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2017 SEP -8 P 5:32

BLADEN COUNTY, N.C.

STATE OF NORTH CAROLINA

COUNTY OF BLADEN

IN THE GENERAL COURT OF JUSTICE
SUPERIOR COURT DIVISION
17 CVS 580

STATE OF NORTH CAROLINA, *ex rel.*, MICHAEL S. REGAN, SECRETARY, NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY,

Plaintiff,

v.

THE CHEMOURS COMPANY FC, LLC,

Defendant.

PARTIAL CONSENT ORDER

Plaintiff, the State of North Carolina, by and through the North Carolina Department of Environmental Quality ("DEQ") and Defendant The Chemours Company FC, LLC ("Chemours"), together with its agents, employees, successors and assigns, hereby agree to the entry of this Partial Consent Order in order to partially resolve matters in controversy between DEQ and Chemours.

This Consent Order partially resolves this matter. Plaintiff reserves, and this Partial Consent Order is without prejudice to, all rights against Chemours, concerning all other matters, including but not limited to the following: 1) claims based on Chemours' new or subsequent violations of surface water quality laws and NPDES permitting requirements; 2) claims based on chemicals not identified in this Partial Consent Order; 3) claims based on Chemours' violations of groundwater quality standards; 4) claims based on Chemours' failure to satisfy any term or

provision of this Partial Consent Order. Chemours reserves, and this Partial Consent Order is also without prejudice to all of Chemours' rights and defenses, except for the matters set forth in this Partial Consent Order and is without admission as to any fact.

NOW THEREFORE, upon the consent of the parties, it is hereby ORDERED, ADJUDGED AND DECREED that:

1. Chemours shall continue the measures it has implemented to prevent the discharge of process wastewater containing GenX (HFPO dimer acid) into waters of the State.
2. Chemours shall immediately prevent the discharge of PFESA compounds referenced in Paragraph 57 of the Complaint in this matter from what Chemours has represented to be the single source of significance in terms of discernible levels of these compounds, and shall continue to prevent the discharge of the same from this source until such time as an NPDES permit with appropriate permit conditions authorizing any such discharge is issued;
3. Upon the Chemours' and DEQ's execution of a mutually agreeable confidentiality agreement, Chemours shall immediately give permission to EPA for DEQ to review confidential business information as set forth in the four categories outlined on page 2 of the August 16, 2017 letter from William Lane to R. Steven DeGeorge;
4. Chemours agrees to make good faith efforts to respond to information requests by DEQ, including providing the remainder of the information requested in the correspondence listed below in a timeframe to be agreed upon by the parties and presented to the Court:
    a. The letter dated July 21, 2017 sent by DEQ Secretary Michael S. Regan, attached to the Complaint in this matter as Exhibit N;

b. The letter dated August 16, 2017 sent by DEQ General Counsel William Lane, attached to the Complaint in this matter as Exhibit O;

c. The August 18, 2017 Letter; and

d. The letter dated August 29, 2017 sent by DWR Deputy Director Linda Culpepper, attached to the Complaint in this matter as Exhibit Q.

5. The Partial Consent Order is enforceable by and through the contempt powers of this Court, pursuant to Chapter 5A of the North Carolina General Statutes.

6. Each undersigned representative of a party to this Partial Consent Order certifies that he or she is authorized to enter into the terms and conditions of this Partial Consent Order, and to execute and legally bind such party to this Partial Consent Order.

This the 8th day of September, 2017.

Douglas B. Sasser
Senior Resident Superior Court Judge

WE CONSENT:

NORTH CAROLINA DEPARTMENT
OF ENVIRONMENTAL QUALITY

By: _____
Linda Culpepper
Deputy Director

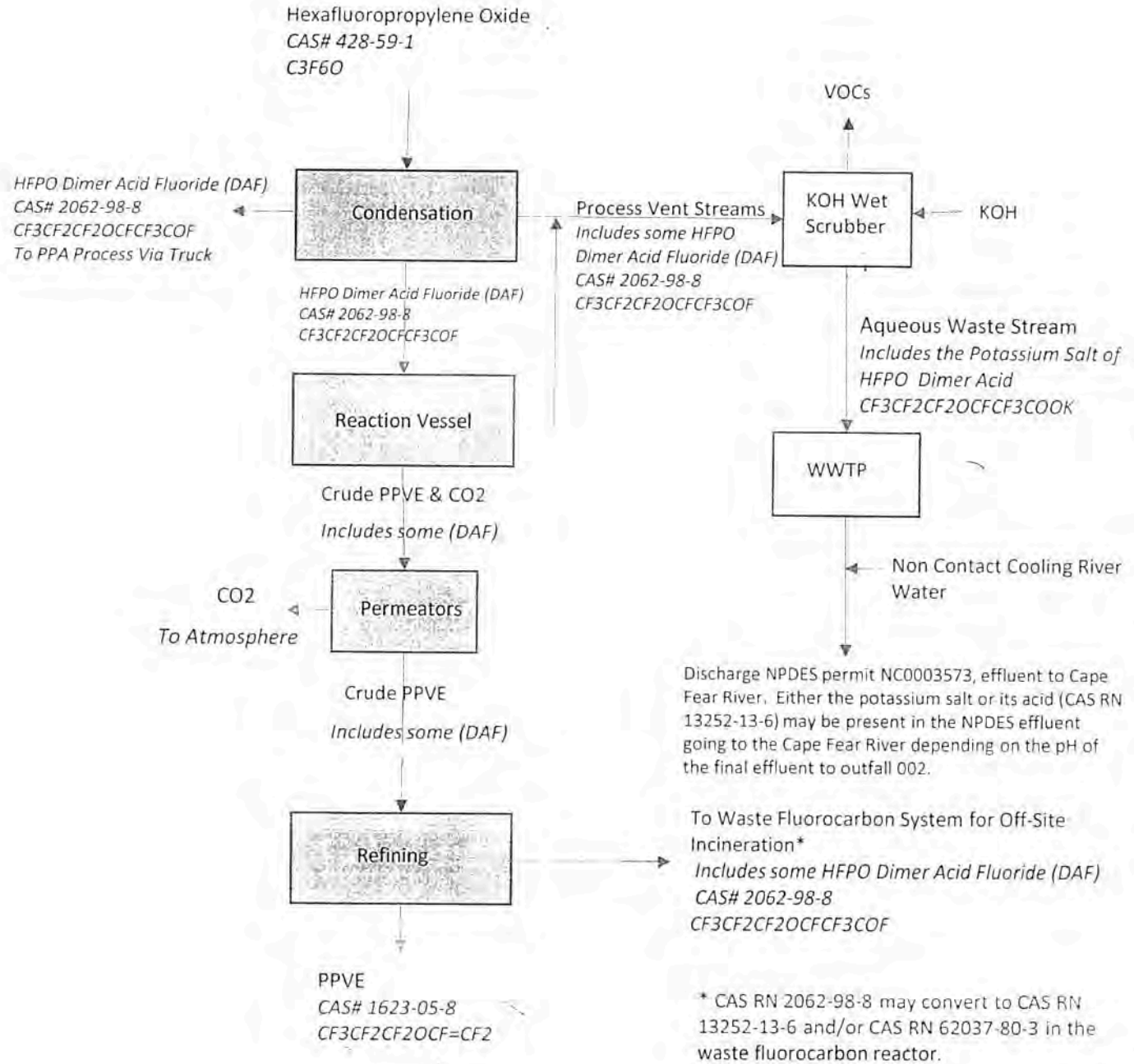
Division of Water Resources
PLAINTIFF

THE CHEMOURS
COMPANY, LLC

By: _____
R. Steven DeGeorge
Robinson Bradshaw & Hinson

0301F190856 2817

Summary Flow Chart
Perfluoropropyl Vinyl Ether (PPVE) Manufacturing Wastewater Treatment Plant (WWTP)



* CAS RN 2062-98-8 may convert to CAS RN 13252-13-6 and/or CAS RN 62037-80-3 in the waste fluorocarbon reactor.

28June2017

STATE OF NORTH CAROLINA

COUNTY OF BLADEN

IN THE GENERAL COURT OF JUSTICE
SUPERIOR COURT DIVISION
17 CVS 580

STATE OF NORTH CAROLINA, *ex rel.*, MICHAEL S. REGAN, SECRETARY, NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY, Plaintiff, v. THE CHEMOURS COMPANY FC, LLC, Defendant.	**COMPLAINT, MOTION FOR TEMPORARY RESTRAINING ORDER, AND MOTION FOR PRELIMINARY INJUNCTIVE RELIEF**

The State of North Carolina, complaining of the Defendant, alleges and says:

PARTIES

1. Plaintiff is the sovereign State of North Carolina. This action is being brought on the relation of Michael S. Regan, Secretary of the North Carolina Department of Environmental Quality ("DEQ"), the State agency established pursuant to N.C. Gen. Stat. § 143B-279.1 *et seq.*, and vested with the statutory authority to enforce the State's environmental protection laws, including laws enacted to protect the water quality of the State. The Division of Water Resources ("DWR") is a division within DEQ and all actions taken by DWR are necessarily actions of the Plaintiff.

2. Defendant The Chemours Company FC, LLC ("Chemours"), is a Delaware limited liability company registered and doing business in North Carolina. Defendant owns and operates a facility known as the Fayetteville Works ("Facility") located at 22828 NC Highway 87 W,

Fayetteville, Bladen County, North Carolina, which is the subject of this action.

JURISDICTION

3. The Superior Court has jurisdiction over this action for injunctive relief for existing or threatened violations of various laws and rules governing the protection of water quality pursuant to N.C. Gen. Stat. § 143-215.6C. Furthermore, jurisdiction for injunctive relief sought to compel enforcement of a statute or regulation rests in the Superior Court pursuant to N.C. Gen. Stat. § 7A-245(a)(2) and N.C. Gen. Stat. § 1-493.

VENUE

4. Bladen County, North Carolina is a proper venue for this action because a significant portion of the violations or threatened violations that are the subject of this action for injunctive relief have occurred, are occurring, and may continue to occur at Chemours' Fayetteville Works facility in Bladen County. N.C. Gen. Stat. § 143-215.6C.

NATURE OF THE ACTION

5. This Action is commenced by the State of North Carolina for the purpose of seeking injunctive relief to enforce its water quality laws. Chemours has contaminated North Carolina's public water resources, including surface waters and groundwater. First, for decades Chemours has been discharging into the Cape Fear River a chemical known as "GenX" and related compounds, which EPA and various health studies have recognized may present an unreasonable risk of injury to human health and the environment. Despite its knowledge of these risks, Chemours failed to disclose and even made statements that misled DEQ as to the presence of GenX and related compounds in its process wastewater. Second, Chemours' chemical manufacturing operation has caused widespread and significant groundwater contamination, with levels of GenX

that exceed by orders of magnitude the regulatory limit set forth in North Carolina's groundwater rules and the health goal set by the North Carolina Department of Health and Human Services. The State is entitled to injunctive relief.

LEGAL BACKGROUND

The Clean Water Act and North Carolina's NPDES Program

6. The Federal Clean Water Act prohibits any person from discharging pollutants into surface waters without first obtaining an appropriate permit. 33 U.S.C. § 1311. All persons are therefore required to obtain a National Pollution Discharge Elimination System ("NDPES") permit prior to the discharge of pollutants into surface waters through a point source. 33 U.S.C. § 1342.

7. Like other federal environmental programs, the Clean Water Act was designed to incorporate principles of cooperative federalism, authorizing individual states to assume responsibility for implementation of an NPDES Program upon statutory authorization and application to the United States Environmental Protection Agency ("EPA"). 33 U.S.C. § 1342(b).

8. EPA approved North Carolina's NPDES program in 1975. North Carolina's NPDES program is carried out in part pursuant to a Memorandum of Agreement between the State and EPA. *See National Pollution Discharge Elimination System Memorandum of Agreement Between the State of NC and the US EPA Region 4* (October 15, 2007) ("MOA"), *available at* https://www.epa.gov/sites/production/files/2013-09/documents/nc-moa-npdes.pdf.

9. As recognized in the MOA, North Carolina has authority to take action to enforce violations of 33 U.S.C. § 1311 of the Clean Water Act, which prohibits the unpermitted discharge of pollutants into surface waters. MOA § VI.A.2.a; N.C. Gen. Stat. § 143-215.1.

10. North Carolina's statutes implementing the NPDES program are set forth in Article

21 of Chapter 143 of the North Carolina General Statutes.

11. North Carolina's water quality statutes and the rules adopted under them are designed to further the public policy of the State, as stated in N.C. Gen. Stat. § 143-211, "to provide for the conservation of its water and air resources . . . [and], within the context of this Article [21] and Articles 21A and 21B of this Chapter [143], to achieve and to maintain for the citizens of the State a total environment of superior quality."

12. North Carolina's primary statute for implementing its NPDES permitting program is N.C. Gen. Stat. § 143-215.1, which requires a permit from the Environmental Management Commission ("EMC") before any person can "make any outlet into waters of the state," or

> [c]ause or permit any waste, directly or indirectly, to be discharged to or in any manner intermixed with the waters of the State in violation of the water quality standards applicable to the assigned classifications or in violation of any effluent standards or limitations established for any point source, unless allowed as a condition of any permit . . . .

13. The EMC has the power to issue permits with such conditions as the EMC believes are necessary to achieve the purposes of Article 21 of Chapter 143 of the General Statutes, including NPDES permits. N.C. Gen. Stat. § 143-215.1(b). The EMC also has the power "[t]o make rules implementing Articles 21" including standards and procedures to implement North Carolina's NPDES program. N.C. Gen. Stat. § 143B-282 *et seq.*

14. The EMC has adopted rules that delegate the authority to issue NPDES permits to DWR.

15. The regulations implementing the State's NPDES permitting process are set forth in subchapter 2H of Title 15A of the North Carolina Administrative Code. Under these rules, the permit applicant has "the burden of providing sufficient evidence to reasonably ensure that the

proposed system will comply with all applicable water quality standards." 15A N.C.A.C. 2H .0112(c). These rules further provide "no permit may be issued when the imposition of conditions cannot reasonably ensure compliance with applicable water quality standards." *Id.*

16. Part of the permit applicant's burden in this regard is to disclose all relevant information, such as the presence of known constituents in a discharge that pose a potential risk to human health. The permit applicant is required to disclose "all known toxic components that can be reasonably expected to be in the discharge, including *but not limited to* those contained in a priority pollutant analysis." 15A N.C.A.C. 2H .0105(j) (emphasis added).

17. While the North Carolina Administrative Code does not contain a definition of "toxic component," North Carolina water quality regulations define "toxic substance" to include:

> any substance or combination of substances (including disease-causing agents), which after discharge and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, has the potential to cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions or suppression in reproduction or growth) or physical deformities in such organisms or their offspring.

15A N.C.A.C. 2B .0202(64).

18. These disclosure obligations do not cease upon issuance of a permit. Rather, they are ongoing. Pursuant to NPDES Standard Permit Condition II.E.8, "Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application . . . or in any report to the Director, it shall promptly submit such facts or information." *See* NPDES Standard Permit Conditions, attached hereto and incorporated herein as Exhibit A; *see also* 40 C.F.R. 122.41(1)(8).

19. These disclosure obligations are critical, in part, because they define the scope of the Clean Water Act's "permit shield." While compliance with the express terms of an NPDES permit generally "shields" the permittee from liability for violations of 33 U.S.C. § 1311, the

permit does not shield the permittee from liability where the pollutant being discharged was not within the "reasonable contemplation" of the permitting agency when it issued the permit due to nondisclosure by the permittee. 33 U.S.C. § 1342(k); *see also Piney Run Pres. Ass'n v. Cty. Comm'rs of Carroll Cty., MD*, 268 F.3d 255, 265 (4th Cir. 2001). Indeed, EPA's guidance regarding the permit shield provides that a permit only "provides authorization and therefore a shield for . . . pollutants resulting from facility processes, waste streams and operations that have been *clearly identified* in the permit application process when discharged from specified outfalls." *EPA, Revised Policy Statement on Scope of Discharge Authorization and Shield Associated with NPDES Permits*, available at https://www3.epa.gov/npdes/pubs/owm0131.pdf (emphasis added).

20. The importance and accuracy of disclosures to the agency is underscored by the signatory requirements set forth in NPDES Permit Standard Conditions and 40 CFR 122.22, which require all "applications, reports or information submitted to [DEQ]" to be signed by a responsible official and accompanied by the following certification:

> I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, *true, accurate and complete*. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

See Exhibit A § II.B.11.d (emphasis added).

21. The NPDES Standard Permit Conditions also impose a duty on permittees to take "all reasonable steps to minimize or prevent any discharge . . . in violation of this permit with a reasonable likelihood of adversely affecting human health or the environment." Exhibit A § II.B.2.

Surface Water Classifications and Standards

22. North Carolina's water quality program takes a three-pronged approach to protecting North Carolina's surface waters. First, it establishes surface water classifications based on the "best uses" of surface waters. *See* 15A N.C.A.C. 2B .0101; N.C. Gen. § 143-214.1(b). Second, it establishes water quality standards for each classification in Subchapter 2B of Title 15A of the North Carolina Administrative Code ("2B Rules") to protect the assigned uses of each classification. *See, e.g.*, 15A N.C.A.C. 2B .0216(1), 15A N.C.A.C. 2B .0211. And third, it assigns these classifications to individual segments of surface waters throughout the State. *See* 15A N.C.A.C. 2B .0201.

23. The relevant segment of the Cape Fear River into which the Facility's discharge flows is classified as "Class WS-IV." The best usage of WS-IV waters is defined as "a source of water supply for drinking, culinary, or food-processing purposes . . . and any other best usage specified for Class C waters." 15A N.C.A.C. 2B .0216(1). Best usage for Class C waters includes "aquatic life propagation and maintenance of biological integrity (including fishing and fish), wildlife, secondary recreation, [and] agriculture." 15A N.C.A.C. 2B .0211(1). "Sources of water pollution that preclude any of these uses on either a short term or long term basis shall be considered to be violating a water quality standard." 15A N.C.A.C. 2B .0211(2), 2B .0216(2).

