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NC License No.: C-3500 and C-295

STORMWATER TREATMENT SYSTEM SAMPLING PLAN

Chemours Fayetteville Works

Prepared for

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LIST OF ABBREVIATIONS

CO	Consent Order
EQ	equalization
GAC	granular activated carbon
gpm	gallons per minute
HFPO-DA	hexafluoropropylene oxide dimer acid
IX	ion exchange
ng/L	nanograms per liter
NCCW	non-contact cooling water
NCDEQ	North Carolina Department of Environmental Quality
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
PFAS	per- and polyfluoroalkyl substances
PFMOAA	2,2-difluoro-2-(trifluoromethoxy) acetic acid
PMPA	perfluoromethoxypropyl carboxylic acid
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
SOP	standard operating procedure
TSS	total suspended solids
USGS	United States Geological Survey

1 INTRODUCTION

Geosyntec Consultants of NC, PC (Geosyntec) has prepared this Stormwater Treatment System Sampling Plan ("Sampling Plan") on behalf of The Chemours Company FC, LLC (Chemours) pursuant to the requirements of Paragraph 4(b) of the Addendum to Consent Order Paragraph 12 (CO Addendum). This paragraph requires that Chemours submit a stormwater sampling plan to quantify the effectiveness of the stormwater capture and treatment system (Treatment System), as measured by concentrations of indicator parameters hexafluoropropylene oxide dimer acid (HFPO-DA), perfluoromethoxypropyl carboxylic acid (PMPA), and 2,2-difluoro-2-(trifluoromethoxy) acetic acid (PFMOAA). The CO Addendum specifies that Chemours shall install and operate a system that captures and treats stormwater from the area (by June 30, 2021, as noted in Paragraph 4[a]). Implementation of this Sampling Plan is intended to achieve the following objectives:

- Characterize the stormwater influent to the Treatment System (flow and concentration);
- Characterize the stormwater effluent from the Treatment System (concentration); and
- Assess the Treatment System PFAS removal efficiency for comparison to the CO Addendum requirement of 99% removal.

2 TREATMENT SYSTEM DESCRIPTION

The Treatment System will treat stormwater runoff from 11.8 acres within the area shown on Attachment 6 of the CO Addendum for per- and polyfluoroalkyl substances (PFAS) and is planned to be installed adjacent to the cooling water channel. As of September 2020, the Treatment System design and vendor selection are ongoing.

Stormwater will be captured, collected, and transferred to an equalization (EQ) Tank. The diversion system, pump, EQ Tank, and Treatment System will be collectively sized to capture stormwater runoff from the North Carolina Department of Environmental Quality (NCDEQ) 1-inch, 24-hour design storm (as reflected in NCDEQ stormwater permits and as implemented in NCDEQ's statewide Stormwater Design Manual) from the drainage area shown in Figure 1.

A design storm is a hypothetical discrete rainstorm (in this case, characterized by a specific rainfall depth of 1 inch and 24 hours of duration) that is used in the design of a stormwater control measure. Sizing a stormwater control measure involves calculating the volume of runoff resulting from the specified design storm, that will drain to the control measure. Therefore, the Treatment System will be sized to capture and treat runoff

equivalent to the design storm volume. The Treatment System will not necessarily capture and treat all runoff from larger storms or a series of storm events that occur in close proximity to each other, including successive 1 inch in 24-hour storm events.

The Treatment System will treat the collected stormwater in the EQ Tank, up to the design flowrate, to achieve the effluent targets for the indicator parameters HFPO-DA, PMPA, and PFMOAA. The Treatment System will use granular activated carbon (GAC) to remove PFAS but may include features for other treatment also. For storm events larger than the design storm, stormwater flows that bypass the in-line diversion structure to the Treatment System will combine (untreated) stormwater with non-contact cooling water (NCCW) in the cooling water channel that flows to Outfall 002.

