i.e., fluoroelastomers);
- Stain- or water-resistant materials, as these are typically fluoropolymer-based;
- Material containing LDPE, particularly if used in direct contact with the sample (e.g., LDPE tubing, as PFAS can sorb to the porous tubing); and
- Material containing "fluoro" in the name – this includes, but is not limited to, fluorinated ethylene propylene, ethylene tetrafluoroethylene, and polyvinylidene fluoride.

2.4 Sediment Sampling Procedures

Surface sediment samples will be collected from the sediment-water interface (i.e., mudline). Sediment samples will be collected with a petite ponar or similar device. Field personnel will make three attempts to collect samples per location. If the initial location does not provide a minimum recovery of 2 inches of material, sampling will be attempted three additional times within a 20-ft radius of the original location. If samples meeting minimum sample recovery cannot be retrieved after three attempts, field personnel may relocate the sample to an area where recovery is feasible and which maintains the Data Quality Objectives (DQOs). If multiple recoveries are required to meet sample mass requirements, the samples will be located as closely as reasonably possible together, and samples will be homogenized by stirring the sample with a stainless-steel spoon (or similar) prior to filling sample jars.

Sediment sampling will be conducted in general accordance with EPA SOP SESDPROC-200-R3 Sediment Sampling (EPA 2014).

The following sample procedures will be followed:

- The sampling location will be field-located using a handheld GPS device. After setting up on the sampling location, the as-built location coordinates will be collected using the GPS device.
- Sampling personnel will use a new pair of nitrile sampling gloves at each location.
- Surface samples will be collected using a petite ponar or similar device.
- The sample will be transferred to a decontaminated stainless-steel bowl. A photo of the sample will be taken prior to disturbing the sample. Sediment texture and other relevant observations will be noted on a field form. The sample will be homogenized using a stainless-steel spoon to mix the sediment in the bowl prior to filling the sample containers. Any large materials present in the sediment (e.g., gravel, vegetation) will be avoided when filling sample bottles.
- Sediment will be transferred into the sampling containers using a stainless-steel spoon or other appropriate device.
- Each sampling container will be capped, labeled as described in Section 2.7, and temporarily stored on ice (4 ± 2°C) in a cooler to await transport or preparation for shipment to the laboratory as directed in the QAPP.
- All reusable equipment will be decontaminated according to the procedures described in Section 2.6.
- Disposable equipment and investigation derived waste will be transferred to the Chemours plant for offsite disposal.
- Documentation will be maintained as described in Section 2.8.1.

2.5 Collection of Field Data

Water depths and water velocities will be measured at each location along each transect. Sediment will be observed for color and texture.

The flow rate of the Cape Fear River will be measured using a submersible flow meter. The height of the water and river bottom will be recorded at each point along each transect. The flow meter will be submerged at each point, and the water velocity will be recorded at 2 water depths at each point along the transect (e.g. top-half and bottom-half of the water column).

2.6 Decontamination Protocol

Sample containers will be new and used only once for each sample and disposable equipment (e.g., gloves, tubing, etc.) will not be reused; therefore, these items will not require decontamination.

All non-dedicated or non-disposable sampling equipment (e.g., stainless steel reusable equipment used in sediment sampling) will be decontaminated between samples in the following manner:

- Water rinse;
- Scrub with de-ionized water containing non-phosphate detergent (e.g., Alconox®);
- Tap water rinse; and
- De-ionized water rinse.

If there is a delay between decontamination and sample collection, decontaminated sampling equipment will be covered with PFAS-free plastic until it is ready for use (Ziploc® bags are acceptable for this purpose).

2.7 Sample Labels, Shipping, Chain of Custody, and Holding Times

Upon sample collection, each containerized sample will be labelled. Sediment sample naming convention is as follows:

FAY-SED-CFR-RM-##-x-MMDDYY

Where:

- FAY indicates Fayetteville
- SED indicates sediment
- CFR indicates Cape Fear River
- RM indicates Rivermile
- ## to be replaced by the Rivermile associated with the sample (in whole numbers or using decimal places for partial Rivermiles)
- x to be replaced by “a” to indicate western portion of River, “b” to indicate middle area of river, and “c” to indicate eastern portion of River

- MMDDYY indicates month, day, year, in 2-digit format (e.g., August 1, 2019 would be 080119)

Sample bottles will be placed as soon as possible into a durable zip-top plastic bag inside an insulated sample cooler with ice. The cooler will serve as a shipping container and will be provided by the laboratory along with the appropriate sample containers.