24. Class C and WS-IV Waters are also subject to "Water Quality Standards for Toxic Substances." 15A N.C.A.C. 2B .0208. Pursuant to 15A N.C.A.C. 2B .0208, "the concentration of toxic substances, either alone or in combination with other wastes, in surface waters shall not render waters injurious to aquatic life or wildlife, recreational activities, public health, or impair the waters for any designated uses." Specifically, "the concentration of toxic substances shall not

exceed the level necessary to protect human health through exposure routes of fish tissue consumption, water consumption, or other route identified as appropriate for the water body." 15A N.C.A.C. 2B .0208(a)(2).

North Carolina's Groundwater Standards

25. In addition to regulating surface waters, the EMC has promulgated rules in 15A N.C.A.C. Subchapter 2L (the "2L Rules") that "establish a series of classifications and water quality standards applicable to the groundwaters of the State." 15A N.C.A.C. 2L .0101(a). "Groundwaters" are defined in the 2L Rules as "those waters occurring in the subsurface under saturated conditions." 15A N.C.A.C. 2L .0102(11).

26. The 2L Rules "are applicable to all activities or actions, intentional or accidental, which contribute to the degradation of groundwater quality, regardless of any permit issued by a governmental agency authorizing such action or activity," except in certain situations not applicable here. 15A N.C.A.C. 2L .0101(b).

27. The 2L Rules "are intended to maintain and preserve the quality of the groundwaters, prevent and abate pollution and contamination of the waters of the state, protect public health, and permit management of the groundwaters for their best usage by the citizens of North Carolina." 15A N.C.A.C. 2L .0103(a). The policy section of the 2L Rules provides further that

> [i]t is the policy of the Commission that the best usage of the groundwaters of the state is as a source of drinking water. These groundwaters generally are a potable source of drinking water without the necessity of significant treatment. It is the intent of these Rules to protect the overall high quality of North Carolina's groundwaters to the level established by the standards and to enhance and restore the quality of degraded groundwaters where feasible and necessary to protect human health and the environment, or to ensure their suitability as a future source of drinking water.

15A N.C.A.C. 2L .0103(a).

28. The policy section of the 2L Rules provides further that "[n]o person shall conduct or cause to be conducted, any activity which causes the concentration of any substance to exceed that specified in Rule .0202 of this Subchapter, except as authorized by the rules of this Subchapter." 15A N.C.A.C. 2L .0103(d).

29. "Contaminant" is defined in the 2L Rules as "any substance occurring in groundwater in concentrations which exceed the groundwater quality standards specified in Rule .0202 of the Subchapter." 15A N.C.A.C. 2L .0102(4).

30. "Natural conditions" are defined in the 2L Rules as "the physical, biological, chemical and radiological conditions which occur naturally." 15A N.C.A.C. 2L .0102(16).

31. The groundwater standards set forth in the 2L Rules are "the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which would otherwise render the groundwater unsuitable for its intended best usage." 15A N.C.A.C. 2L .0202(a).

32. With certain exceptions not relevant here, "substances which are not naturally occurring and for which no standard is specified shall not be permitted in concentrations at or above the practical quantitation limit" in groundwaters. 15A N.C.A.C. 2L .0202(c).

33. The "practical quantitation limit" or "PQL" is defined as "the lowest concentration of a given material that can be reliably achieved among laboratories within specified limits of precision and accuracy by a given analytical method during routine laboratory analysis." 15A N.C.A.C. 2L .0102(15).

34. "Any person conducting or controlling an activity that results in the discharge of a

waste or hazardous substance or oil to the groundwaters of the State, or in proximity thereto, shall take action upon discovery to terminate and control the discharge, mitigate any hazards resulting from exposure to the pollutants and notify the Department." 15A N.C.A.C. 2L .0106(b).

35. Pursuant to the 2L Rules, "[i]nitial response required to be conducted prior to or concurrent with the assessment required" as set forth above "shall include" among other things,

> (2) abatement, containment, or control of the migration of contaminants; (3) removal, treatment, or control of any primary pollution source such as buried waste, waste stockpiles, or surficial accumulations of free products; (4) removal, treatment, or control of secondary pollution sources that would be potential continuing sources of pollutants to the groundwaters, such as contaminated soils and non-aqueous phase liquids.

15A N.C.A.C. 2L .0106(f).

Standard for Injunctive Relief Under N.C. Gen. Stat. § 143-215.6C

36. Whenever DEQ has reasonable cause to believe that any person has violated or is threatening to violate any of the provisions of the State's water quality laws or administrative rules, DEQ is authorized to "request the Attorney General to institute a civil action in the name of the State upon the relation of [DEQ] for injunctive relief to restrain the violation or threatened violation." N.C. Gen. Stat. § 143-215.6C. That section further provides that "[u]pon a determination by the court that the alleged violation of the provisions of this Part or the regulations of the Commission has occurred or is threatened, the court shall grant the relief necessary to prevent or abate the violation or threatened violation." N.C. Gen. Stat. § 143-215.6C.

37. When the State brings an action to vindicate the public interest pursuant to a statute which provides for injunctive relief to abate violations of law, the usual test for issuance of injunctions need not be met. *See State ex rel. Morgan v. Dare To Be Great, Inc.*, 15 N.C. App. 275, 189 S.E.2d 802 (1972) (negating the general rule that there will be no equitable relief if there

is an adequate remedy at law when the statutory scheme provided the State with injunctive relief under the circumstances presented). For example, the State is not required to show actual injury, such as irreparable harm, in order to obtain injunctive relief, including a preliminary injunction. *State ex rel. Edmisten v. Challenge, Inc.*, 54 N.C. App. 513, 521-22, 284 S.E.2d 333, 338-39 (1981) (explaining that irreparable harm need not be established by the State as long as the statutory conditions for issuance of a preliminary injunction exist). Rather, it must show only that the acts or practices complained of adversely affect the public interest. *See id.* An adverse effect on the public interest exists as a matter of law where the statutory conditions for issuance of injunctive relief are present, i.e., where a violation of the applicable statute or regulations exists or is threatened. *Id.* at 522, 284 S.E.2d at 339.

FACTUAL ALLEGATIONS

The Fayetteville Works Facility

38. The Chemours Company - Fayetteville Works, formerly known as the Dupont Company - Fayetteville Works, (the "Facility") is a chemical manufacturing facility with manufacturing areas operated by three separate companies, including Chemours.

39. Upon information and belief, E. I. DuPont de Nemours & Company, Inc. ("DuPont"), began its Nafion® manufacturing process at the Facility in the 1970s. Since that time, the Facility's business has expanded to include other chemical manufacturing processes.

40. The Facility discharges wastewater pursuant to National Pollutant Discharge Elimination System Permit No. NC003573 ("NPDES Permit"), the most recent version of which was issued by DWR on October 28, 2015. The NPDES Permit is attached hereto and incorporated herein as Exhibit B.

41. Upon information and belief, Chemours took ownership of the Facility and the NPDES Permit in 2015.

42. Upon information and belief, the Chemours Fluoromonomers/Nafion® Membrane Manufacturing Area produces, among other products, Chemours Nafion® Membrane and Polymer Dispersions, HFPO monomers and vinyl ether monomers. *See* NPDES Permit Application dated April 27, 2016, Supplemental Information at 3, attached hereto and incorporated herein as Exhibit C; *see also* Facility Map, attached hereto and incorporated herein as Exhibit D.

43. Upon information and belief, the Chemours Polymer Processing Aid ("PPA") Manufacturing Area produces a polymer processing aid, also referred to as "GenX." Exhibit C, Supplemental Information, at 3.

44. Upon information and belief, GenX falls within a family of chemicals known as per- and polyfluoroalkyl substances or "PFASs," which are commonly used in the manufacture of nonstick coatings and for other purposes.

45. The Facility also houses areas rented by Kuraray America Inc. for the manufacture of Butacite® and SentryGlas®. Another area is rented by DuPont—upon information and belief, Chemours' predecessor—for the manufacture of Polyvinyl Fluoride ("PVF").

46. The NPDES Permit authorizes discharge of wastewater and stormwater from the Facility through Outfalls 001 and 002. Outfall 001 is an internal outfall from the Facility's wastewater treatment plant. Outfall 002 discharges Chemours' treated wastewater into the Cape Fear River. *See* Exhibit C, at 5 (figure titled "Chemours Company – Fayetteville Works/Locations of Intake and Discharge Structures").

47. The segment of the Cape Fear River into which the Facility's wastewater is

discharged is upstream of various drinking water intakes and is classified as a WS-IV water.

48. The surface water into which the Facility's wastewater is discharged is used as a public water source that serves residents and businesses in several counties.

49. Upon information and belief, the Facility began producing GenX commercially in 2009.

50. Upon information and belief, wastewater from the GenX production process occurring in the PPA Manufacturing Area has been collected and shipped offsite for disposal since that time.

51. Upon information and belief, GenX and related compounds have also been generated as byproducts during other manufacturing processes occurring at the Facility.

52. Upon information and belief, GenX and related compounds generated as byproducts have been discharged by the Facility into the Cape Fear River since the early 1980s.

53. Upon information and belief, the onsite wastewater treatment plant at the Facility is ineffective at removing GenX and related compounds from the process wastewater that is ultimately discharged into the Cape Fear River through Outfall 002.

54. Upon information and belief, public water treatment plants such as the Sweeney Plant operated by the Cape Fear Public Utility Authority in Wilmington, are ineffective at removing GenX and related compounds from the water taken from the Cape Fear River.

55. Upon information and belief, GenX and related compounds discharged by the Facility have been and are present in public drinking water supplied to residents and businesses in several counties.

56. Upon information and belief, Chemours and DuPont have known for years that

GenX and related compounds were being generated as byproducts and discharged into surface waters of the State.

57. On August 31, 2017, EPA submitted a report to DEQ indicating that additional PFASs had been identified in the Cape Fear River and at Outfall 002, including to two perfluorethersulfonic acids ("PFESAs"). EPA's August 31, 2017 report is attached hereto and incorporated herein as Exhibit E.

58. In its report, EPA identified these compounds as "PFESA Byproduct 1" and "PFESA Byproduct 2" and stated that these compounds were likely byproducts from Chemours' Nafion® manufacturing process. Exhibit E, at 2.

59. Upon information and belief, Chemours continues to knowingly discharge wastewater containing various PFASs, including the PFESAs identified in EPA's report.

DEQ's Investigation of GenX Contamination in the Cape Fear River

60. In recent months, DEQ, in consultation with the North Carolina Department of Health and Human Services ("DHHS"), has led a state investigation into the presence of GenX and related compounds in the Cape Fear River.

61. DHHS set a health goal for exposure to GenX in drinking water of 140 nanograms per liter ("ng/L") (also referred to as parts per trillion or "ppt"). *See* DHHS Risk Assessment for GenX attached hereto and incorporated herein as Exhibit F.

62. On June 19, 2017, DEQ began collecting water samples from twelve sites along the Cape Fear River.

63. Samples collected at various locations along the Cape Fear River in June of 2017 showed that concentrations of GenX were present in the Cape Fear River at levels that were well

above the DHHS health goal of 140 ppt.

64. Upon information and belief, after discussions with DWR, on or around June 21, 2017, Chemours ceased discharging the wastewater containing GenX from the vinyl ether monomer production process and began collecting that wastewater and shipping it off-site for disposal.

65. Upon information and belief, since that time, concentrations of GenX in the Cape Fear River have steadily declined.

Chemours' Nondisclosure and Misrepresentations Relating to Its Discharge of GenX and Related Compounds Into the Cape Fear River

66. Upon information and belief, DuPont and Chemours failed to timely disclose to DWR the discharge of GenX and related compounds into the Cape Fear River.

67. In particular, none of the Dupont or Chemours NPDES permit applications referenced "GenX" or any chemical name, formula, or CAS number that would identify any GenX or related compounds in the Facility's discharge.

68. In fact, information provided by DuPont and Chemours led DWR staff to reasonably believe that GenX was not being discharged into the Cape Fear.

69. On August 26, 2010, representatives of DuPont, including environmental manager Michael Johnson, met with DEQ staff regarding DuPont's anticipated use of GenX technology at the Fayetteville Works as a replacement for the compound perfluorooctanoic acid ("PFOA"), also known as "C8."

70. The information DuPont provided indicated that the GenX compounds would be produced in a closed-loop system that would not result in the discharge of those compounds into the Cape Fear River.

71. Upon information and belief, DuPont and Chemours did not notify DWR of an actual discharge of GenX or related compounds at this meeting or in any information subsequently provided to DWR prior to 2017.

72. While DuPont no longer produces C8 or PFOA, its manufacturing history is telling.

73. On May 3, 2001, DuPont submitted an NPDES renewal application to DWR stating that it intended to begin manufacturing PFOA. The 2001 Application and the 2004 Fact Sheet for NPDES Permit Development are attached hereto and incorporated herein as Exhibits G and H.

74. During the application process, DuPont represented to DWR that:

a. PFOA does not pose a health concern to humans or animals at levels present in the workplace or environment;

b. DuPont had used PFOA for forty years with no observed health effects on workers;

c. PFOA is neither a known developmental toxin nor a known carcinogen. Exhibit G, at 4 (page titled "Potential Facility Changes"); Exhibit H, at 4.

75. Upon information and belief, EPA launched a "PFOA Stewardship Program" in January 2006 because of concerns about the impact of PFOA and long-chain PFASs on human health and the environment, including concerns about their persistence, presence in the environment and in the blood of the general U.S. population, long half-life in people, and developmental and other adverse effects in laboratory animals.

76. In 2006, DuPont began to phase out its use of PFOA as part of the PFOA Stewardship Program, aiming to completely eliminate the use and production of PFOA.

77. Upon information and belief, in 2008 DuPont submitted to EPA notices of its intent

to manufacture GenX pursuant to the Toxic Substances Control Act ("TSCA").

78. On January 28, 2009, EPA and DuPont entered into a Consent Order governing the manufacture of GenX. A publicly-available redacted version of the Consent Order is attached hereto and incorporated herein as Exhibit I.

79. The Consent Order provides that "EPA has concerns that [GenX] will persist in the environment, could bioaccumulate, and be toxic . . . to people, wild animals, and birds." Exhibit I, at vii.

80. The Consent Order also stated that EPA had "human health concerns" regarding GenX. Exhibit I, at vii. The Consent Order recognized that "uncontrolled . . . disposal of [GenX] may present an unreasonable risk of injury to human health and the environment." Exhibit I, at xv.

81. The Consent Order required DuPont to "recover and capture (destroy) or recycle [GenX] at an overall efficiency of 99% from all the effluent process streams and the air emissions (point source and fugitive)." Exhibit I, at 36.

82. At DuPont's 2010 meeting with DEQ regarding its transition from PFOA to GenX, DuPont explained that GenX would be produced in a closed-loop system that would not result in the discharge of GenX into the Cape Fear River.

83. DuPont represented that the wastewater generated from the manufacture of GenX would be collected and shipped off-site for disposal and therefore this wastewater would not be discharged into the Facility's wastewater treatment plant or into the Cape Fear River.

84. At no time during this meeting did DuPont notify DWR of an actual discharge of GenX or related compounds into the Cape Fear River.

85. On April 29, 2011, DuPont submitted an NDPES permit renewal application, which is attached hereto and incorporated herein as Exhibit J, confirming that "all process wastewater generated from [the PPA Manufacturing Area] is collected and shipped offsite for disposal" and "no process wastewater from this manufacturing facility is discharged to the site's biological [waste water treatment plant] or to the Cape Fear River." The application made no mention of GenX or related compounds being discharged into the Cape Fear River.

86. On February 6, 2012, DWR issued a renewal permit with an effective date of March 1, 2012 ("2012 Permit"). The 2012 Permit is attached hereto and incorporated herein as Exhibit K. The 2012 Permit makes no mention of GenX as part of the authorized discharge from the Facility.

87. On or around November 10, 2016, the EPA and Dr. Detlef Knappe, professor of Civil, Construction and Environmental Engineering at N.C State University, published a study that identified the presence of GenX and other PFASs in the Cape Fear River. This publication is attached hereto and incorporated herein as Exhibit L. The study indicated that levels of GenX in one sample area in the Cape Fear River were as high as approximately 4500 ng/L, Exhibit L, at 3, which is more than thirty times higher than the health goal set by DHHS.

88. On June 12, 2017, after substantial media coverage regarding the presence of GenX in the Cape Fear River, Chemours informed DEQ in a meeting that for several decades, GenX and other PFASs had been produced as byproducts at the Facility and routinely discharged into the Cape Fear River.

89. In late August, 2017, Chemours provided to DEQ—and only after DEQ's request—internal health studies on GenX compounds that had been conducted previously by DuPont or

Chemours.

90. DuPont and Chemours' ongoing misrepresentations and inadequate disclosures shielded important information from DEQ and the public, and they deterred DEQ staff from inquiring further into the nature of GenX discharges and other related activities at the Facility.

91. Had the appropriate disclosures been made, they would have justified the application of one or more different permit conditions at the time the Permit was issued, such as monitoring and reporting requirements, appropriate health-based water quality standards, effluent limits, or evaluation of alternatives to discharging GenX and other chemicals in the process wastewater at the Facility.

92. In August of 2017 EPA reported to DEQ that additional undisclosed byproducts of concern were detected in samples collected at Outfall 002, including PFESA Byproduct 1 and PFESA Byproduct 2. *See* Ex. E, at 2. Upon information and belief, these compounds are a byproduct of Chemours' Nafion® manufacturing process.

93. By letter dated August 29, 2017, attached hereto and incorporated herein as Exhibit M, DWR requested that Chemours "immediately explore any and all options to reduce or eliminate the release of these chemicals into the Cape Fear River until the State of North Carolina can review available information related to these chemicals and properly evaluate potential health effects."

94. Neither Chemours nor DuPont ever disclosed to DWR that it was discharging PFESA Byproduct 1 or PFESA Byproduct 2 into the Cape Fear River.