The Treatment System will also potentially include the following: (i) prefiltration to remove total suspended solids (TSS), turbidity, and other constituents that clog and potentially reduce PFAS removal by downstream unit operations; (ii) settling tanks and solids handling system for the backwash waste from the prefiltration system (including chemical dosing skids); and (iii) a post-filtration system to remove GAC fines.

3 SCOPE OF WORK

This Sampling Plan addresses the need to characterize stormwater influent to and effluent from the Treatment System and assess its effectiveness in removing indicator PFAS. This scope of work involves collecting influent and effluent samples from the Treatment System during rain events when the Treatment System is treating stormwater. The sampling scope and schedule presented herein may be modified based on changes in Site conditions, adjustments in understanding of Site conditions, or potential sampling requirements in future permits such as a National Pollutant Discharge Elimination System (NPDES) permit.

3.1 Sampling Schedule

Sampling will be performed during wet weather, when the Treatment System is discharging treated stormwater from the drainage area. For the first two months after the Treatment System begins operating, sampling will be conducted up to four times per month. Following the first two months of operation, sampling will be conducted up to twice per month. The ability to collect samples will depend on the occurrence of rainfall events of sufficient volume to enable sampling. Sampling events in a given month are intended to occur at least three days apart.

3.2 Sample Types and Locations

Time-weighted composite samples will be collected from the influent and the effluent to the Treatment System and each will be analyzed for HFPO-DA, PMPA, and PFMOAA. This is summarized in Table 1.

3.3 Flow Measurement Scope

Continuous flow measurements at appropriate time intervals (e.g., 5 or 15 minute) will be taken from the influent (discharge from the EQ Tank) and water levels will be measured in the EQ Tank during every sampling event. This is summarized in Table 1. Flow measurements will also be taken to measure any stormwater flow that bypasses the Treatment System.

3.4 Associated Data Recording Scope

The following types of data will be recorded during Treatment System operation:

- Precipitation during a given evaluation period will be monitored by using either the existing United States Geological Survey (USGS) weather monitoring station at the W.O. Huske Dam (gage 02105500) or the onsite meteorological station;
- Total stormwater volume treated by the stormwater Treatment System;
- Total stormwater volume bypassing the system;
- Capacity of EQ Tank throughout the evaluation period; and
- Other recorded field data or observations.

4 METHODS

This section describes the field methods and specific procedures for collecting samples and field measurements.

4.1 Sample Collection

Influent and effluent samples will be collected as time-weighted composite samples using autosamplers. Samples will be collected from subsamples collected every two hours. Collection will continue for a total of three subsamples or the duration of a storm, whichever occurs first. For all samples, care will be taken to avoid collecting settled/bed sediment or other materials which may be potentially present in the sample. Other relevant sampling procedure information can be found in the Poly and Perfluoroalkyl Substance Quality Assurance Project Plan (AECOM, 2018).

4.2 Equipment Decontamination

All non-dedicated or non-disposable sampling equipment will be decontaminated immediately before sample collection in the following manner:

- De-ionized water rinse;
- Scrub with de-ionized water containing non-phosphate detergent (i.e., Alconox®);
- De-ionized water rinse; and
- Disposable equipment (e.g. gloves, tubing, etc.) will not be reused.

4.3 Flow Measurement Methods

The Treatment System will include instrumentation to collect flow and water level measurements. The flow meter will be installed at the Treatment System influent (discharge from the EQ Tank) and will represent both influent and effluent flows for the Treatment System. Additionally, flow measurements will be collected of any stormwater flow that bypasses the Treatment System. This flow will potentially be measured at the overflow weir from the diversion sump/lift station. Alternatively, flow may be measured both in the channel just downstream of the diversion sump/lift station and in the pipe conveying NCCW, just upstream of discharge into the channel, where the difference in these two flows represents stormwater flow bypassing the Treatment System, or some other method that can measure this flow.

Water level will also be measured within the EQ Tank. Both readings will be recorded during every sampling event.