Samples will be shipped to either TestAmerica Sacramento, or Eurofins Lancaster Laboratories depending on laboratory availability at the time of sampling. Chemours will request that samples be analyzed by the laboratory within the holding times specified in **Table 3**. The additional samples collected at each location for potential future analyses will be stored under COC protocol in a secured, refrigerated location on Site.

Prior to shipment of the samples to the laboratory, a COC form will be completed by the field sample custodian. Sample locations, sample identification numbers, description of samples, number of samples collected, and specific laboratory analyses to be performed on each sample will be recorded on the COC. The COC will be signed by the field personnel relinquishing the samples to the courier and will be signed by the laboratory upon receipt of the cooler. Prior to shipping, the cooler will be taped shut and a custody seal will be taped across the lid of the cooler; laboratory personnel will confirm the signature is intact upon receipt.

2.8 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) activities will be performed in the field and in the laboratories to document the data quality.

2.8.1 Field Documentation

Each sample will be labelled with a unique sample identification number as described in Section 2.7, date, time, and the initials of the individual collecting the sample. A field form will be used to record information regarding additional items such as QA/QC, sample identifications, color, odor, turbidity, and other field parameters.

The project field team will keep a daily record of field activities during the execution of field work including sampling notes and observations, instrument calibration records, measured field parameters, sample COC and shipping records. All field collected data will be furnished to Chemours within 10 business days of the conclusion of the field event.

2.8.2 Bottleware

Bottleware requirements are listed in **Table 3**. Bottleware will be pre-cleaned and will be supplied by a vendor to minimize the risk of unplanned sample contamination from the sample container (i.e., blank contamination).

2.8.3 Field QA/QC

Field QA/QC samples will be collected and analyzed along with the investigative samples to evaluate potential bias and variability introduced in sample collection, storage, handling and shipping. Criteria for achieving data quality objectives for field QA/QC samples are summarized in **Table 4**. Four types of field QA/QC samples will be collected: equipment blanks, trip blanks, field blanks, and field duplicates.

Equipment Blanks

Equipment blanks (field rinsate blanks) are used to evaluate equipment and cleaning or decontamination procedures. At the sample location, laboratory-supplied analyte-free water will be poured over or through the clean, non-dedicated sampling equipment, and collected in a sample container. The equipment blank samples will then be shipped, stored and handled with the other samples and will be analyzed for the same parameters as other samples collected using the same device. Equipment blanks will be collected at a frequency of one per day during sampling activities.

Trip Blanks

Trip blanks are used to assess whether samples might be inadvertently contaminated during shipment and handling. The trip blanks will consist of a series of new containers filled with analyte-free water prepared by the laboratory analyzing the samples and will travel to the Site with the empty sample bottles and back from the Site with the investigative samples. Trip blanks will not be opened in the field. Trip blanks will be collected at a frequency of one per day during sampling activities.

Field Blanks

Field blanks are used to assess whether field conditions pose a potential for bias or variability in the results of analysis. The field blank will be collected by transferring laboratory-supplied analyte-free water into a sample container without contacting any other sampling equipment. Field blanks will be collected at a frequency of one per day during sampling activities.

Field Duplicates

Duplicate samples are collected to assess the precision of the laboratory analysis through calculation of the relative percent difference (RPD) between duplicate samples. The equation for calculating RPD is shown below:

$$RPD(\%) = \frac{|(Sample\ 1 - Sample\ 2)|}{\left[\frac{(Sample\ 1 + Sample\ 2)}{2}\right]} \times 100\%$$

RPDs less than or equal to 25% indicate acceptable precision at mid and high range concentrations; RPDs less than or equal to 50% indicate acceptable precision within a factor of five of the reporting limit. Duplicates will be collected in the same manner as investigative samples and the duplicate samples will be analyzed for the same parameters as the collocated investigative sample. Duplicates will be numbered sequentially with investigative samples so they are not identifiable by the analytical laboratories (i.e., "blind" duplicates). Field duplicate samples will be collected at a minimum frequency of one duplicate for every 20 investigative samples.