95. As of the time of this filing, 2017, DWR has received no indication from Chemours that it intends to cease discharging PFESA Byproduct 1 or PFESA Byproduct 2 into the Cape Fear River.

96. Since learning of the presence of GenX in the discharge from the Facility, DEQ has sent Chemours several requests for information to which Chemours has failed to fully respond, including:

a. A letter dated July 21, 2017 sent by DEQ Secretary Michael S. Regan requesting records related to the discharge of GenX and other emerging contaminants, attached hereto and incorporated herein as Exhibit N;

b. A letter dated August 16, 2017 sent by DEQ General Counsel William Lane requesting access or consent for the release of Chemours' confidential business information in the possession of EPA, attached hereto and incorporated herein as Exhibit O;

c. A letter dated August 18, 2017 sent by NPDES Permit Writer Teresa Rodriguez, requesting detailed information about the wastewater streams at the Facility, attached hereto and incorporated herein as Exhibit P; and

d. A letter dated August 29, 2017 sent by DWR Deputy Director Linda Culpepper, providing clarification and shortening the deadline for DWR's August 18 letter, attached hereto and incorporated herein as Exhibit Q.

97. The communications DEQ has received in response to these requests did not contain complete information.

Chemours' Contamination of Groundwater

98. In 2003, DuPont began a groundwater monitoring program at the Fayetteville Works, testing for various constituents including PFOA.

99. The requirement to conduct this groundwater monitoring was incorporated into the

Resource Conservation and Recovery Act Facility Investigation Workplan Outline ("RFI Workplan"), which is a part of the facility's Hazardous Waste Management Permit, No. NCD047368642-R2-M3 ("DWM Permit").

100. The DWM Permit was first issued in February of 1984 by DEQ's Division of Waste Management ("DWM") with the most recent version issued on June 23, 2015. The most recent version of the DWM Permit is attached hereto and incorporated herein as Exhibit R.

101. The DWM Permit allows the Facility to store and treat hazardous waste, including waste from the Fluoromonomers/Nafion® Membrane Manufacturing Area.

102. In 2015, following the detection of certain PFASs (in addition to PFOA) in the Cape Fear River, DEQ instructed Chemours to conduct supplemental groundwater sampling to determine whether groundwater flowing from the site was causing these concentrations in the river.

103. The groundwater sampling results showed an elevated concentration of one of these PFASs in the groundwater sample from an onsite monitoring well.

104. Chemours provided DEQ only with the PFOA groundwater sampling results, but, until July of 2017, failed to share the results showing the elevated concentration of this additional PFAS.

105. In August of 2017, DWM asked for additional groundwater sampling to occur at the Facility, including sampling for GenX.

106. Because GenX is not naturally occurring in groundwater and no numerical groundwater standard has been established for GenX, the applicable groundwater standard is the PQL. *See* 15A N.C.A.C. 2L .0202(c).

107. Samples were gathered from 14 groundwater monitoring wells and shared with three laboratories, including the National Exposure Research Laboratory of the EPA ("EPA Lab"), GEL Laboratories in Charleston, SC ("GEL"), and Test America, a private lab contracted by Chemours.

108. The data received from GEL show GenX in samples taken from 13 of the 14 monitoring wells at levels greater than the PQL of 10 ng/L, and therefore in violation of the groundwater standard set forth in the 2L Rules.

109. In fact, GenX has been detected in these 13 wells at levels ranging from 519 to 61,300 ng/L – far greater than the 140 ng/L health goal set by the DHHS and the 10 ng/L PQL. A map generated by DEQ illustrating these well locations and measured concentrations of GenX in groundwater is attached hereto and incorporated herein as Exhibit S.

110. All five wells located adjacent to the Cape Fear River have GenX levels greater than 11,800 ng/L.

111. GenX concentrations exceeding the DHHS health goal by orders of magnitude are site wide – indicating widespread groundwater contamination.

112. On September 6, 2017, DWR and DWM jointly issued Chemours a notice of violation and notice of intent to enforce for Chemours' violation of groundwater standards at the Facility. The notice of violation and notice of intent to enforce is attached hereto and incorporated herein as Exhibit T.

VIOLATIONS OF NORTH CAROLINA'S WATER QUALITY LAWS

Claim I: Violation of Groundwater Standards

113. The allegations contained in Paragraphs 1 through 112 are incorporated into this

claim as if fully set forth herein.

114. The applicable groundwater standard for GenX is the Practical Quantitation Limit or PQL, which is 10 ng/L. A memorandum dated July 13, 2017 from the EPA to Linda Culpepper, Deputy Director of DWR, documenting the PQL is attached hereto and incorporated herein as Exhibit U.

115. Concentrations of GenX in groundwater water samples taken from monitoring wells at the Facility drastically exceed applicable groundwater standards.

116. Chemours' failure to correct these violations constitutes a continuing violation of the State's water quality laws that, as a matter of law, adversely affects the public interest. *See Challenge*, 54 N.C. App. at 522, 284 S.E.2d at 339. The State is therefore entitled to preliminary and permanent injunctive relief against Chemours to prevent and abate Chemours' violation of Groundwater Standards pursuant to N.C. Gen. Stat. § 143-215.6C.

Claim II: Misrepresentation and Violation of NPDES Disclosure Requirements

117. The allegations contained in Paragraphs 1 through 116 are incorporated into this claim for relief as if fully set forth herein.

118. Upon information and belief, the process wastewater from the Fluoromonomers/Nafion® Membrane Manufacturing Area contains and has contained substances or combinations of substances which meet the definition of "toxic substance" set forth in 15A N.C.A.C. 2B .0202.

119. Upon information and belief, Chemours was aware that these substances had potential toxic effects prior to submitting its 2012 Permit Application to DWR.

120. Upon information and belief, by representing to DWR that its GenX manufacturing

process would be a closed loop system and, therefore, that GenX would not be discharged into surface waters, and withholding information regarding its discharge of GenX, Chemours knowingly misled DWR into believing that GenX was not being discharged from the Facility into surface waters.

121. Upon information and belief, Chemours violated 15A N.C.A.C. 2H .0105(j) by failing to fully disclose all known toxic components reasonably expected to be in the discharge when it submitted the 2012 Permit Application.

122. Upon information and belief, Chemours violated NPDES Permit Standard Condition II.E.8, by failing to disclose all known toxic components reasonably expected to be in the discharge after it became aware that such facts were not disclosed in the 2012 Permit Application.

123. Upon information and belief, Chemours continues to withhold relevant information regarding the contents of its wastewater discharge and the health risks associated with the chemical byproducts produced by the Facility and discharged into waters of the State.

124. Chemours' failure to correct these violations constitutes a continuing violation of the NPDES Permit and the State's water quality laws that, as a matter of law, adversely affects the public interest. *See Challenge*, 54 N.C. App. at 522, 284 S.E.2d at 339. The State is entitled to preliminary and permanent injunctive relief against Chemours to address Chemours' misrepresentations and violations of NPDES disclosure requirements pursuant to N.C. Gen. Stat. § 143-215.6C.

Claim III: Unpermitted Discharge

125. The allegations contained in Paragraphs 1 through 124 are incorporated into this

claim for relief as if fully set forth herein.

126. The presence of various toxic substances, including GenX and related compounds, were not in the reasonable contemplation of DWR when it issued the 2012 Permit.

127. Chemours has discharged these substances into the Cape Fear River in violation of its N.C. Gen. Stat. § 143-215.1.

128. Chemours's failure to correct these violations constitutes a continuing violation of the State's water quality laws that, as a matter of law, adversely affects the public interest. *See Challenge*, 54 N.C. App. at 522, 284 S.E.2d at 339.

129. The State is entitled to preliminary and permanent injunctive relief against Chemours to prevent and abate Chemours' unpermitted discharge pursuant to N.C. Gen. Stat. § 143-215.6C.

MOTION FOR TEMPORARY RESTRAINING ORDER

1. The allegations contained in Paragraphs 1 through 129 are incorporated into this Motion for Temporary Restraining Order as if fully set forth herein.

2. The State is entitled to a temporary restraining order to immediately restrain Chemours' unlawful discharge of chemical byproducts from its manufacturing processes into surface waters of the State.

3. As described above, when the State brings an action to vindicate the public interest pursuant to a statute which provides for injunctive relief to abate violations of law, the usual test for issuance of injunctions need not be met. The State is not required to show actual injury, such as irreparable harm, in order to obtain injunctive relief, including a temporary restraining order. Rather, it must show only that the acts or practices complained of adversely affect the public

interest. An adverse effect on the public interest exists as a matter of law where the statutory conditions for issuance of injunctive relief are present, i.e., where a violation of the applicable statute or regulations exists or is threatened.

4. Pursuant to N.C. Gen. Stat. 143-215.6C, "[u]pon a determination by the court that the alleged violation of the provisions of this Part or the regulations of the Commission has occurred or is threatened, the court shall grant the relief necessary to prevent or abate the violation or threatened violation."

5. Here a temporary restraining order is necessary to prevent or abate Chemours' unpermitted discharge of chemical byproducts in violation of N.C. Gen. Stat. § 143-215.1 and to address Chemours' misrepresentations relating to its discharge of GenX and related compounds.

6. Even if the Court required a further showing of irreparable harm, that test is easily met here. By failing to disclose the presence of GenX and related compounds in its discharge, and by misrepresenting that GenX and related compounds were not present in its discharge, Chemours has caused a state of public alarm and uncertainty regarding the safety of public drinking water.

7. Moreover, Chemours delayed or prevented the State from developing health-based water quality standards for the GenX and related compounds that Chemours discharged to the waters of the State. After GenX was disclosed in the Cape Fear River, the State produced a preliminary health assessment which concludes that GenX has health risks over a certain level. When GenX was first measured, it was above this health goal in surface water.

8. While the State does not yet have sufficient data to establish a health goal for these related compounds, given the health risks associated with GenX and other PFASs, the public is entitled to the protections afforded by the precautionary measures requested in this Motion.

9. Furthermore, as noted in the State's preliminary health assessment, EPA guidance indicates where contamination is found in surface water and information is lacking about other sources of exposure in the environment, environmental agencies should assume that drinking water is not the only source of exposure.

10. An immediate cessation of Chemours' discharge of recently discovered chemical byproducts is necessary to immediately put a stop to the adverse environmental impacts caused by Chemours' unlawful discharge and restore public confidence in the safety of drinking water while this litigation proceeds.

11. While not necessary to prove that a temporary restraining order should issue under N.C. Gen. Stat. § 143-215.6C, the balance of equities and the public interest strongly favor granting the temporary injunctive relief sought by this Motion.

12. Accordingly, the State requests that the Court enter a temporary restraining order directing Chemours' to: 1) immediately cease discharging the substances identified as PFESA Byproduct 1 and PFESA Byproduct 2 in Exhibit E, at p. 2, Tbl. 1, from its manufacturing process into surface waters; and 2) continue to prevent the discharge of process wastewater containing GenX into waters of the State.

PRAYER FOR RELIEF

WHEREFORE, the Plaintiff, State of North Carolina, prays that the Court grant the following relief:

1. That this verified Complaint be used as an affidavit upon which to base all orders of the Court.

2. That the Court grant a temporary restraining order requiring Chemours to

a. immediately cease discharging the substances identified as PFESA Byproduct 1 and PFESA Byproduct 2 in Exhibit E, at p. 2, Tbl. 1, from its manufacturing process into surface waters; and

b. continue to prevent the discharge of process wastewater containing GenX into waters of the State.

3. That the Court preliminarily, and upon final judgment permanently, enter a prohibitory and/or mandatory injunction requiring Chemours to:

a. Eliminate the discharge of PFASs to surface waters until such time as DEQ issues a NPDES permit authorizing such discharge or otherwise authorizes such activities;

b. Remove, treat or control any source of PFASs that has the potential to contaminate groundwater in accordance with a plan as approved by DEQ and with such conditions as DEQ shall deem necessary.

c. Complete site assessment activities and submit a plan and proposed schedule for corrective action to DEQ as required by 15A N.C.A.C. 2L .0106.

d. Take appropriate action to abate the violations of N.C. Gen. Stat. § 143-215.1, NPDES Permit and groundwater standards at the facility pursuant to a corrective action plan and schedule approved by DEQ.

e. Comply in full with DEQ's requests for information, attached hereto and incorporated herein as Exhibits N-Q.

4. That the cost of this action, including attorneys' fees, if allowable, be taxed against Chemours.

5. That this Court grant such other and further relief as the Court shall deem to be just and proper.

Respectfully submitted this the 7th day of September, 2017.

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STATE OF NORTH CAROLINA

COUNTY OF BLADEN

VERIFICATION

Linda Culpepper, being duly sworn, deposes and says that she is the Deputy Director of the Division of Water Resources of the North Carolina Department of Environmental Quality, that she has read the foregoing COMPLAINT, MOTION FOR TEMPORARY RESTRAINING ORDER, AND MOTION FOR PRELIMINARY INJUNCTIVE RELIEF and that she is acquainted with all of the facts and circumstances stated therein; that the same is true of her own knowledge, except as to those matters and things stated and alleged upon information and belief, and as to those matters and things she believes them to be true.

Linda Culpepper

Subscribed and sworn to before me

this the 7th day of September, 2017.

Anna V. Smith

Notary Public

ANNA V. SMITH NOTARY PUBLIC WAKE COUNTY, NC

My Commission Expires: 10/22/2021

Environmental Science & Technology LETTERS

Letter

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Legacy and Emerging Perfluoroalkyl Substances Are Important Drinking Water Contaminants in the Cape Fear River Watershed of North Carolina

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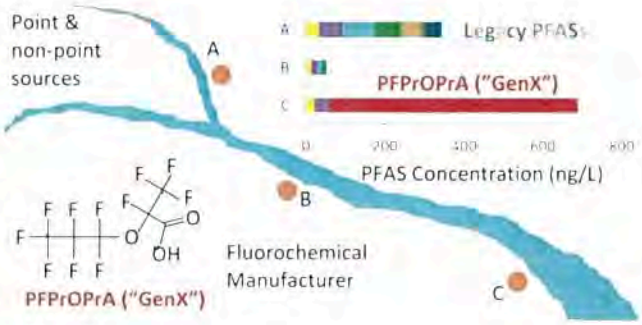
Supporting Information

ABSTRACT: Long-chain per- and polyfluoroalkyl substances (PFASs) are being replaced by short-chain PFASs and fluorinated alternatives. For ten legacy PFASs and seven recently discovered perfluoroalkyl ether carboxylic acids (PFECAs), we report (1) their occurrence in the Cape Fear River (CFR) watershed, (2) their fate in water treatment processes, and (3) their adsorbability on powdered activated carbon (PAC). In the headwater region of the CFR basin, PFECAs were not detected in raw water of a drinking water treatment plant (DWTP), but concentrations of legacy PFASs were high. The U.S. Environmental Protection Agency's lifetime health advisory level (70 ng/L) for perfluorooctanesulfonic acid and perfluorooctanoic acid (PFOA) was exceeded on 57 of 127 sampling days. In raw water of a DWTP downstream of a PFAS manufacturer, the mean concentration of perfluoro-2-propoxypropanoic acid (PFPrOPrA), a replacement for PFOA, was 631 ng/L ($n = 37$). Six other PFECAs were detected, with three exhibiting chromatographic peak areas up to 15 times that of PFPrOPrA. At this DWTP, PFECA removal by coagulation, ozonation, biofiltration, and disinfection was negligible. The adsorbability of PFASs on PAC increased with increasing chain length. Replacing one CF_2 group with an ether oxygen decreased the affinity of PFASs for PAC, while replacing additional CF_2 groups did not lead to further affinity changes.



INTRODUCTION

Per- and polyfluoroalkyl substances (PFASs) are extensively used in the production of plastics, water/stain repellents, firefighting foams, and food-contact paper coatings. The widespread occurrence of PFASs in drinking water sources is closely related to the presence of sources such as industrial sites, military fire training areas, civilian airports, and wastewater treatment plants.[1] Until 2000, long-chain perfluoroalkyl sulfonic acids [$C_nF_{2n+1}SO_3H$; $n \geq 6$ (PFSAs)] and perfluoroalkyl carboxylic acids [$C_nF_{2n+1}COOH$; $n \geq 7$ (PFCAs)] were predominantly used.[2] Accumulating evidence about the ecological persistence and human health effects associated with exposure to long-chain PFASs[3,4] has led to an increased level of regulatory attention. Recently, the U.S. Environmental Protection Agency (USEPA) established a lifetime health advisory level (HAL) of 70 ng/L for the sum of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) concentrations in drinking water.[5,6] Over the past decade, production of long-chain PFASs has declined in Europe and North America, and manufacturers are moving toward short-chain PFASs and fluorinated alternatives.[7−10] Some fluorinated alternatives were recently identified,[8,11] but others remain unknown[12−14] because they are either proprietary or manufacturing byproducts.

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One group of fluorinated alternatives, perfluoroalkyl ether carboxylic acids (PFECAs), was recently discovered in the Cape Fear River (CFR) downstream of a PFAS manufacturing facility.[11] Identified PFECAs included perfluoro-2-methoxyacetic acid (PFMOAA), perfluoro-3-methoxypropanoic acid (PFMOPrA), perfluoro-4-methoxybutanoic acid (PFMOBA), perfluoro-2-propoxypropanoic acid (PFPrOPrA), perfluoro(3,5-dioxahexanoic) acid (PFO2HxA), perfluoro(3,5,7-trioxaoctanoic) acid (PFO3OA), and perfluoro(3,5,7,9-tetraoxadecanoic) acid (PFO4DA) (Table S1 and Figure S1). The ammonium salt of PFPrOPrA is a known PFOA alternative[15] that has been produced since 2010 with the trade name "GenX". To the best of our knowledge, the only other published PFECA occurrence data are for PFPrOPrA in Europe and China,[15] and no published data about the fate of PFECAs during water treatment are available. Except for a few studies (most by the manufacturer),[16−20] little is known about the toxicity, pharmacokinetic behavior, or environmental fate and transport of PFECAs.