4.4 Field QA/QC Samples

Quality assurance/quality control (QA/QC) samples will be collected at an overall frequency of at minimum twenty percent (20%) for the program. QA/QC samples may not be collected during each sampling event. The following types of QA/QC samples will be collected:

- Equipment Blanks: 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.

- Field Blanks: The field blank will be collected by transferring laboratory-supplied, analyte-free water into a sample container in the vicinity of a sample location without contacting any other sampling equipment.
- Field Duplicates: The duplicate will be collected in the same manner as the other samples and the duplicate sample will be analyzed for the same parameters as the co-located samples. Duplicates will be numbered sequentially with the other samples, so they are not identifiable by the analytical laboratory (i.e., "blind" duplicates).
- Matrix Spike/Matrix Spike Duplicate: The matrix spike and matrix spike duplicate sample will be collected in the same manner as the other samples. At the laboratory an appropriate spike of PFAS will be added to the sample and the sample analyzed for the same parameters as the other co-located samples.

4.5 Sample Packing and Shipping

Upon sample collection, each containerized sample will be labeled and placed as soon as possible into an insulated sample cooler. The cooler will serve as a shipping container and will be provided by the laboratory along with the appropriate sample containers. Wet ice will be placed around the sample containers within heavy-duty plastic bags within the sample cooler. Samples will be maintained at a cool temperature (optimum 4°Celsius ± 2°Celsius) from the time of collection until the coolers arrive at the laboratory (if required). Plastic "bubble wrap" and/or polystyrene foam may also be used to protect the samples during shipping.

Prior to shipment of the samples to the laboratory, a chain-of-custody 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 run on each sample will be recorded on the chain-of-custody form.

Samples for the first two months of sampling will be shipped to either TestAmerica Sacramento, TestAmerica Denver, or Lancaster Laboratories depending on laboratory availability at the time of sampling. After the first two months, samples will be sent to the onsite laboratory for analysis provided the detection limits at the onsite laboratory have been demonstrated to be sufficiently sensitive to demonstrate a 99% reduction in the concentration of the three indicator parameters by the Treatment System.[1] Samples will be analyzed using the methods shown in Table 1.

[1] As of September 2020, the Fayetteville Works Onsite laboratory had a detection limit of 100 nanograms per liter (ng/L) i.e. parts per trillion for most Table 3+ compounds. The ability to demonstrate a 99% reduction will therefore be contingent upon the concentration of influent samples being above 10,000 ng/L.

5 CALCULATIONS

The Treatment System PFAS removal efficiency will be calculated using information collected as part of this sampling program. Treatment System PFAS removal effectiveness will be defined by the percentage removal of the combined concentrations of the three indicator parameters (HFPO-DA, PFMOAA and PMPA). Removal effectiveness will be determined on a quarterly average basis using composite influent and effluent samples. The system PFAS removal efficiency calculation uses volume weighted concentrations of the influent and effluent samples to calculate the percentage of mass removal. Volume weighted concentrations were developed in the event that either the influent and effluent autosamplers have different compositing durations or that the composite sampling periods in the quarter have different durations (e.g. 12 hours and 32 hours). Both circumstances could arise due to a potential equipment malfunction or severe weather event. Weighting by volume provides a representative assessment of mass present in both the influent and effluent over time; samples corresponding to greater flow volumes will have a proportionately higher weight. The Treatment System PFAS removal efficiency will be calculated using Equation 1 below.

Equation 1: System Removal Effectiveness for Indicator Parameters

$$E_{TS-IXM-Ind} = \left(1 - \frac{c_{eff}}{c_{inf}}\right) \times 100\%$$

$$= \left(1 - \frac{\sum_{m=1}^{M} \sum_{i=1}^{i=3} c_{eff,m,i} \times w_m}{\sum_{n=1}^{N} \sum_{i=1}^{i=3} c_{inf,n,i} \times w_n}\right) \times 100\%$$