3. TEST METHODS AND LABORATORY STANDARDS

3.1 Sample Analysis

Samples will be collected and analyzed for methods according to **Table 3**.

3.2 Data Quality Objectives

DQOs are established here to provide data of known and sufficient quality to accomplish the following:

- Characterize concentrations of PFAS in Cape Fear River sediment upstream, adjacent to, and downstream of the Site;
- Collect related data on field conditions at each sampling transect.

The analytical criteria for achieving the DQOs are provided in **Table 5**.

3.3 Data Verification

The analytical laboratory performing the analysis will provide all analytical data to Chemours's data verification contractor, AECOM's in-house Analytical Data Quality Management (ADQM) group. The data package will be reviewed by ADQM for

compliance with the laboratory SOPs and usability. The laboratory will also deliver the analytical data electronically for upload to the Chemours Locus EIM™ database.

All data will be reviewed using the Data Verification Module (DVM). The DVM is an automated database algorithm developed by the ADQM group that includes a series of data quality checks, which are binary (yes/no) and do not require professional judgement. Manual review is performed after the DVM process to address validation components that are not readily automated. The data are evaluated against the following data usability checks:

- Field and laboratory blank contamination;
- United States Environmental Protection Agency (USEPA) hold time criteria;
- Missing quality control samples;
- Matrix spike recoveries to verify measurement precision;
- Laboratory control sample recoveries verify measurement precision;
- Surrogate spike recoveries to verify measurement accuracy;
- RPD between field duplicate sample pairs to verify field duplicate precision;
- Completeness as a percentage of the planned samples actually collected and analyzed; and
- Sensitivity of the practical quantitation limits compared to regulatory standards or screening levels.

The DVM applies the following data evaluation qualifiers to analysis results, as warranted:

- R - Unusable result. Analyte may or may not be present in the sample.
- B – Not detected substantially above the level reported in the laboratory or field blanks.
- J – Analyte present. Reported value may not be accurate or precise.
- UJ – Not detected. Reporting limit may not be accurate or precise.

An individual DVM narrative report will be generated for each lot entered into the EIM™ database which will summarize any samples that are qualified, the specific reasons for the qualification, and the potential bias in reported results.

The DVM review process described above will be performed on 100% of the data generated for the sampling event. The DVM review process will be supplemented by a manual review of the instrument- related QC results for calibration standards, blanks, and recoveries to elevate the overall review process to be consistent with Stage 2b of the EPA

Guidance for Labelling Externally Validated Laboratory Analytical Data for Superfund Use (EPA-540-R-08-005, 2009).

4. REPORTING

A report will be submitted following receipt of results. The report will include a map of sample locations, data tables of measured concentrations, and a data review summary.

5. REFERENCES

AECOM, 2018. Poly and Perfluoroalkyl Substance Quality Assurance Project Plan for the Chemours Corporate Remediation Group. August, 2018.

EPA, 2009. Guidance for Labelling Externally Validated Laboratory Analytical Data for Superfund Use. EPA-540-R-08-005, 2009. Stage 2b.

EPA, 2014. Region 4. Operating Procedure: Sediment Sampling. EPA SOP SESDPROC-200-R3. August 2014.

Parsons, 2018. Health and Safety Plan Chemours Fayetteville Site.

United States Army Corps of Engineers. Nationwide Permit 6. 19 March 2017. http://saw-reg.usace.army.mil/NWP2017/2017NWP06.pdf. Accessed 30 January 2019.