The strong C−F bond makes PFASs refractory to abiotic and biotic degradation,[21] and most water treatment processes are ineffective for legacy PFAS removal.[22−27] Processes capable of removing PFCAs and PFSAs include nanofiltration,[28] reverse osmosis,[25] ion exchange,[28,29] and activated carbon adsorption,[28,29] with activated carbon adsorption being the most widely employed treatment option.

The objectives of this research were (1) to identify and quantify the presence of legacy PFASs and emerging PFECAs in drinking water sources, (2) to assess PFAS removal by conventional and advanced processes in a full-scale drinking water treatment plant (DWTP), and (3) to evaluate the adsorbability of PFASs on powdered activated carbon (PAC).

MATERIALS AND METHODS

Water Samples. Source water of three DWTPs treating surface water in the CFR watershed was sampled between June 14 and December 2, 2013 (Figure S2). Samples were collected from the raw water tap at each DWTP daily as either 8 h composites (DWTP A, 127 samples) or 24 h composites (DWTP B, 73 samples; DWTP C, 34 samples). Samples were collected in 250 mL HDPE bottles and picked up (DWTPs A and B) or shipped overnight (DWTP C) on a weekly basis. All samples were stored at room temperature until they were analyzed (within 1 week of receipt). PFAS losses during storage were negligible on the basis of results of a 70 day holding study at room temperature. On August 18, 2014, grab samples were collected at DWTP C after each unit process in the treatment train [raw water ozonation, coagulation/flocculation/sedimentation, settled water ozonation, biological activated carbon (BAC) filtration, and disinfection by medium-pressure UV lamps and free chlorine]. Operational conditions of DWTP C on the sampling day are listed in Table S2. Samples were collected in 1 L HDPE bottles and stored at room temperature until they were analyzed. On the same day, grab samples of CFR water were collected in six 20 L HDPE carboys at William O. Huske Lock and Dam downstream of a PFAS manufacturing site and stored at 4 °C until use in PAC adsorption experiments (background water matrix characteristics listed in Table S3).

Adsorption Experiments. Adsorption of PFASs by PAC was studied in batch reactors (amber glass bottles, 0.45 L of CFR water). PFECA adsorption was studied at ambient concentrations (~1000 ng/L PFPrOPrA, chromatographic peak areas of other PFECAs being approximately 10−800% of the PFPrOPrA area). Legacy PFASs were present at low concentrations (<40 ng/L) and spiked into CFR water at ~1000 ng/L each. Data from spiked and nonspiked experiments showed that the added legacy PFASs and methanol (1 ppm$_v$) from the primary stock solution did not affect native PFECA removal. A thermally activated, wood-based PAC (PicaHydro MP23, PICA USA, Columbus, OH; mean diameter of 12 μm, BET surface area of 1460 m^2/g)[30] proven to be effective for PFAS removal in a prior study[29] was used at doses of 30, 60, and 100 mg/L. These doses represent the upper feasible end for drinking water treatment. Samples were taken prior to and periodically after PAC addition for PFAS analysis. PFAS losses in PAC-free blanks were negligible.

PFAS Analysis. Information about analytical standards and liquid chromatography−tandem mass spectrometry (LC−MS/MS) methods for PFAS quantification is provided in the Supporting Information.

RESULTS AND DISCUSSION

Occurrence of PFASs in Drinking Water Sources. Mean PFAS concentrations in source water of three DWTPs treating surface water from the CFR watershed are shown in Figure 1.

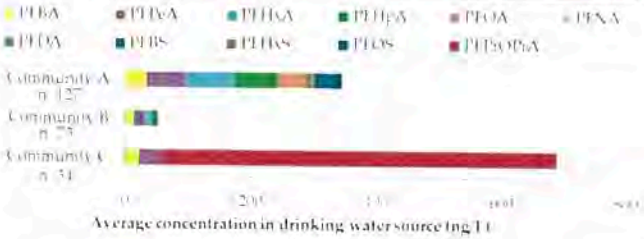

Figure 1. Occurrence of PFASs at drinking water intakes in the CFR watershed. Concentrations represent averages of samples collected between June and December 2013. Individual samples with concentrations below the quantitation limits (QLs) were considered as 0 when calculating averages, and average concentrations below the QLs were not plotted.

In communities A and B, only legacy PFASs were detected (mean $\sum$PFAS of 355 ng/L in community A and 62 ng/L in community B). Detailed concentration data are shown in Table S6 and Figure S3. In community A, PFCAs with four to eight total carbons, perfluorohexanesulfonic acid (PFHxS), and PFOS were detected at mean concentrations above the quantitation limits (QLs). During the 127 day sampling campaign, the sum concentration of PFOA and PFOS exceeded the USEPA HAL of 70 ng/L on 57 days. The mean sum concentration of PFOA and PFOS over the entire study period was 90 ng/L, with approximately equal contributions from PFOS (44 ng/L) and PFOA (46 ng/L). Maximum PFOS and PFOA concentrations were 346 and 137 ng/L, respectively. Similar PFOS and PFOA concentrations were observed in the same area in 2006,[31] suggesting that PFAS source(s) upstream of community A have continued negative impacts on drinking water quality. Also, our data show that legacy PFASs remain as surface water contaminants of concern even though their production was recently phased out in the United States. It is important to note, however, that among the PFCAs that were measured in both 2006 and 2013 (PFHxA to PFDA), the PFCA speciation shifted from long-chain (~80−85% $C_nF_{2n+1}COOH$; n = 7−9) in 2006 to short-chain (76% $C_nF_{2n+1}COOH$; n = 5−6) in 2013. In contrast, the PFSA speciation was dominated by PFOS in both 2006 and 2013.

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Relating total PFAS concentration to average daily streamflow (Figure S4) illustrated a general trend of low PFAS concentrations at high flow, and high concentrations at low flow, consistent with the hypothesis of one or more upstream point sources.

In community B, perfluorobutanoic acid (PFBA) and perfluoropentanoic acid (PFPeA) were most frequently detected with mean concentrations of 12 and 19 ng/L, respectively. Mean PFOA and PFOS concentrations were below the QLs, and the maximum sum concentration of PFOA and PFOS was 59 ng/L. Lower PFAS concentrations in community B relative to community A can be explained by the absence of substantive PFAS sources between the two communities, dilution by tributaries, and the buffering effect of Jordan Lake, a large reservoir located between communities A and B.

In community C (downstream of a PFAS manufacturing site), only mean concentrations of PFBA and PFPeA were above the QLs. The relatively low concentrations of legacy PFASs in the finished drinking water of community C are consistent with results from the USEPA's third unregulated contaminant monitoring rule for this DWTP.[32] However, high concentrations of PFPrOPrA were detected (up to ~4500 ng/L). The average PFPrOPrA concentration (631 ng/L) was approximately 8 times the average summed PFCA and PFSA concentrations (79 ng/L). Other PFECAs had not yet been identified at the time of analysis. Similar to communities A and B, the highest PFAS concentrations for community C were also observed at low flow (Figure S4). Stream flow data were used in conjunction with PFPrOPrA concentration data to determine PFPrOPrA mass fluxes at the intake of DWTP C. Daily PFPrOPrA mass fluxes ranged from 0.6 to 24 kg/day with a mean of 5.9 kg/day.

Fate of PFASs in Conventional and Advanced Water Treatment Processes. To investigate whether PFASs can be removed from impacted source water, samples from DWTP C were collected at the intake and after each treatment step. Results in Figure 2 suggest conventional and advanced treatment processes (coagulation/flocculation/sedimentation, raw and settled water ozonation, BAC filtration, and disinfection by medium-pressure UV lamps and free chlorine) did not remove legacy PFASs, consistent with previous studies.[22−26] The data further illustrate that no measurable PFECA removal occurred in this DWTP. Concentrations of some PFCAs, PFSAs, PFMOPrA, PFPrOPrA, and PFMOAA may have increased after ozonation, possibly because of the oxidation of precursor compounds.[25] Disinfection with medium-pressure UV lamps and free chlorine (located between the BAC effluent and the finished water) may have decreased concentrations of PFMOAA, PFMOPrA, PFMOBA, and PFPrOPrA, but only to a limited extent. Small concentration changes between treatment processes may also be related to temporal changes in source water PFAS concentrations that occurred in the time frame corresponding to the hydraulic residence time of the DWTP.

Results in Figure 2 further illustrate that the PFAS signature of the August 2014 samples was similar to the mean PFAS signature observed during the 2013 sampling campaigns shown in Figure 1; i.e., PFPrOPrA concentrations (400−500 ng/L) greatly exceeded legacy PFAS concentrations. Moreover, three PFECAs (PFMOAA, PFO2HxA, and PFO3OA) exhibited peak areas 2−113 times greater than that of PFPrOPrA (Figure 2b).

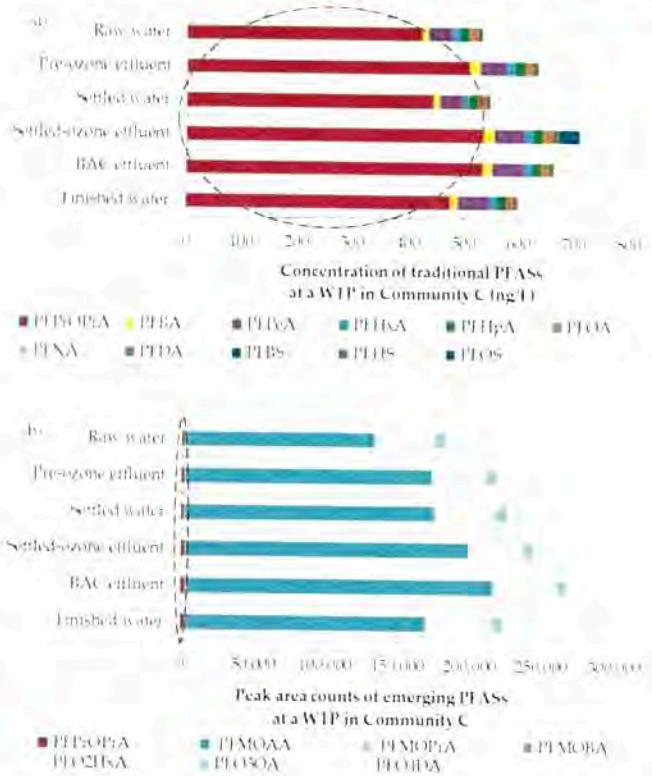

Figure 2. Fate of (a) legacy PFASs and PFPrOPrA and (b) PFECAs through a full-scale water treatment plant. Because authentic standards were not available for PFECAs other than PFPrOPrA, chromatographic peak area counts are shown in panel b. PFPrOPrA data are shown in both panels and highlighted with dashed ovals for reference. Compounds with concentrations below the QLs were not plotted.

The existence of high levels of emerging PFASs suggests a need for their incorporation into routine monitoring.

Adsorption of PFASs by PAC. PAC can effectively remove long-chain PFCAs and PFSAs, but its effectiveness decreases with decreasing PFAS chain length.[24,25,29] It is unclear, however, how the presence of ether group(s) in PFECAs impacts adsorbability. After a contact time of 1 h, a PAC dose of 100 mg/L achieved >80% removal of legacy PFCAs with total carbon chain lengths of ≥7. At the same PAC dose, removals were 95% for PFO4DA and 54% for PFO3OA, but <40% for other PFECAs. Detailed removal percentage data as a function of PAC contact time are shown in Figure S5. There was no meaningful removal of PFMOBA or PFMOPrA, and the variability shown in Figure S5 is most likely associated with analytical variability. PFMOAA could not be quantified by the analytical method used for these experiments; however, on the basis of the observations that PFAS adsorption decreases with decreasing carbon chain length and that PFECAs with one or two more carbon atoms than PFMOAA (i.e., PFMOPrA and PFMOBA) exhibited negligible removal (Figure 3), it is expected that PFMOAA adsorption is also negligible under the tested conditions.

To compare the affinity of different PFASs for PAC, PFAS removal percentages were plotted as a function of PFAS chain length [the sum of carbon (including branched), ether oxygen, and sulfur atoms] (Figure 3b). The adsorbability of both legacy and emerging PFASs increased with increasing chain length. PFSAs were more readily removed than PFCAs of matching chain length, a result that agrees with those of previous

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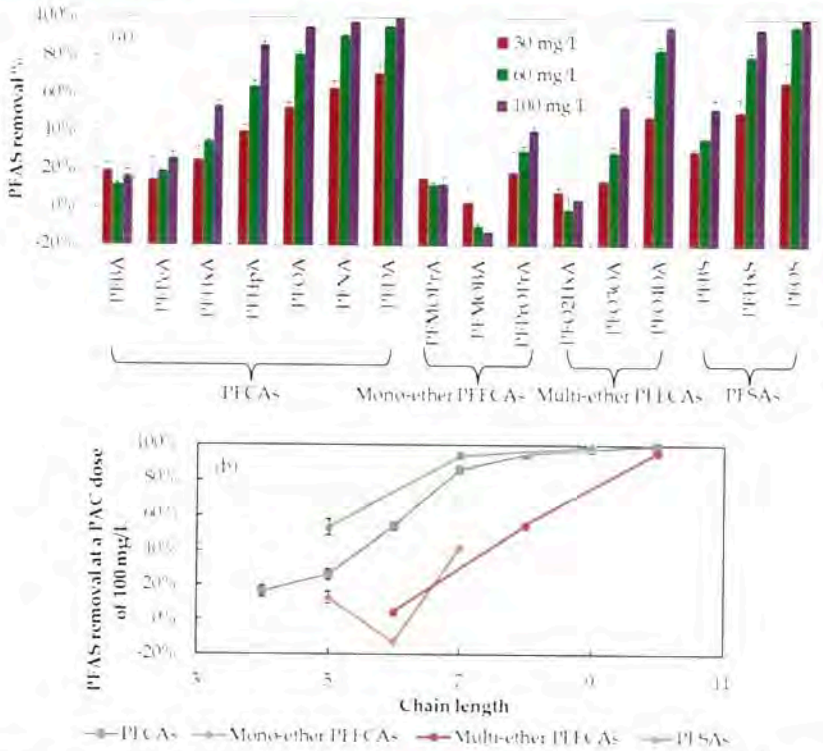

Figure 3. PFAS adsorption on PAC (a) at carbon doses of 30, 60, and 100 mg/L and (b) as a function of PFAS chain length. The PAC contact time in CFR water was 1 h. Legacy PFASs were spiked at ~1000 ng/L, and the emerging PFASs were at ambient concentrations. Figures show average PFAS removal percentages, and error bars show one standard deviation of replicate experiments.

studies.[24,25,29] PFECAs exhibited adsorbabilities lower than those of PFCAs of the same chain length (e.g., PFMOBA < PFHxA), suggesting that the replacement of a CF_2 group with an ether oxygen atom decreases the affinity of PFASs for PAC. However, the replacement of additional CF_2 groups with ether groups resulted in small or negligible affinity changes among the studied PFECAs (e.g., PFMOBA ~ PFO2HxA, PFPrOPrA ~ PFO3OA). Alternatively, if only the number of perfluorinated carbons were considered as a basis of comparing adsorbability, the interpretation would be different. In that case, with the same number of perfluorinated carbons, PFCAs have an affinity for PAC higher than that of monoether PFECAs (e.g., PFPeA > PFMOBA) but an affinity lower than that of multi-ether PFECAs (e.g., PFPeA < PFO3OA).

To the best of our knowledge, this is the first paper reporting the behavior of recently identified PFECAs in water treatment processes. We show that PFECAs dominated the PFAS signature in a drinking water source downstream of a fluorochemical manufacturer and that PFECA removal by many conventional and advanced treatment processes was negligible. Our adsorption data further show that PFPrOPrA ("GenX") is less adsorbable than PFOA, which it is replacing. Thus, PFPrOPrA presents a greater drinking water treatment challenge than PFOA does. The detection of potentially high levels of PFECAs, the continued presence of high levels of legacy PFASs, and the difficulty of effectively removing legacy PFASs and PFECAs with many water treatment processes suggest the need for broader discharge control and contaminant monitoring.

■ ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available free of charge on the ACS Publications website at DOI: 10.1021/acs.estlett.6b00398.

Six tables, five figures, information about PFASs, analytical methods, and detailed results (PDF)

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Notes

The views expressed in this article are those of the authors and do not necessarily represent the views or policies of the USEPA.

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Supporting information

Legacy and Emerging Perfluoroalkyl Substances Are Important Drinking Water Contaminants in the Cape Fear River Watershed of North Carolina

Supporting information includes analytical method description, 6 tables, and 5 figures.

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Analytical standards: PFASs studied in this research are listed in Table S1. For legacy PFASs, native and isotopically labeled standards were purchased from Wellington Laboratories (Guelph, Ontario, Canada). Native PFPrOPrA was purchased from Thermo Fisher Scientific (Waltham, MA). No analytical standards were available for other PFECAs.

PFAS quantification: PFAS concentrations in samples from DWTPs and adsorption tests were determined by liquid chromatography tandem mass spectrometry (LC-MS/MS) using a large-volume (0.9 mL) direct injection method. An Agilent 1100 Series LC pump and PE Sciex API 3000 LC-MS/MS system equipped with a 4.6 mm x 50 mm HPLC column (Kinetex C18 5μm 100Å, Phenomenex Inc.) was used for PFAS analysis. The eluent gradient is shown in Table S4 in SI. All samples, calibration standards, and quality control samples were spiked with isotopically labeled internal standards, filtered through 0.45-μm glass microfiber syringe filters, and analyzed in duplicate. The MS transitions for PFAS analytes and internal standards are shown in Table S5 in SI. The quantitation limit (QL) was 25 ng/L for PFOS and perfluorodecanoic acid, and 10 ng/L for other legacy PFASs and PFPrOPrA. The QL was defined as the first point of the standard curve, for which the regression equation yielded a calculated value within ±30% error. For PFECAs without analytical standards, chromatographic peak areas are reported.