$$= \left(1 - \frac{\sum_{m=1}^{M} \sum_{i=1}^{i=3} c_{eff,\mathrm{m},i} \times \frac{V_m}{\sum_{m=1}^{M} V_m}}{\sum_{n=1}^{N} \sum_{i=1}^{i=3} c_{inf,n,i} \times \frac{V_n}{\sum_{n=1}^{N} V_n}}\right) \times 100\%$$

where,

$E_{TS-IXM-Ind}$ = is the Treatment System PFAS removal efficiency for the three indicator parameters HFPO-DA, PMPA, and PFMOAA;

c_{eff}= is the volume weighted effluent concentration for a given evaluation period;

c_{inf} = is the volume weighted influent concentration for a given evaluation period;

m = represents an individual effluent composite sample time interval during a given evaluation period;

M = is the total number of effluent composite sample time intervals during a given evaluation period;

n = represents an individual influent composite sample time interval during a given evaluation period;

N = is the total number of influent composite sample time intervals during a given evaluation period;

i = represents the three indicator parameters HFPO-DA, PMPA, and PFMOAA;

$c_{eff,m,i}$ = is the measured concentration of the three indicator parameters for each effluent composite samples[2];

$c_{inf,n,i}$ = is the measured concentration of the three indicator parameters for each influent composite samples[2];

w_m = is the effluent concentration volumetric weighting factor calculated for and applied individually to each effluent composite sample concentration;

V_m = is the volume of water entering (and exiting) the Treatment System during the effluent composite sample collection period;

w_n = is the influent concentration volumetric weighting factor calculated for and applied individually to each influent composite sample concentration; and

V_n = is the volume of water entering (and exiting) the Treatment System during the influent composite sample collection period.

6 REPORTING

By September 30, 2021 Chemours will submit to DEQ a report evaluating the Treatment System's capture of stormwater from the drainage area for rain events up to the 1-inch, 24-hour design storm and removal of PFAS compounds as measured by concentrations of indicator parameters HFPO-DA, PMPA, and PFMOAA.

[2] Non-detect influent and effluent sample results will be assigned a value of zero for the calculation and the values from duplicate samples will be averaged together.

7 POTENTIAL ADJUSTMENTS

The sampling and calculation methodologies described in this report have been outlined based on the present understanding of Site conditions. If conditions or methods change, modifications may need to be made to this plan. Any modifications made will be described in future submitted reports.

8 REFERENCES

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

Geosyntec, 2020. Site Conveyance Network and Outfall 002 PFAS Mass Loading Calculation Protocol. 31 August 2020.

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TABLES

TABLE 1
SAMPLING AND ANALYSIS
Chemours Fayetteville Works, North Carolina

Parameter/Measurement	Sample Type	Measurement Type	Analytical Method	Sample Collection[a]			
				Bypass[c]	EQ Tank	Influent	Effluent
HFPO-DA, PMPA, PFMOAA	Time-weighted composite	Lab Analysis	Table 3+ Lab SOP			X	X
Flow	Continuous[b]	Field Parameter	--	X		X	
Water Level					X		

Notes:

[a] Sampling will be performed during wet weather, when the Treatment System is discharging treated stormwater. Samples will be collected up to four times per month during the first two months. Following the first two months of operation, sampling will be conducted up to twice per month.

[b] Continuous measurements will be collected at appropriate intervals (e.g., 5 or 15 minutes).

[c] Bypass flow will be measured at the overflow weir from the diversion sump/lift station, or both in the channel just downstream of the diversion sump/lift station and in the pipe conveying NCCW, just upstream of discharge into the channel, where the difference represents stormwater flow bypassing the Treatment System, or some other method.