Table 1
PFAS and Associated Methods
Chemours Fayetteville Works, North Carolina

Analytical Method	Common Name	Chemical Name	CASN	Chemical Formula	Soil/Sediment (ng/g)	
					TestAmerica	Eurofins Lancaster
Table 3+ Lab SOP	HFPO-DA*	Hexafluoropropylene oxide dimer acid	13252-13-6	C6HF11O3	1.00	TBD
	PEPA	Perfluoroethoxypropyl carboxylic acid	267239-61-2	C5HF9O3	1.00	TBD
	PFECA-G	Perfluoro-4-isopropoxybutanoic acid	801212-59-9	C12H9F9O3S	1.00	TBD
	PFMOAA	Perfluoro-2-methoxyaceticacid	674-13-5	C3HF5O3	1.00	TBD
	PFO2HxA	Perfluoro(3,5-dioxahexanoic) acid	39492-88-1	C4HF7O4	1.00	TBD
	PFO3OA	Perfluoro(3,5,7-trioxaoctanoic) acid	39492-89-2	C5HF9O5	1.00	TBD
	PFO4DA	Perfluoro(3,5,7,9-tetraoxadecanoic) acid	39492-90-5	C6HF11O6	1.00	TBD
	PMPA	Perfluoromethoxypropyl carboxylic acid	13140-29-9	C4HF7O3	1.00	TBD
	Hydro-EVE Acid	Perfluoroethoxsypropanoic acid	773804-62-9	C8H2F14O4	1.00	TBD
	EVE Acid	Perfluoroethoxypropionic acid	69087-46-3	C8HF13O4	1.00	TBD
	PFECA B	Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	C5HF9O4	1.00	TBD
	R-EVE	R-EVE	NA[1]	C8H2F12O5	1.00	TBD
	PFO5DA	Perfluoro-3,5,7,9,11-pentaoxadodecanoic acid	39492-91-6	C7HF13O7	1.00	TBD
	Byproduct 4	Byproduct 4	NA[1]	C7H2F12O6S	1.00	TBD
	Byproduct 6	Byproduct 6	NA[1]	C6H2F12O4S	1.00	TBD
	Byproduct 5	Byproduct 5	NA[1]	C7H3F11O7S	1.00	TBD
	NVHOS	Perfluoroethoxysulfonic acid	1132933-86-8	C4H2F8O4S	1.00	TBD
	PES	Perfluoroethoxyethanesulfonic acid	113507-82-7	C4HF9O4S	1.00	TBD
	NEtPFOSA	NEtPFOSA	4151-50-2	C10H6F17NO2S	1.00	NA[2]
	NEtPFOSAE	NEtPFOSAE	1691-99-2	C12H10F17NO3S	1.00	NA[2]
	NMePFOSA	NMePFOSA	31506-32-8	C9H4F17NO2S	1.00	NA[2]
	NMePFOSAE	NMePFOSAE	24448-09-7	C11H8F17NO3S	1.00	NA[2]
	PFESA-BP1	Byproduct 1	29311-67-9	C7HF13O5S	1.00	TBD
	PFESA-BP2	Byproduct 2	749836-20-2	C7H2F14O5S	1.00	TBD
EPA Method 537 Mod	PFBA	Perfluorobutanoic acid	375-22-4	C4HF7O2	0.200	2.0
	PFDA	Perfluorodecanoic acid	335-76-2	C10HF19O2	0.200	0.6
	PFDoA	Perfluorododecanoic acid	307-55-1	C12HF23O2	0.200	0.6
	PFHpA	Perfluoroheptanoic acid	375-85-9	C7HF13O2	0.200	0.6
	PFNA	Perfluorononanoic acid	375-95-1	C9HF17O2	0.200	0.6
	PFOA	Perfluorooctanoic acid	335-67-1	C8HF15O	0.200	0.6
	PFHxA	Perfluorohexanoic acid	307-24-4	C6HF11O2	0.200	0.6
	PFPeA	Perfluoropentanoic acid	2706-90-3	C5HF9O2	0.200	0.6
	PFTeA	Perfluorotetradecanoic acid	376-06-7	C14HF27O2	0.200	0.6
	PFTriA	Perfluorotridecanoic acid	72629-94-8	C13HF25O2	0.200	0.6
	PFUnA	Perfluoroundecanoic acid	2058-94-8	C11HF21O2	0.200	0.6
	PFBS	Perfluorobutanesulfonic acid	375-73-5	C4HF9SO	0.200	0.6
	PFDS	Perfluorodecanesulfonic acid	335-77-3	C10HF21O3S	0.200	1.0
	PFHpS	Perfluoroheptanesulfonic acid	375-92-8	C7HF15O3S	0.200	0.6
	PFHxS	Perfluorohexanesulfonic acid	355-46-4	C6HF13SO3	0.200	0.6
	PFNS	Perfluorononanesulfonic acid	68259-12-1	C9HF19O3S	0.200	0.6
	PFOS	Perfluorooctanesulfonic acid	1763-23-1	C8HF17SO3	0.500	0.9
	PFPeS	Perfluoropentanesulfonic acid	2706-91-4	C5HF11O3S	0.200	0.6
	10:2 FTS	10:2-fluorotelomersulfonic acid	120226-60-0	C12H5F21O3	2.00	3.0
	4:2 FTS	4:2 fluorotelomersulfonic acid	757124-72-4	C6H5F9O3S	2.00	3.0
	6:2 FTS	6:2 fluorotelomersulfonic acid	27619-97-2	C8H5F13SO3	2.00	2.0
	8:2 FTS	8:2 fluorotelomersulfonic acid	39108-34-4	C10H5F17O3S	2.00	2.0
	NEtFOSAA	NEtFOSAA	2991-50-6	C12H8F17NO4S	2.00	2.0
	NEtPFOSA	NEtPFOSA	4151-50-2	C10H6F17NO2S	NA[3]	2.0
	NEtPFOSAE	NEtPFOSAE	1691-99-2	C12H10F17NO3S	NA[3]	2.0
	NMeFOSAA	NMeFOSAA	2355-31-9	C11H6F17NO4S	2.00	2.0
	NMePFOSA	NMePFOSA	31506-32-8	C9H4F17NO2S	NA[3]	2.0
	NMePFOSAE	NMePFOSAE	24448-09-7	C11H8F17NO3S	NA[3]	2.0
	PFDOS	Perfluorododecanesulfonic acid	79780-39-5	C12HF25O3S	0.200	0.9
	PFHxDA	Perfluorohexadecanoic acid	67905-19-5	C16HF31O2	0.200	0.6
	PFODA	Perfluorooctadecanoic acid	16517-11-6	C18HF35O2	0.200	0.6
	PFOSA	Perfluorooctanesulfonamide	754-91-6	C8H2F17NO2S	0.200	0.6