PFAS concentrations along the treatment train of DWTP C were analyzed using a Waters Acquity ultra performance liquid chromatograph interfaced with a Waters Quattro Premier XE triple quadrupole mass spectrometer (Waters, Milford, MA, USA) after solid phase extraction. Method details are described elsewhere.[1] The QL for all PFASs with analytical standards was 0.2 ng/L, and peak areas were recorded for PFECAs without standards.

Table S1. Perfluoroalkyl substances (PFASs) detected in the Cape Fear River (CFR) watershed

Compound	Molecular weight	Formula	CAS #	# of perfluorinated carbons	Chain length (including all C, O and S)
Perfluorocarboxylic acids (PFCAs)					
Perfluorobutanoic acid (PFBA)	214.0	$C_4HF_7O_2$	375-22-4	3	4
Perfluoropentanoic acid (PFPeA)	264.0	$C_5HF_9O_2$	2706-90-3	4	5
Perfluorohexanoic acid (PFHxA)	314.1	$C_6HF_{11}O_2$	307-24-4	5	6
Perfluoroheptanoic acid (PFHpA)	364.1	$C_7HF_{13}O_2$	375-85-9	6	7
Perfluorooctanoic acid (PFOA)	414.1	$C_8HF_{15}O_2$	335-67-1	7	8
Perfluorononanoic acid (PFNA)	464.1	$C_9HF_{17}O_2$	375-95-1	8	9
Perfluorodecanoic acid (PFDA)	514.1	$C_{10}HF_{19}O_2$	335-76-2	9	10
Perfluorosulfonic acids (PFSAs)					
Perfluorobutane sulfonic acid (PFBS)	300.1	$C_4HF_9SO_3$	375-73-5	4	5
Perfluorohexane sulfonic acid (PFHxS)	400.1	$C_6HF_{13}SO_3$	355-46-4	6	7
Perfluorooctane sulfonic acid (PFOS)	500.1	$C_8HF_{17}SO_3$	1763-23-1	8	9
Perfluoroalkyl ether carboxylic acids with one ether group (mono-ether PFECAs)					
Perfluoro-2-methoxyacetic acid (PFMOAA)	180.0	$C_3HF_5O_3$	674-13-5	2	4
Perfluoro-3-methoxypropanoic acid (PFMOPrA)	230.0	$C_4HF_7O_3$	377-73-1	3	5
Perfluoro-4-methoxybutanoic acid (PFMOBA)	280.0	$C_5HF_9O_3$	863090-89-5	4	6
Perfluoro-2-propoxypropanoic acid (PFPrOPrA)	330.1	$C_6HF_{11}O_3$	13252-13-6	5	7
Perfluoroalkyl ether carboxylic acids with multiple ether group (multi-ether PFECAs)					
Perfluoro(3,5-dioxahexanoic) acid (PFO2HxA)	246.0	$C_4HF_7O_4$	39492-88-1	3	6
Perfluoro(3,5,7-trioxaoctanoic) acid (PFO3OA)	312.0	$C_5HF_9O_5$	39492-89-2	4	8
Perfluoro(3,5,7,9-tetraoxadecanoic) acid (PFO4DA)	378.1	$C_6HF_{11}O_6$	39492-90-5	5	10

Table S2. Operational conditions of DWTP C on sampling day (August 18, 2014)

Parameter	Value
Raw water ozone dose	3.1 mg/L
Raw water total organic carbon concentration	6.0 mg/L
Aluminum sulfate coagulant dose	43 mg/L
Coagulation pH	5.70
Settled water ozone dose	1.3 mg/L
Settled water total organic carbon concentration	1.90 mg/L
Empty bed contact time in biological activated carbon filters	9.4 minutes for granular activated carbon layer 2.3 minutes for sand layer
Medium pressure UV dose	25 mJ/cm^2
Free chlorine dose	1.26 mg/L as Cl_2
Free chlorine contact time	17.2 hours

Table S3. Water quality characteristics of surface water used in adsorption tests

Non-purgeable organic carbon (mg/L)	Ultraviolet absorbance at a wavelength of 254 nm	pH	Alkalinity (mg/L as $CaCO_3$)	Conductivity (μS/cm)
9.036	0.399	7.53	19	133.5

Table S4. LC gradient method for PFAS analysis

Time (min)	Mobile Phase A% (v/v)	Mobile Phase B%	Flow Rate (mL/min)
0 – 2	95	5	0.9
2 – 5	95	5	0.9
5 – 10	95 → 10	5 → 90	0.9
10 – 10.1	10	90	0.9
10.1 – 14	10 → 95	90 → 5	0.9

Mobile phase A: 2 mM ammonium acetate in ultrapure water with 5% methanol

Mobile phase B: 2 mM ammonium acetate in acetonitrile with 5% ultrapure water

Table S5. MS transitions for PFAS Analysis

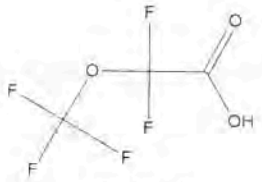
	Compound	MS/MS Transition	Internal standard
Legacy PFASs	PFBA	212.8 → 168.8	13C4-PFBA
	PFPeA	262.9 → 218.8	13C2- PFHxA
	PFHxA	313.6 → 268.8	13C2- PFHxA
	PFHpA	362.9 → 318.8	13C4- PFOA
	PFOA	413.0 → 368.8	13C4- PFOA
	PFNA	463.0 → 418.8	13C4- PFOA
	PFDA	513.1 → 68.8	13C2-PFDA
	PFBS	299.1 → 98.8	18O2-PFHxS
	PFHxS	399.1 → 98.8	18O2-PFHxS
	PFOS	498.9 → 98.8	13C4-PFOS
PFECAs	PFMOAA	180.0 → 85.0	N/A
	PFMOPrA	229.1 → 184.9	N/A
	PFMOBA	279.0 → 234.8	N/A
	PFPrOPrA	329.0 → 284.7	13C2- PFHxA
	PFO2HxA	245.1 → 85.0	N/A
	PFO3OA	311. → 84.9	N/A
	PFO4DA	377.1 → 85.0	N/A
Internal standards	Perfluoro-n-[1,2,3,4-$^{13}C_4$]butanoic acid (13C4-PFBA)	217.0 → 172	Not applicable
	Perfluoro-n-[1,2-$^{13}C_2$]hexanoic acid (13C2-PFHxA)	315.1 → 269.8	
	Perfluoro-n-[1,2,3,4-$^{13}C_2$]octanoic acid (13C4-PFOA)	417.0 → 372.0	
	Perfluoro-n-[1,2-$^{13}C_2$]decanoic acid (13C2-PFDA)	515.1 → 469.8	
	Sodium perfluoro-1-hexane[$^{18}O_2$]sulfonate (18O2-PFHxS)	403.1 → 83.8	
	Sodium perfluoro-1-[1,2,3,4-$^{13}C_4$]octane sulfonate (13C4-PFOS)	502.9 → 79.9	

Table S6. Maximum, minimum, mean and median concentrations (ng/L) of PFASs at three drinking water intakes. *

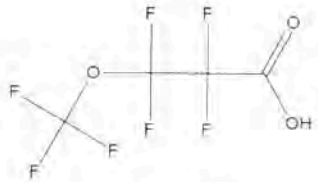
	Community A				Community B				Community C			
	max	min	median	mean	max	min	median	mean	max	min	median	mean
PFBA	99	<10	26	33	38	<10	12	12	104	<10	12	22
PFPeA	191	14	44	62	38	<10	19	19	116	<10	30	36
PFHxA	318	<10	48	78	42	<10	<10	11	24	<10	<10	<10
PFHpA	324	<10	39	67	85	<10	<10	11	24	<10	<10	<10
PFOA	137	<10	34	46	32	<10	<10	<10	17	<10	<10	<10
PFNA	38	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PFDA	35	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
PFBS	80	<10	<10	<10	11	<10	<10	<10	<10	<10	<10	<10
PFHxS	193	<10	10	14	14	<10	<10	<10	14	<10	<10	<10
PFOS	346	<25	29	44	43	<25	<25	<25	40	<25	<25	<25
PFPrOPrA	<10	<10	<10	<10	10	<10	<10	<10	4560	55	304	631
PFOA+PFOS	447	0	64	90	59	0	0	9	55	<10	<10	<10
∑ PFASs**	1502	18	212	355	189	0	47	62	4696	55	345	710

* Concentrations less than quantitation limits were considered as zero to calculate means and ∑ PFASs.

** Other PFECAs were present in water samples from community C but could not be quantified and were therefore not included in ∑ PFASs



PFMOAA



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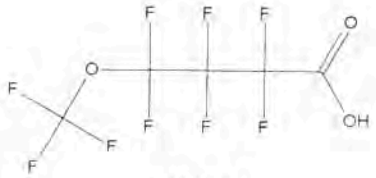

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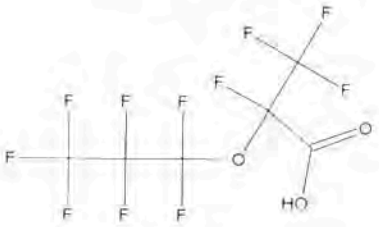

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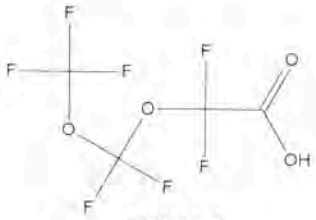

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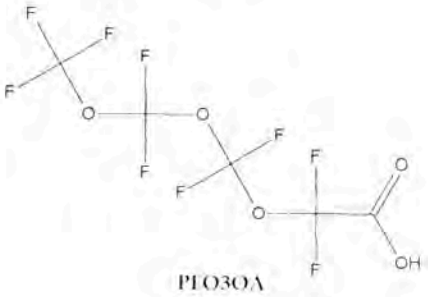

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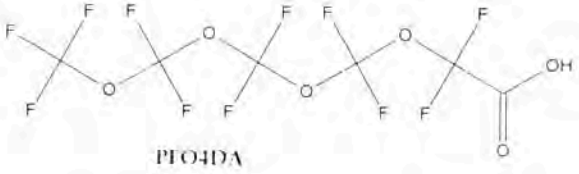
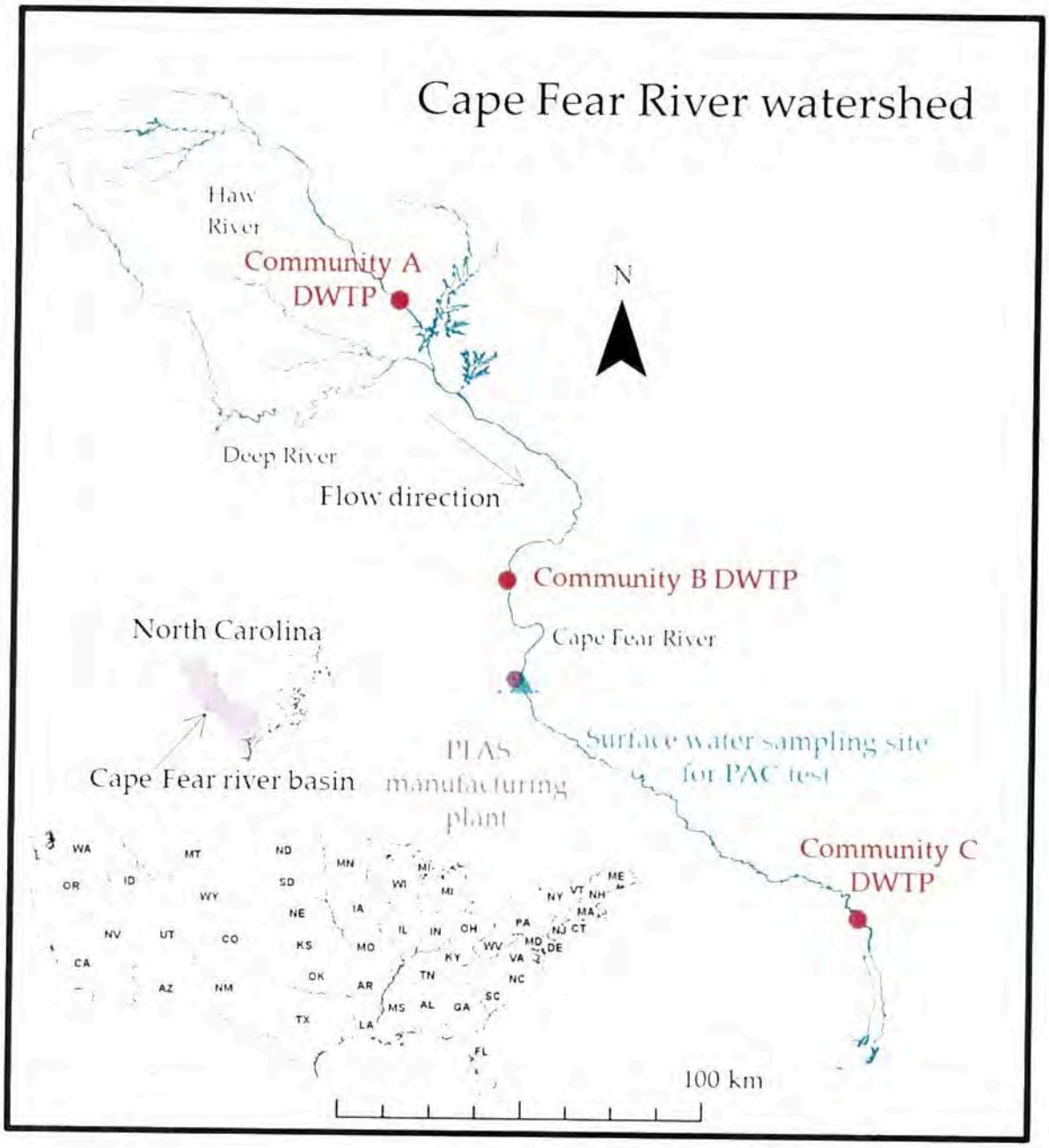


PFO4DA

Figure S1. Molecular structures of PFECAs evaluated in this study



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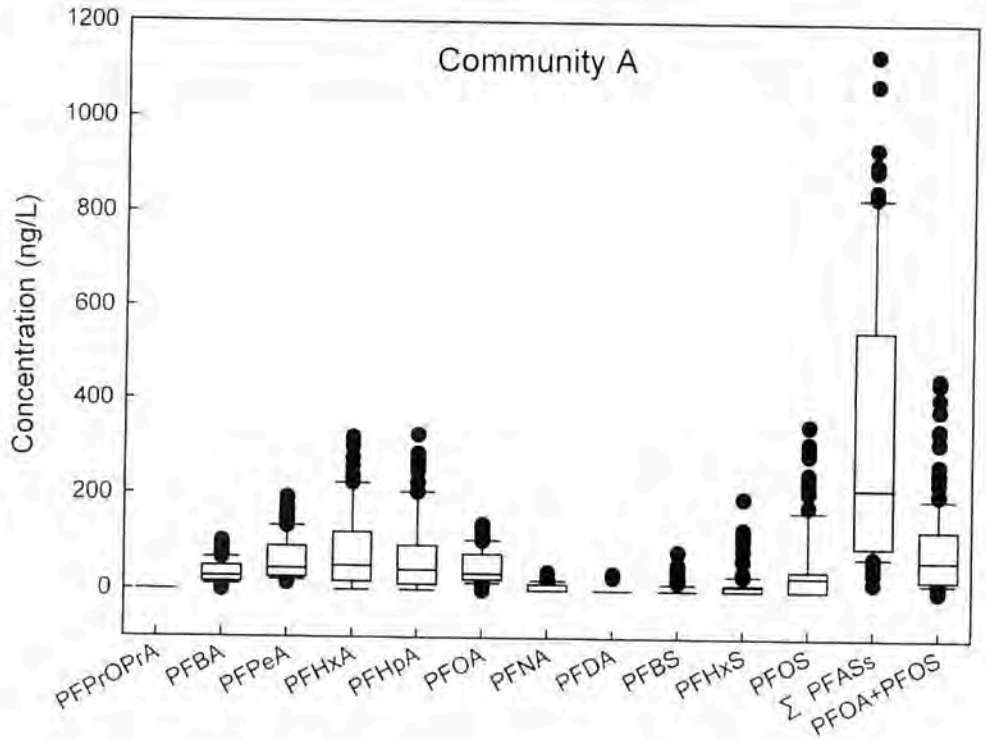
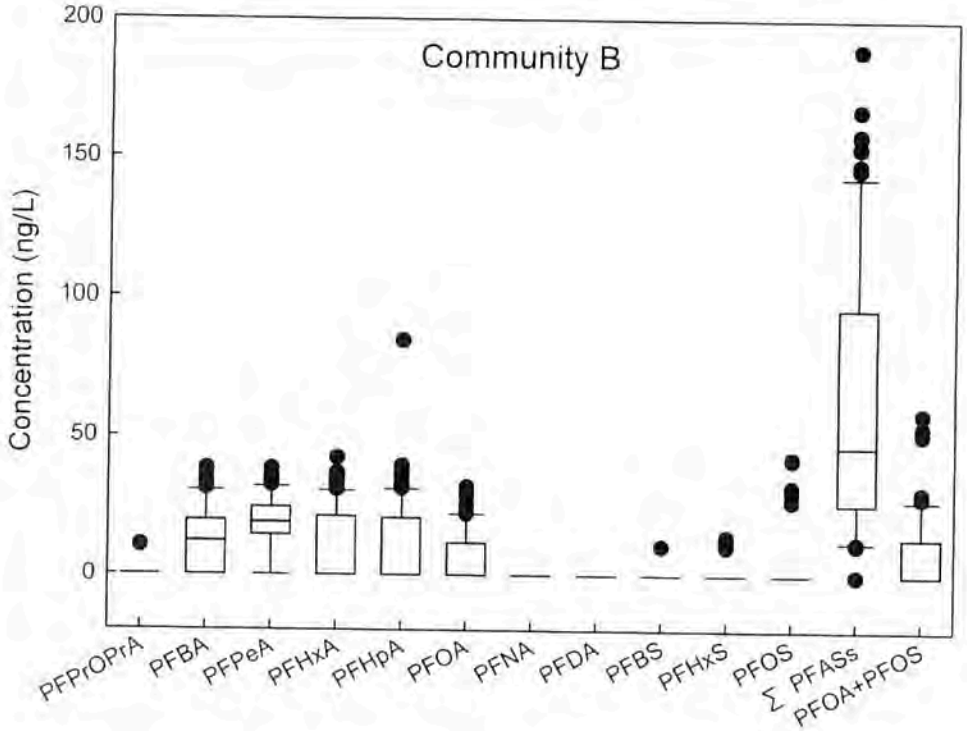