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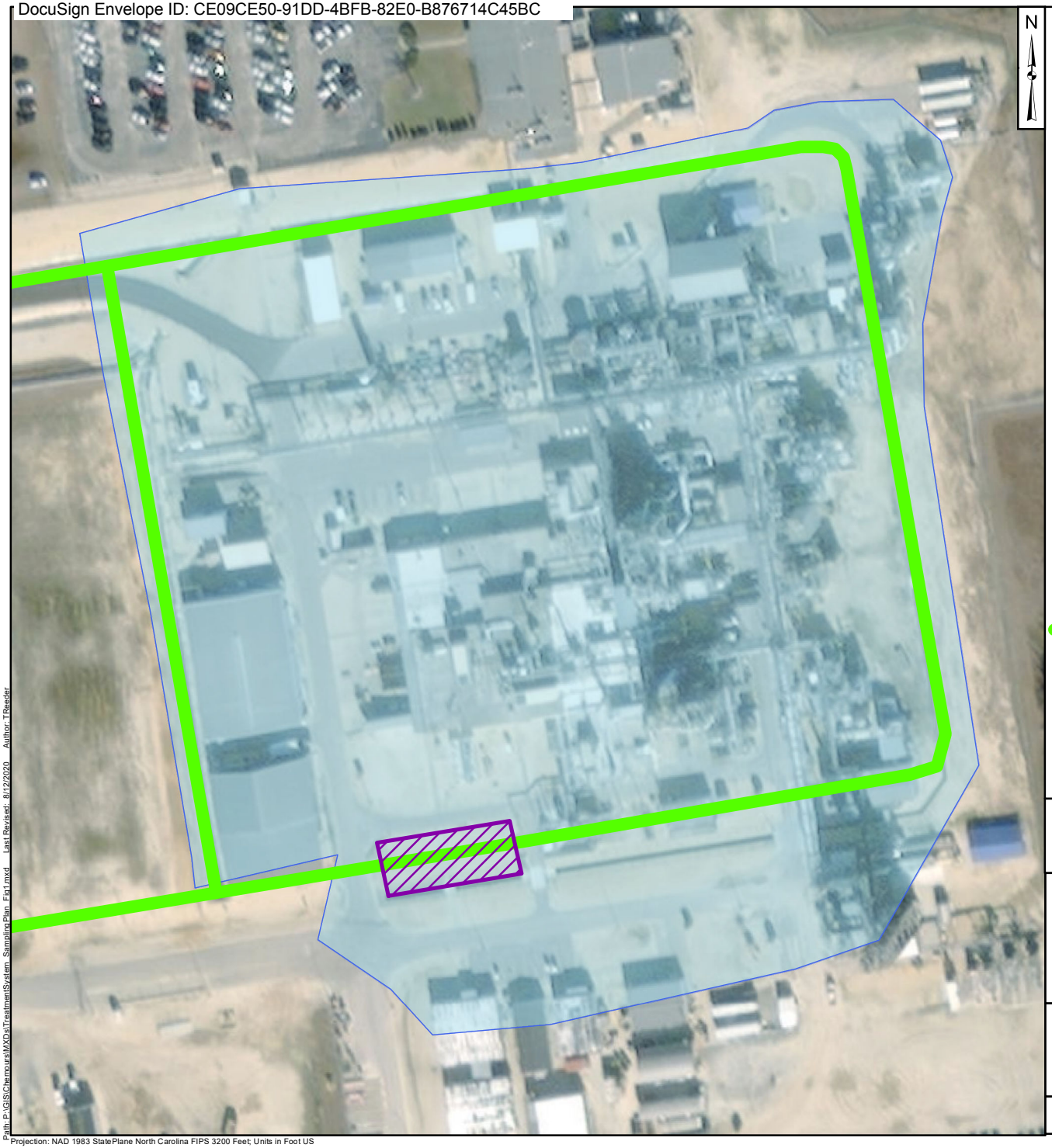
FIGURES



Legend

- Proposed Stormwater Treatment System Location
- Drainage area to the Stormwater Treatment System
- Cooling Water Channel

125 62.5 0 125 Feet

Proposed Stormwater Treatment System Location

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Figure 1

Path: P:\GIS\Chemours\MXDs\TreatmentSystem_SamplingPlan_Fig1.mxd Last Revised: 8/12/2020 Author: TReader

Projection: NAD 1983 StatePlane North Carolina FIPS 3200 Feet; Units in Foot US