Notes:

PQLs are as of March 31, 2019

EPA - Environmental Protection Agency

ng/g - nanograms per gram

PFAS - per- and polyfluoroalkyl substances

PQL - practical quantitation limit

SOP - Standard Operating Procedure

TBD - PQL is to be determined

NA[1] - no CAS number assigned

NA[2] - Eurofins Lancaster uses EPA Method 537 Mod for these analytes. See EPA Method 537 Mod list for the associated PQL.

NA[3] - Table 3+ Method is used by TestAmerica for these analytes. See Table 3+ list for the associated PQL.

*Depending on the laboratory, HFPO-DA may also appear on the EPA Method 537 Mod analyte list

Table 2
Description of Sampling Locations
Chemours Fayetteville Works, North Carolina

Sample Identification	Co-located Sediment Sample Location Description	Sample Category		
		Sampling Method	Target Concentrations	Sediment
CFR-RM-20	Co-located with Mile 20 surface water sample collected June 2018; representative of background conditions; near USGS Stream Gage 02102500 and Harnett County's drinking water intake.	Grab	Background	3 samples
CFR-RM-52	Co-located with Mile 52 surface water sample collected June 2018; representative of background conditions; near Fayetteville's drinking water intake.	Grab	Background	3 samples
CFR-RM-76.2	Co-located with CFR-05 surface water samples collected Sept 2017 and May 2018; adjacent to Site.	Grab	Site	3 samples
CFR-RM-77.25	Located downstream of Outfall 002, immediately upstream of dam.	Grab	Site	3 samples
CFR-RM-84	Co-located with Mile 84 surface water sample collected June 2018; downstream of Site; highest concentrations of HFPO-DA, PFECA, and PFESA detected during June 2018 surface water sampling event. Locate upstream and within 1000 ft of Blden Bluff Drinking Water Intake (RM 84.8).	Grab	Downstream	3 samples
CFR-RM-100	Co-located with Mile 100 surface water sample collected June 2018; downstream of Site.	Grab	Downstream	3 samples
CFR-RM-116	Co-located with Mile 116 surface water sample collected June 2018; downstream of Site.	Grab	Downstream	3 samples
CFR-RM-132	Co-located Mile 132 surface water samples collected June 2018; HFPO-DA was ND June 2018.	Grab	Downstream	3 samples

Notes
Sample identifications (IDs) refer to locations identified in Figure 1. Sample IDs are abbreviations, full sample IDs are provided in text.