Community A
Concentration (ng/L)
1200
1000
800
600
400
200
0
PFPrOPrA
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFBS
PFHxS
PFOS
∑ PFASs
PFOA+PFOS


Community B
Concentration (ng/L)
200
150
100
50
0
PFPrOPrA
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
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PFHxS
PFOS
∑ PFASs
PFOA+PFOS

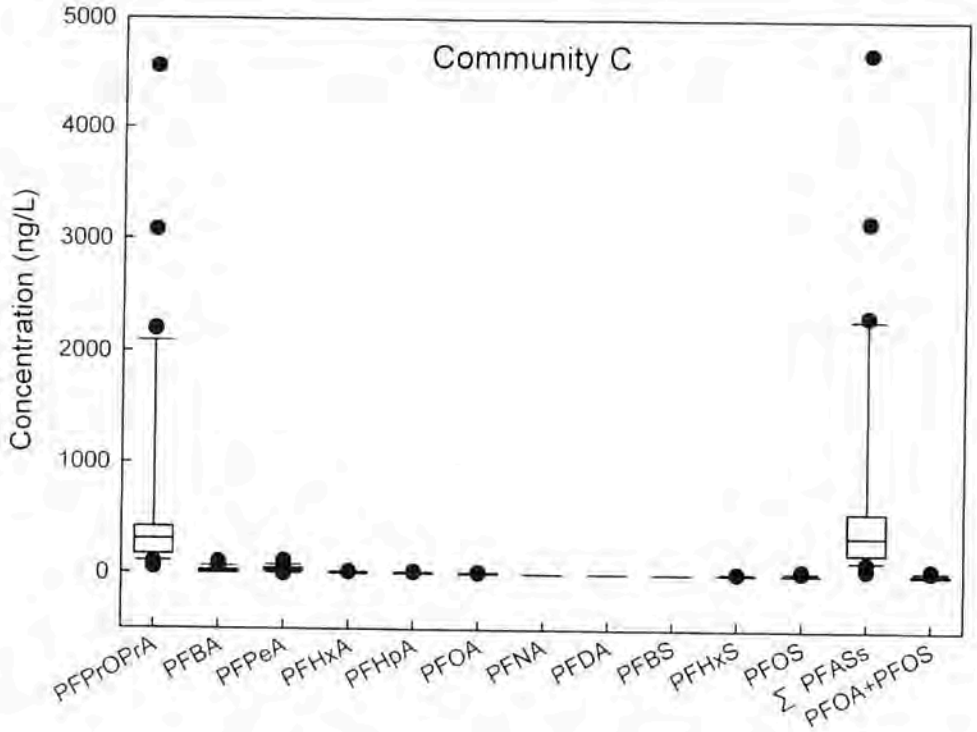

Figure S3. PFAS concentration distributions in the CFR watershed at three drinking water intakes. Concentrations less than quantitation limits were considered as zero. Upper and lower edges of a box represent the 75th and 25th percentile, respectively; the middle line represents the median; upper and lower bars represent the 90th and 10th percentile, respectively; and dots represent outliers (>90th or <10th percentile).

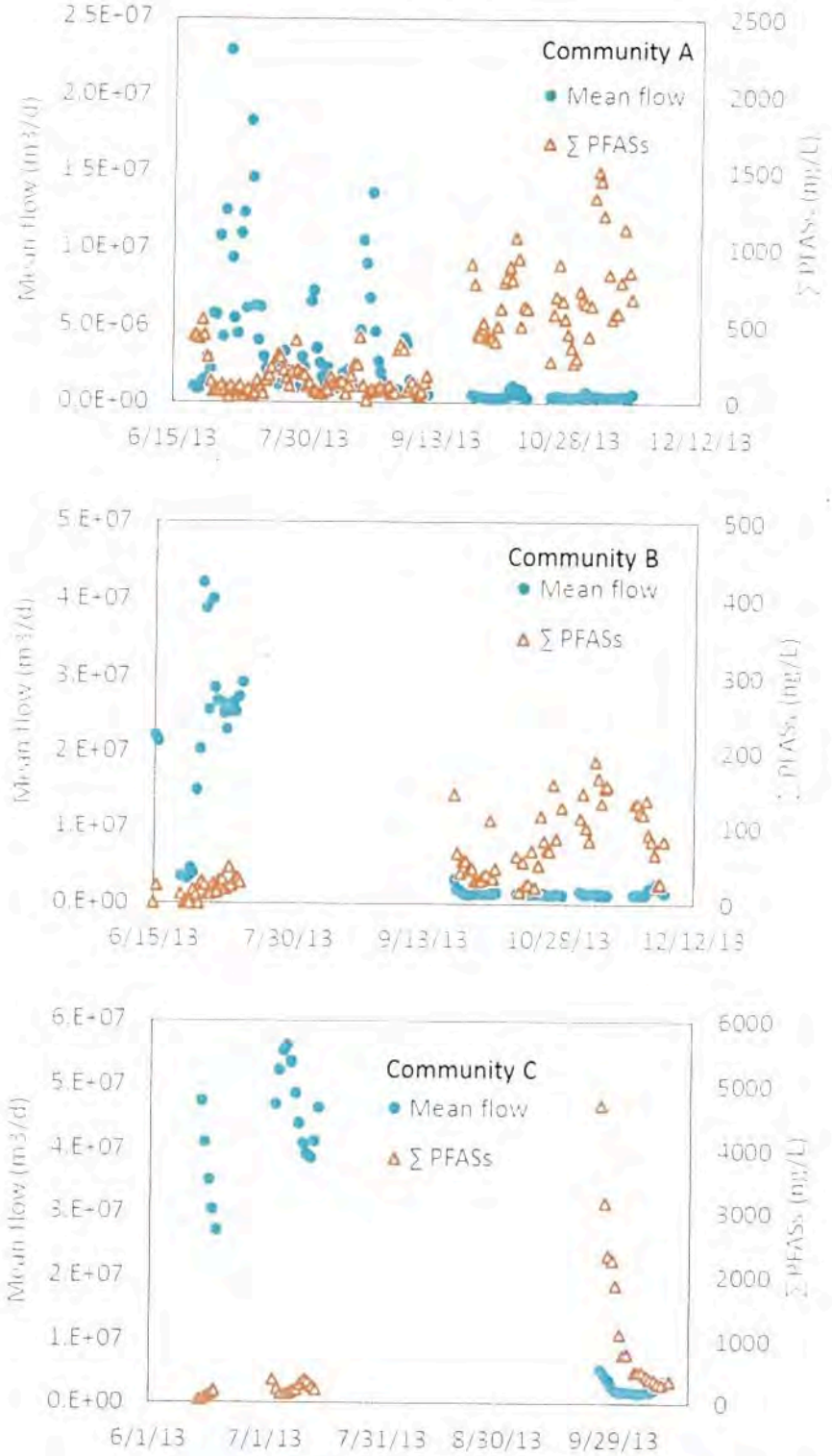

Figure S4. Total PFAS concentrations in the source water and stream flow at the three studied DWTPs. Stream flow data were acquired from US Geological Survey stream gage records

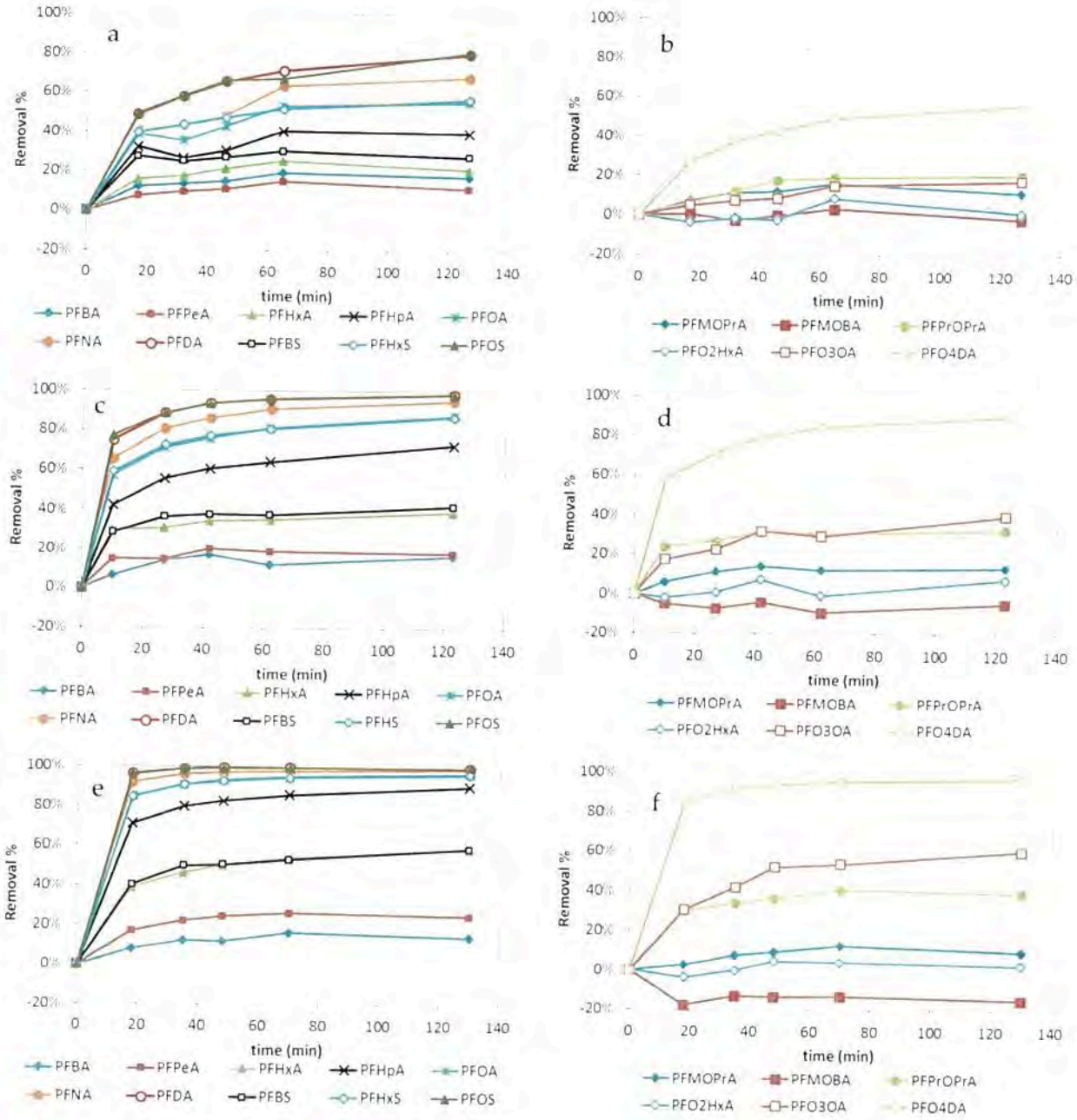

Figure S5. PFAS adsorption at powdered activated carbon doses of (a, b) 30 mg/L, (c, d) 60 mg/L and (e, f) 100 mg/L. Figures show average PFAS removal percentages of duplicate tests.

Reference

1. Nakayama, S.; Strynar, M. J.; Helfant, L.; Egeghy, P.; Ye, X.; Lindstrom, A. B., Perfluorinated compounds in the Cape Fear drainage basin in North Carolina. *Environ. Sci. Technol.* **2007,** *41*, (15), 5271-5276.

Supporting information

Legacy and Emerging Perfluoroalkyl Substances Are Important Drinking Water Contaminants in the Cape Fear River Watershed of North Carolina

Supporting information includes analytical method description, 6 tables, and 5 figures.

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Analytical standards: PFASs studied in this research are listed in Table S1. For legacy PFASs, native and isotopically labeled standards were purchased from Wellington Laboratories (Guelph, Ontario, Canada). Native PFPrOPrA was purchased from Thermo Fisher Scientific (Waltham, MA). No analytical standards were available for other PFECAs.

PFAS quantification: PFAS concentrations in samples from DWTPs and adsorption tests were determined by liquid chromatography tandem mass spectrometry (LC-MS/MS) using a large-volume (0.9 mL) direct injection method. An Agilent 1100 Series LC pump and PE Sciex API 3000 LC-MS/MS system equipped with a 4.6 mm x 50 mm HPLC column (Kinetex C18 5μm 100Å, Phenomenex Inc.) was used for PFAS analysis. The eluent gradient is shown in Table S4 in SI. All samples, calibration standards, and quality control samples were spiked with isotopically labeled internal standards, filtered through 0.45-μm glass microfiber syringe filters, and analyzed in duplicate. The MS transitions for PFAS analytes and internal standards are shown in Table S5 in SI. The quantitation limit (QL) was 25 ng/L for PFOS and perfluorodecanoic acid, and 10 ng/L for other legacy PFASs and PFPrOPrA. The QL was defined as the first point of the standard curve, for which the regression equation yielded a calculated value within ±30% error. For PFECAs without analytical standards, chromatographic peak areas are reported.

PFAS concentrations along the treatment train of DWTP C were analyzed using a Waters Acquity ultra performance liquid chromatograph interfaced with a Waters Quattro Premier XE triple quadrupole mass spectrometer (Waters, Milford, MA, USA) after solid phase extraction. Method details are described elsewhere.[1] The QL for all PFASs with analytical standards was 0.2 ng/L, and peak areas were recorded for PFECAs without standards.

Table S1. Perfluoroalkyl substances (PFASs) detected in the Cape Fear River (CFR) watershed

Compound	Molecular weight	Formula	CAS #	# of perfluorinated carbons	Chain length (including all C, O and S)
Perfluorocarboxylic acids (PFCAs)					
Perfluorobutanoic acid (PFBA)	214.0	$C_4HF_7O_2$	375-22-4	3	4
Perfluoropentanoic acid (PFPeA)	264.0	$C_5HF_9O_2$	2706-90-3	4	5
Perfluorohexanoic acid (PFHxA)	314.1	$C_6HF_{11}O_2$	307-24-4	5	6
Perfluoroheptanoic acid (PFHpA)	364.1	$C_7HF_{13}O_2$	375-85-9	6	7
Perfluorooctanoic acid (PFOA)	414.1	$C_8HF_{15}O_2$	335-67-1	7	8
Perfluorononanoic acid (PFNA)	464.1	$C_9HF_{17}O_2$	375-95-1	8	9
Perfluorodecanoic acid (PFDA)	514.1	$C_{10}HF_{19}O_2$	335-76-2	9	10
Perfluorosulfonic acids (PFSAs)					
Perfluorobutane sulfonic acid (PFBS)	300.1	$C_4HF_9SO_3$	375-73-5	4	5
Perfluorohexane sulfonic acid (PFHxS)	400.1	$C_6HF_{13}SO_3$	355-46-4	6	7
Perfluorooctane sulfonic acid (PFOS)	500.1	$C_8HF_{17}SO_3$	1763-23-1	8	9
Perfluoroalkyl ether carboxylic acids with one ether group (mono-ether PFECAs)					
Perfluoro-2-methoxyacetic acid (PFMOAA)	180.0	$C_3HF_5O_3$	674-13-5	2	4
Perfluoro-3-methoxypropanoic acid (PFMOPrA)	230.0	$C_4HF_7O_3$	377-73-1	3	5
Perfluoro-4-methoxybutanoic acid (PFMOBA)	280.0	$C_5HF_9O_3$	863090-89-5	4	6
Perfluoro-2-propoxypropanoic acid (PFPrOPrA)	330.1	$C_6HF_{11}O_3$	13252-13-6	5	7
Perfluoroalkyl ether carboxylic acids with multiple ether group (multi-ether PFECAs)					
Perfluoro(3,5-dioxahexanoic) acid (PFO2HxA)	246.0	$C_4HF_7O_4$	39492-88-1	3	6
Perfluoro(3,5,7-trioxaoctanoic) acid (PFO3OA)	312.0	$C_5HF_9O_5$	39492-89-2	4	8
Perfluoro(3,5,7,9-tetraoxadecanoic) acid (PFO4DA)	378.1	$C_6HF_{11}O_6$	39492-90-5	5	10

Table S2. Operational conditions of DWTP C on sampling day (August 18, 2014)

Parameter	Value
Raw water ozone dose	3.1 mg/L
Raw water total organic carbon concentration	6.0 mg/L
Aluminum sulfate coagulant dose	43 mg/L
Coagulation pH	5.70
Settled water ozone dose	1.3 mg/L
Settled water total organic carbon concentration	1.90 mg/L
Empty bed contact time in biological activated carbon filters	9.4 minutes for granular activated carbon layer 2.3 minutes for sand layer
Medium pressure UV dose	25 mJ/cm^2
Free chlorine dose	1.26 mg/L as Cl_2
Free chlorine contact time	17.2 hours

Table S3. Water quality characteristics of surface water used in adsorption tests

Non-purgeable organic carbon (mg/L)	Ultraviolet absorbance at a wavelength of 254 nm	pH	Alkalinity (mg/L as $CaCO_3$)	Conductivity (μS/cm)
9.036	0.399	7.53	19	133.5

Table S4. LC gradient method for PFAS analysis

Time (min)	Mobile Phase A% (v/v)	Mobile Phase B%	Flow Rate (mL/min)
0 – 2	95	5	0.9
2 – 5	95	5	0.9
5 – 10	95 → 10	5 → 90	0.9
10 – 10.1	10	90	0.9
10.1 – 14	10 → 95	90 → 5	0.9