Table 3
Sampling Containers, Preservation, and Holding Times
Chemours Fayetteville Works, North Carolina

Matrix	Analysis	Analytical Method	Container Type and Volume	Sample Volume or Mass Required	Field Prep	Number of Containers	Preservation	Holding Times	
								TestAmerica	Eurofins Lancaster
Sediment	PFOS/PFOA Compounds	EPA Method 537 Mod	250 mL HDPE	100 g	Homogenized	2	Cool to 4ºC± 2ºC	14 days to extraction, 40 days to analysis	14 days to extraction, 28 days to analysis
	Site-associated Compounds	Table 3+ Lab SOP	250 mL HDPE	100 g	Homogenized	1	Cool to 4ºC± 2ºC	28 Days	14 days
	Total Organic Carbon	Lloyd Kahn	4 oz glass	50 mg	Homogenized	1	Cool to 4ºC± 2ºC	28 Days	28 Days
	Grainsize Distribution	ASTM D422; D7928	16 oz glass	fill container	Homogenized	1	None	Sample to be sent to TA Burlington	Sample to be sent to TA Burlington
	Moisture Content	ASTM D2216	2 oz glass	fill container	Homogenized	1	None	Sample to be sent to TA Burlington	Sample to be sent to TA Burlington
	Archived for potential future analyses	TBD	250 mL HDPE	fill container	Homogenized	2	Cool to 4ºC± 2ºC	TBD	TBD
	Archived for potential future analyses	TBD	4 oz glass	fill container	Homogenized	4	Cool to 4ºC± 2ºC	TBD	TBD

Notes:
HDPE - high density polyethylene
SOP - Standard Operating Procedure
N/A - not applicable

Table 4
Quality Assurance/Quality Control Samples
Chemours Fayetteville Works, North Carolina

Matrix	Analytical Method	Field					Lab					
		Investigative Samples (per event)	**Equipment Blank** (per day)	**Trip Blank** (per shipment)	**Field Blank** (per day)	**Field Duplicate** (per 20 samples)	**Method Blank** (per sample group)	**Matrix Spike** (per sample group)	**Lab Replicate** (per sample group)	**Lab Control Sample** (per sample group)	**Isotope Dilution Analytes** (every sample)	**Continuing Calibration Verification** (beginning of each group)
Sediment	EPA Method 537 Mod	24	1	1	1	1	1	1	1	1	32	1
	Table 3+ Lab SOP	24	1	1	1	1	1	1	1	1	N/A	1

Notes:
N/A - none available at present
SOP - Standard Operating Procedure

Table 5
Criteria for Achieving Data Quality Objectives
Chemours Fayetteville Works, North Carolina

Category	Data Quality Objective	Sediment Criteria
Precision	Field Duplicate RPD (%)	40*
	Lab Replicate RPD (%)	30*
Accuracy	MS % Recovery	70-130
	LCS % Recovery	70-130
	Isotope Dilution Analyte % Recovery	25-150
Calibration	CCV % Difference	70-130
Completeness	% Complete	90

Notes
* RPD criteria apply if result is within a factor of five of the reporting limit.
Criteria may be replaced by statistical limits generated by the laboratory(ies).
CCV - continuing calibration verification
LCS - laboratory control sample
MS - matrix spike
RPD - relative percent difference

Start of Cape Fear River

CFR-RM-20

USGS Gauge 02102500

CFR-RM-52

USGS Gauge 02104000

Chemours Fayetteville Works

USGS Gauge 02105500

CFR-RM-84

CFR-RM-100

CFR-RM-116

CFR-RM-132

Cape Fear Lock and Dam #1 / Kings Bluff Intake Canal

USGS Gauge 02105769

Willis Creek Mouth

CFR-RM-76.2

Site River Water Intake

Outfall 002

CFR-RM-77.25

W.O. Huske Dam

Old Outfall Channel Mouth

Georgia Branch Creek Mouth

Legend

- Sampling Transect
- USGS Stream Gauge
- Site Features
- Chemours Fayetteville Works
- Cape Fear River

Notes:
1. Sample IDs shown here are abbreviations, see Characterization Plan for full sample IDs.
2. Basemap source provided by ESRI OpenStreetMap contributors, and the GIS User Community

8 4 0 8 Miles

Proposed Sampling Transect Locations

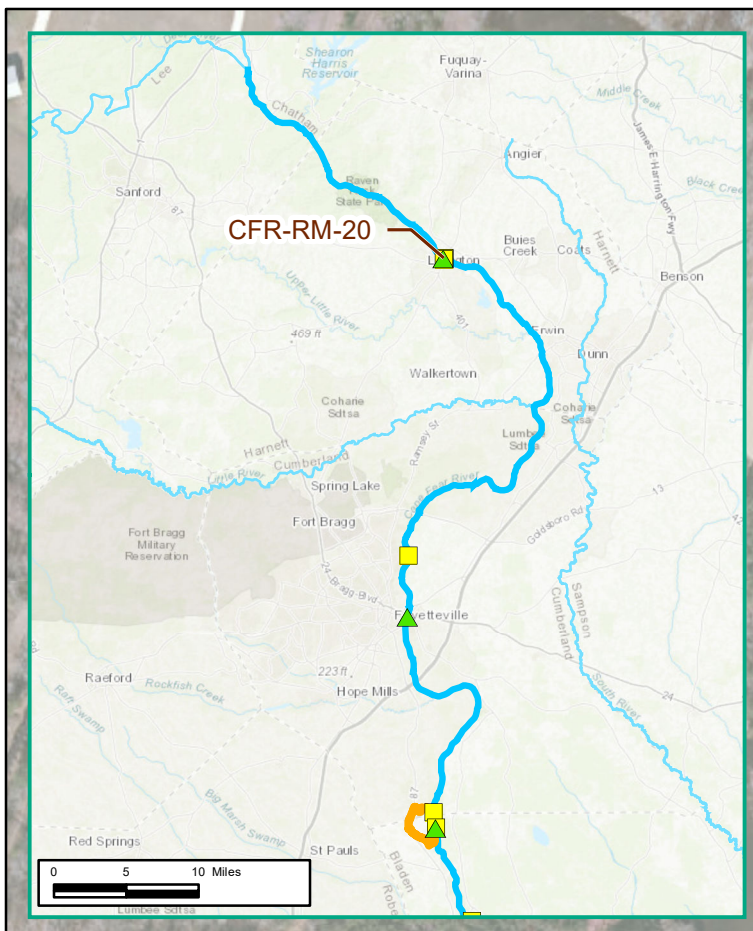
Chemours Fayetteville Works, North Carolina

Geosyntec
Consultants of NC, PC
NC License No.: C-3500

Raleigh | August 2019

Figure 1

Path: P:\PRJ\Projects\TR0726 - Confidential\Database and GIS\GIS\Sediment Characterization Workplan\TR0726_Confidential_SedimentSampleLocations.mxd; SSommarain; 08/15/2019



Legend

- USGS Stream Gauge
- Conceptual Sampling Location in Transect
- Chemours Fayetteville Works

Notes:
1. Sample IDs shown here are abbreviations, see Characterization Plan for full sample IDs.
2. Basemap source provided by ESRI OpenStreetMap contributors, and the GIS User Community

300 150 0 300 Feet

Conceptual Layout of Transect Sampling Location

Chemours Fayetteville Works, North Carolina

Geosyntec
Consultants of NC, PC
NC License No.: C-3500

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Figure **2**

Path: P:\PR\Projects\TR0795 - Confidential\Database and GIS\GIS\Sediment Characterization Workplan\TR0726_Confidential_ConceptualSedimentTransect.mxd; SSomnarain; 08/15/2019