Mobile phase A: 2 mM ammonium acetate in ultrapure water with 5% methanol

Mobile phase B: 2 mM ammonium acetate in acetonitrile with 5% ultrapure water

Table S5. MS transitions for PFAS Analysis

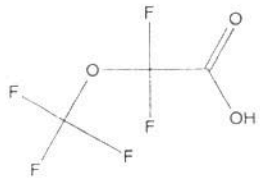
	Compound	MS/MS Transition	Internal standard
Legacy PFASs	PFBA	212.8 → 168.8	13C4-PFBA
	PFPeA	262.9 → 218.8	13C2- PFHxA
	PFHxA	313.6 → 268.8	13C2- PFHxA
	PFHpA	362.9 → 318.8	13C4- PFOA
	PFOA	413.0 → 368.8	13C4- PFOA
	PFNA	463.0 → 418.8	13C4- PFOA
	PFDA	513.1 → 68.8	13C2-PFDA
	PFBS	299.1 → 98.8	18O2-PFHxS
	PFHxS	399.1 → 98.8	18O2-PFHxS
	PFOS	498.9 → 98.8	13C4-PFOS
PFECAs	PFMOAA	180.0 → 85.0	N/A
	PFMOPrA	229.1 → 184.9	N/A
	PFMOBA	279.0 → 234.8	N/A
	PFPrOPrA	329.0 → 284.7	13C2- PFHxA
	PFO2HxA	245.1 → 85.0	N/A
	PFO3OA	311. → 84.9	N/A
	PFO4DA	377.1 → 85.0	N/A
Internal standards	Perfluoro-n-[1,2,3,4-$^{13}C_4$]butanoic acid (13C4-PFBA)	217.0 → 172	Not applicable
	Perfluoro-n-[1,2-$^{13}C_2$]hexanoic acid (13C2-PFHxA)	315.1 → 269.8	
	Perfluoro-n-[1,2,3,4-$^{13}C_2$]octanoic acid (13C4-PFOA)	417.0 → 372.0	
	Perfluoro-n-[1,2-$^{13}C_2$]decanoic acid (13C2-PFDA)	515.1 → 469.8	
	Sodium perfluoro-1-hexane[$^{18}O_2$]sulfonate (18O2-PFHxS)	403.1 → 83.8	
	Sodium perfluoro-1-[1,2,3,4-$^{13}C_4$]octane sulfonate (13C4-PFOS)	502.9 → 79.9	

Table S6. Maximum, minimum, mean and median concentrations (ng/L) of PFASs at three drinking water intakes. *

	Community A				Community B				Community C			
	max	min	median	mean	max	min	median	mean	max	min	median	mean
PFBA	99	<10	26	33	38	<10	12	12	104	<10	12	22
PFPeA	191	14	44	62	38	<10	19	19	116	<10	30	36
PFHxA	318	<10	48	78	42	<10	<10	11	24	<10	<10	<10
PFHpA	324	<10	39	67	85	<10	<10	11	24	<10	<10	<10
PFOA	137	<10	34	46	32	<10	<10	<10	17	<10	<10	<10
PFNA	38	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
PFDA	35	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25
PFBS	80	<10	<10	<10	11	<10	<10	<10	<10	<10	<10	<10
PFHxS	193	<10	10	14	14	<10	<10	<10	14	<10	<10	<10
PFOS	346	<25	29	44	43	<25	<25	<25	40	<25	<25	<25
PFPrOPrA	<10	<10	<10	<10	10	<10	<10	<10	4560	55	304	631
PFOA+PFOS	447	0	64	90	59	0	0	9	55	<10	<10	<10
∑ PFASs**	1502	18	212	355	189	0	47	62	4696	55	345	710

* Concentrations less than quantitation limits were considered as zero to calculate means and ∑ PFASs.

** Other PFECAs were present in water samples from community C but could not be quantified and were therefore not included in ∑ PFASs



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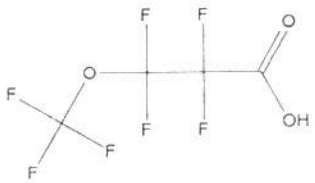

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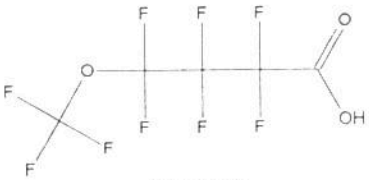

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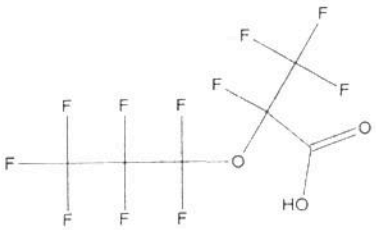

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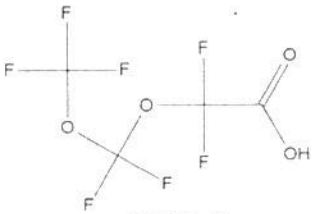

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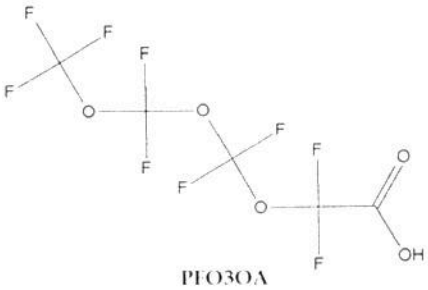

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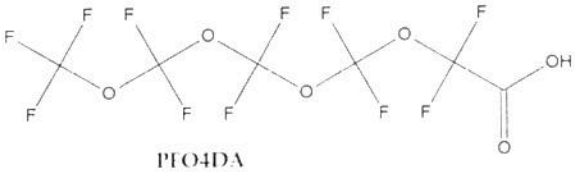

PFO4DA

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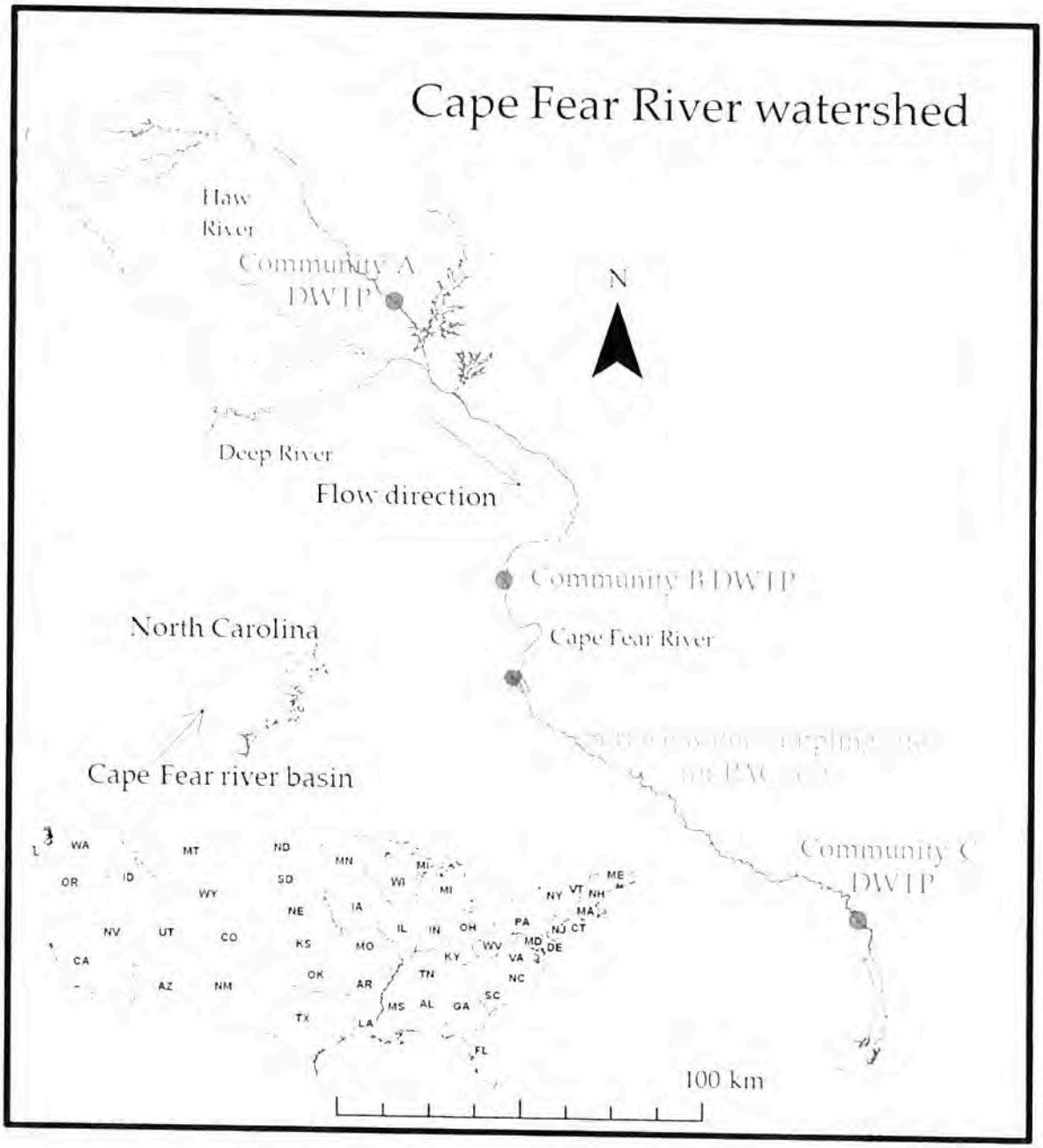

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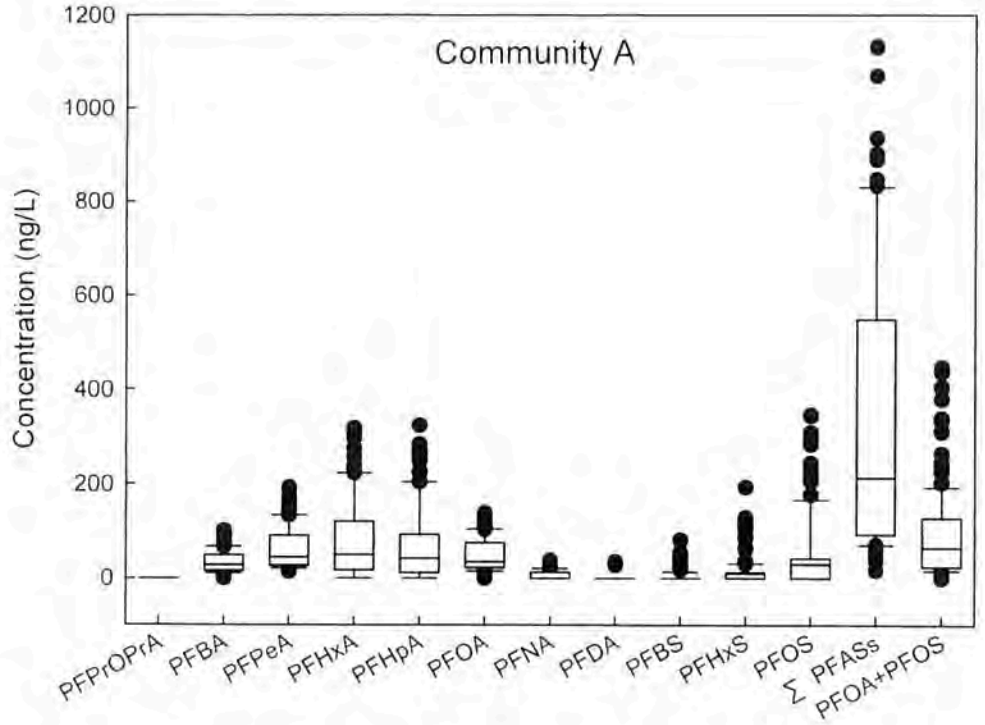
Community A
Concentration (ng/L)
1200
1000
800
600
400
200
0
PFPrOPrA
PFBA
PFPeA
PFHxA
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PFNA
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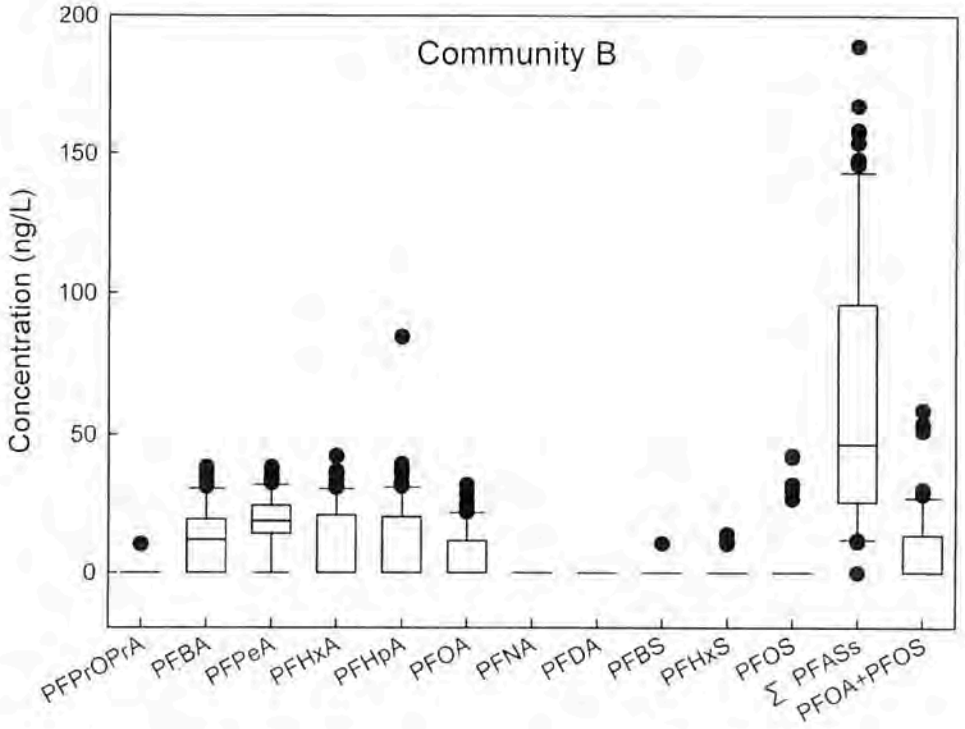
Community B
Concentration (ng/L)
200
150
100
50
0
PFPrOPrA
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
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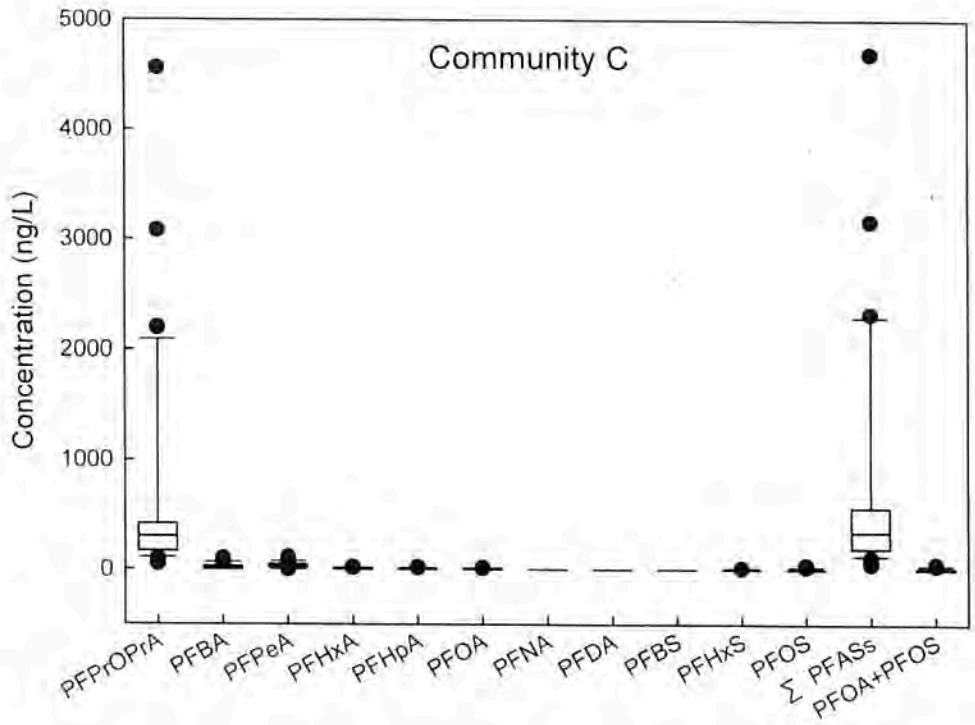
PFOS
∑ PFASs
PFOA+PFOS



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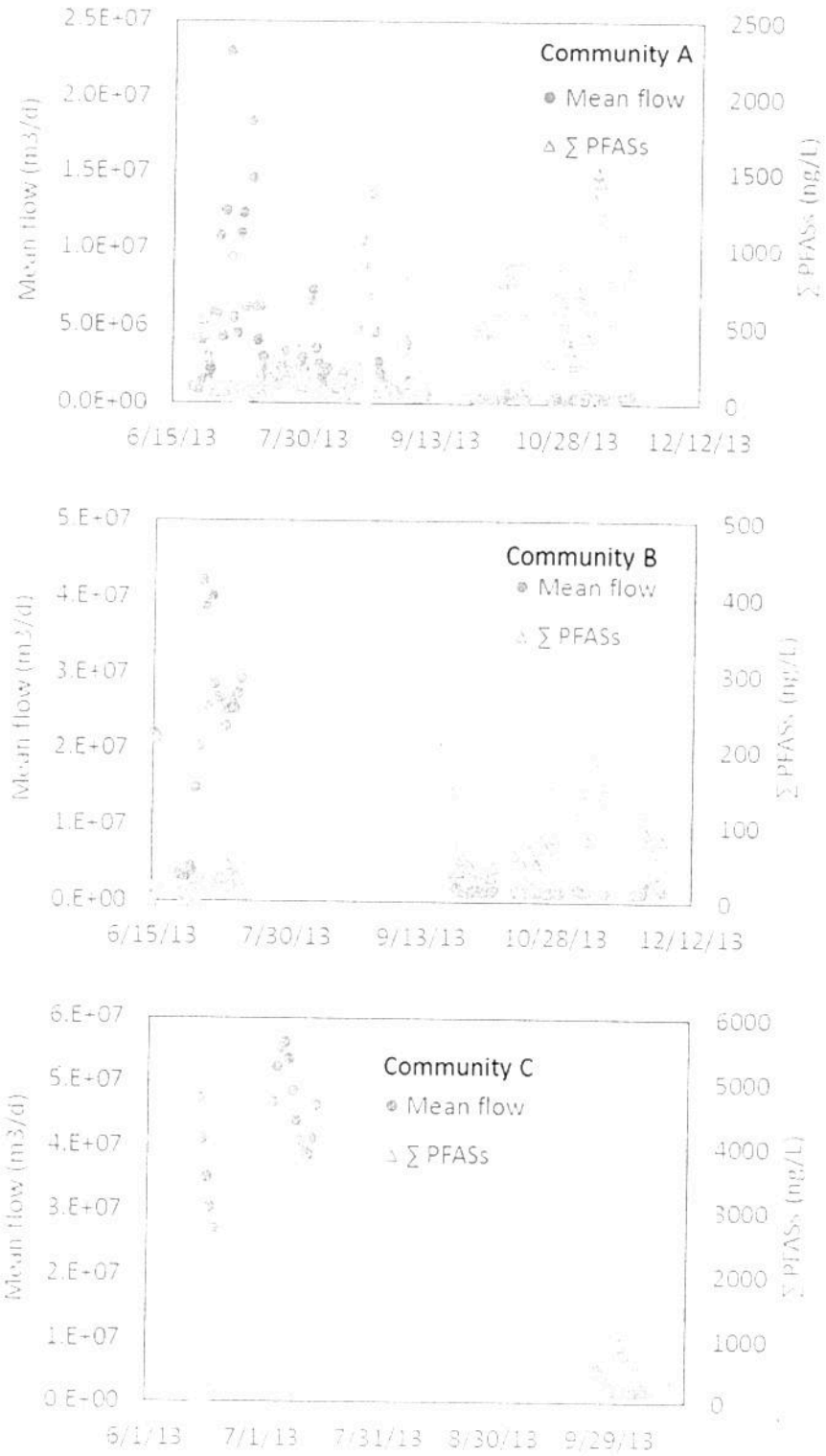

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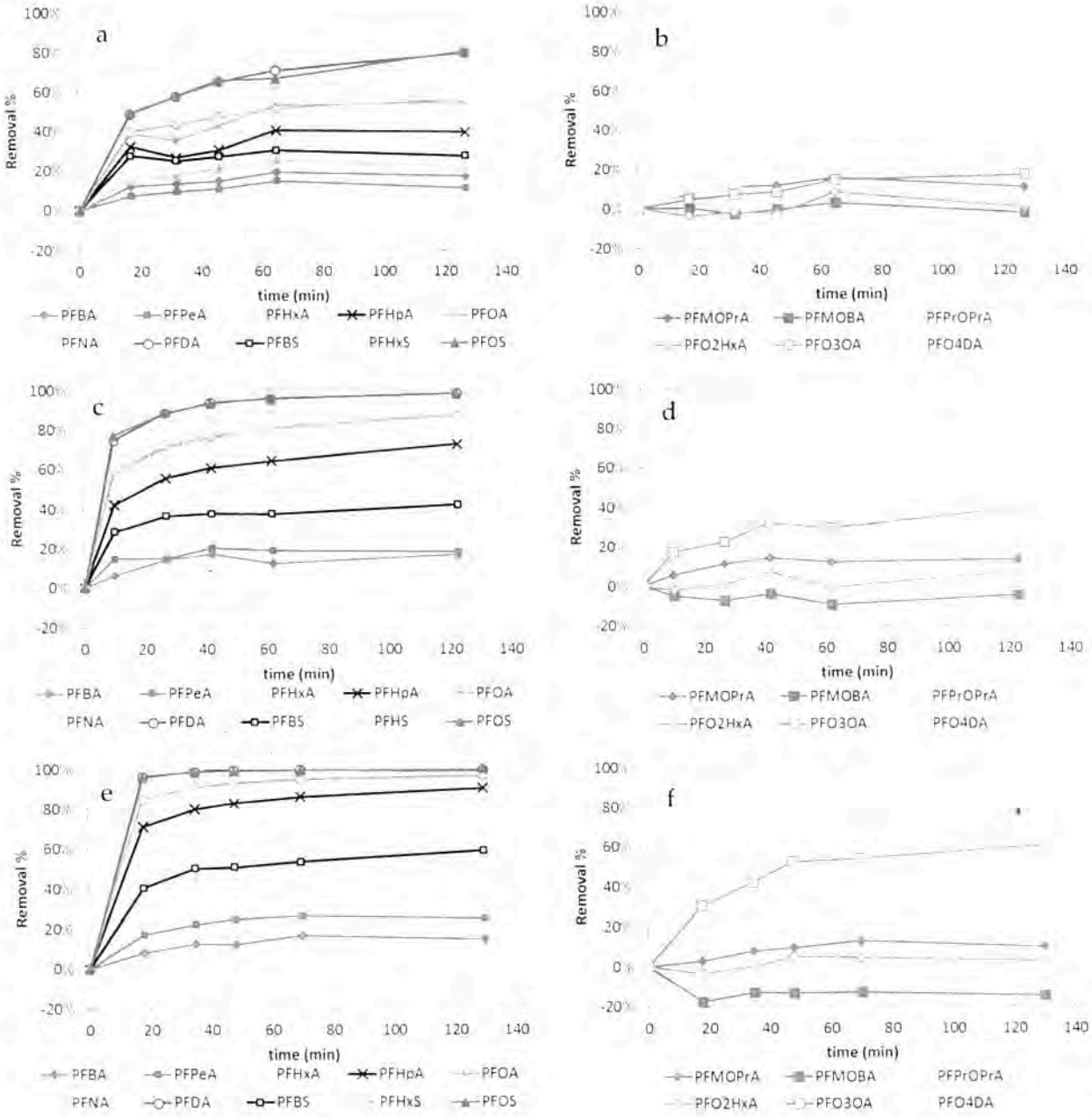

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State releases first water quality data, updated health information for GenX in Cape Fear River

Treated drinking water concentrations trending down; latest levels below updated health risk threshold

Raleigh NC

Jul 14, 2017

State officials today released their first results of water quality samples and an updated preliminary health assessment for concentrations of the unregulated compound GenX in finished, or treated, drinking water.

The revised health goal for exposure to GenX in drinking water is 140 nanograms per liter (also referred to as parts per trillion).

Samples were analyzed at the U.S. Environmental Protection Agency lab in Research Triangle Park and at Test America, a lab in Colorado under contract to Chemours.

Data from samples collected June 19 and July 6 show that the most recent results of finished, or treated, water in all but one facility were below the N.C. Department of Health and Human Services' health goal of 140 parts per trillion. The data also reveal that concentrations of GenX are trending downward.

Although no information is available about recreational health risks, people should refrain from swimming near the Chemours facility.

"Our goal is to protect the safety and health of all North Carolinians," said Mandy Cohen, secretary of the N.C. Department of Health and Human Services. "We are working closely with our partners at the Department of Environmental Quality to understand and communicate information in a timely manner, to help those impacted."

N.C. Department of Environmental Quality Secretary Michael Regan said:

Safe drinking water is a top priority for this administration, and DEQ takes seriously its responsibility to protect the health and welfare of the public. We will continue to investigate this issue and make new information available to the public in a timely fashion."

The findings reflect water quality data from samples collected at 13 sites in the Fayetteville and Wilmington areas between June 19 -July 6. Results show higher concentrations near the point where Chemours' Fayetteville manufacturing facility was discharging GenX into the Cape Fear River, and much lower concentrations at the public water supply systems near the facility and 70 miles downstream in the Wilmington area.

The N.C. Department of Health and Human Services released an initial preliminary health risk assessment on June 8 for GenX in the Cape Fear River. Based on continuing analysis of health data and consultation with the Environmental Protection Agency, the N.C. Department of Health and Human Services today updated its initial preliminary health assessment for GenX, the unregulated chemical compound recently identified in the lower Cape Fear River.

This updated health goal of 140 parts per trillion is expected to be the most conservative and health protective for non-cancer effects in bottle-fed infants, pregnant women, lactating women, children and adults. This health goal is lower than the health goal in the initial preliminary health assessment. This changes reflect information from new data. Detailed information regarding the initial and revised assessments are posted online at: https://ncdenr.s3.amazonaws.com/s3fs-public/GenX/NC%20DHHS%20Risk%20Assessment%20FAQ%20Final%20Clean%20071417%20PM.pdf .

Lower second week values reflect reduced exposure to GenX when, at the urging of state, local officials and concerned citizens, Chemours on June 21 began diverting wastewater containing the contaminant into storage tanks to be shipped out of state for incineration. DEQ inspected the Chemours site again this week after the company indicated that data it had collected was higher than what it would have expected to see after the June 21 wastewater diversion had started. DEQ inspectors confirmed this week that Chemours stopped the additional discharges of GenX into the river and is collecting them for removal and incineration.

The following data table reflects partial results of concentrations of GenX after the water had been treated by public water systems.

Gen X Concentration in Finished Water

Location	06/22/2017 results ppt	06/29/2017 res ılts ppt	07/06/2017 results ppt

	Test America, CO	EPA RTP, NC	Test America, CO	EPA RTP, NC	Test America	EPA RTP, NC
International Paper Finished	690	523	140	111	N/A	80
NW Brunswick Water Treatment Plant (WTP) Finished	910	695	51	52	N/A	125
Pender Co. 421 WTP Finished	340	269	160	112	N/A	68
CFPUA Sweeney Finished	1100	726	110	100	N/A	87

Gen X Concentration in Finished Water

Location	06/19/2017 results ppt	06/26/2017 results ppt
	Test America, CO	Test America, CO
Bladen Bluffs Finished	790	76

Early results from all 13 test sites can be found on the N.C. Department of Environmental Quality's GenX website: https://ncdenr.maps.arcgis.com/apps/webappviewer/index.html?id=0ce5c1795dee402686675956865d5790 . A document showing the results in a spreadsheet is at: https://www.ncwater.org/basins/Cape_Fear/GenXDataspreadsheet.pdf .

Additional water sample testing and analysis are underway with results to be shared once analysis is completed.

The state's preliminary health goal was developed in consultation with EPA and the Centers for Disease Control and Prevention. Ongoing discussions will apply guidance from leading federal researchers of emerging contaminants to help state officials provide the public with the best information available on potential health risks

posed by GenX.

Officials have been collecting water samples at multiple locations in the Fayetteville and Wilmington areas each week since June 19 and will continue sampling until at least late July. DEQ officials have extended the state's sampling regimen from three-to-six weeks to provide a more comprehensive understanding of GenX concentrations in the lower Cape Fear River.

For further information, please contact Chris Mackey, with the N.C. Department of Health and Human Services, at 919-855-4840 or 919-441-3577, or Jamie Kritzer, with the N.C. Department of Environmental Quality at 919-707-8602 or 919-218-5935.

This press release is related to:

NCDEQ (/news/press-releases?field_agency_department_tid=642&field_agency_department_tid_op=or)

NCDENR (/news/press-releases)

Contact Information

Jamie.Kritzer
jamie.kritzer@ncdenr.gov (mailto:jamie.kritzer@ncdenr.gov)
919-707-8602

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↑

HFPO-DA (GenX) Analysis June - July 2017

Fayetteville Location	06/19/2017 results ppt		06/26/2017 results ppt		07/03/2017 results ppt		07/12/2017 results ppt		7/17/2017		7/24/2017		QA Comments[1, 2, 3]
	Test America	EPA RTP, NC	Test America	EPA RTP, NC	Test America	EPA RTP, NC	Test America	EPA RTP, NC	Test America	EPA RTP, NC	Test America	EPA RTP, NC	
Hoffer WTP Raw	N/A	N/A	N/A	N/A		4							**EPA 7/03**: Below Limit of Quantiation (LOQ) of 10 ppt
Chemours outfall 002	39000	21760	19000	15250		21530							**TestAmerica 6/19:** 50X dilution, DUPs 41000 and 36000 [13% RPD], SURR RECs 45 and 48%, MS DNR, IS Low for DUP and MS **EPA 6/19**: 20X dilution **TestAmerica 6/26:** 50X dilution, DUPs 18000 and 21000 [15.4% RPD], MS DNR **EPA 6/26:** 20X dilution **EPA 7/03**: 20X dilution
Bladen Bluffs Raw	570	501	36	31		168							**EPA 6/19:** 5X dilution **TestAmerica 6/26:** SURR REC 33%, IS Low
Bladen Bluffs Raw Duplicate	590		33										
Bladen Bluffs Finished	790		76										**TestAmerica 6/19:** 2X dilution, SURR REC 14%, IS Low
Smithfield Foods Well Field	<10		<10										**TestAmerica 6/19**: SURR REC 9%, IS Low
Chemours Field Blank	<10		<10										

Wilmington Location	06/22/2017 results ppt		06/29/2017 results ppt		07/06/2017 results ppt		7/13/2017 results ppt		7/20/2017		7/27/2107		QA Comments[1, 2, 3]
	Test America	EPA RTP, NC	Test America	EPA RTP, NC	Test America	EPA RTP, NC	Test America	EPA RTP, NC	Test America	EPA RTP, NC	Test America	EPA RTP, NC	
International Paper Raw	810	703	73	41		158							**TestAmerica 6/22:** DUPs 810 and 810 (0%RPD], MS 101% **EPA 6/22:** 5X dilution **TestAmerica 6/29**: SURR REC 20%, IS Low
International Paper Raw DUP						162							
International Paper Finished	690	523	140	111		80							**TestAmerica 6/22:** SURR REC 45%, IS Low **EPA 6/22**: 5X dilution **TestAmerica 6/29**: SURR REC 19%, IS Low
NW Brunswick WTP Finished	910	695	51	52		125							**EPA 6/22**: 5X dilution **TestAmerica 6/29:** SURR REC 24%, IS Low
Pender Co. 421 WTP Finished	340	269	160	112		68							**TestAmerica 6/22:** SURR REC 8%, IS Low **EPA 6/22:** 5X dilution **TestAmerica 6/29:** SURR REC 43%, IS Low
LCFWSA Raw	830	629	67	72		119							**TestAmerica 6/22:** IS Low **EPA 6/22:** 5X dilution **TestAmerica 6/29:** SURR REC 24%, IS Low
CFPUA Sweeney Finished	1100	726	110	100		87							**EPA 6/22:** 5X dilution **TestAmerica 6/29**: SURR REC 40%, IS Low
CFPUA – ASR Well	820	588	400	336		148							**EPA 6/22**: 5X dilution **TestAmerica 6/29:** SURR REC 25 %, MS 118% REC, IS Low **EPA 6/29:** 2X dilution
Wrightsville Beach Well No. 11	26	27	24	28		24							**TestAmerica 6/22**: DUPs 26 and 25 **TestAmerica 6/29**: SURR REC 34%, IS Low
International Paper Raw Site Blank	<10		N/A										
Wrightsville Beach Well No. 11 Blank	<10		N/A										
EPA Trip Spike High	N/A		270										**TestAmerica 6/29:** HNO3 preserved; adj w/10% NH_4OH, SURR REC 24%, IS Low, Spike nominal value 200 ppt, 135% REC
EPA Trip Spike Low	N/A		95										**TestAmerica 6/29:** HNO3 preserved; adj w/10% NH_4OH, SURR REC 23%, IS Low, Spike nominal value 70 ppt, 136% REC
EPA Trip Blank	N/A		<10										**TestAmerica 6/29:** HNO3 preserved; adj w/10% NH_4OH, SURR REC 9%, IS Low
Trip Blank 9	N/A		<10										

QA samples (Blanks, Duplicate & Spikes)

[1] The TestAmerica laboratory performs an isotope dilution methodology which employs internal standards which are arestable isotopically labeled analogs of the target analytes added to the sample prior to extraction. Physical and chemical properties of each labeled compound are virtually the same as its unlabeled native analog, thus any losses of the target compound that may occur during sample preparation or determinative steps will be mirrored by a similar loss of the labeled standard. A recovery correction is then applied to sample results.

[2] Except where noted the associated MB, low-level LCS, mid-level LCS/LCSD and MS recoveries were in control for TestAmerica data. QC data not yet reported for EPA.

[3] The internal standard/surrogate is added to samples prior to the extraction step.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

AUG 30 2018

CERTIFIED MAIL 7010 1060 0002 1703 8839
RETURN RECEIPT REQUESTED

Mr. Jay Zimmerman
Division Director
North Carolina Department of Environment and Natural Resources
1611 Mail Service Center
Raleigh, North Carolina 27699

Re: Overview Evaluation of the North Carolina Department of Environment and Natural Resources, Fayetteville Regional Office

Dear Mr. Zimmerman:

The purpose of this letter is to transmit the National Pollutant Discharge Elimination System (NPDES) Overview Evaluation of the North Carolina Department of Environment and Natural Resources, Fayetteville Regional Office, which was conducted by staff from Region 4 of the U.S. Environmental Protection Agency's Science and Ecosystem Support Division the week of June 25-28, 2018. The overall NPDES evaluation was determined to be satisfactory. A report documenting the overview evaluation is enclosed for your review.

If you should have any further questions, please contact Mr. Namon Mathews at (404) 562-9777 or via email at Mathews.Namon@epa.gov.

Sincerely,

David M. Apanian, P.E.
Acting Chief
Municipal and Industrial Enforcement Section
NPDES Permitting and Enforcement Branch

Enclosure

cc: Ms. Connie Wylie
North Carolina Department of Environment and Natural Resources

Project ID: 18-0507

Final Report

NPDES Program Overview Evaluation

North Carolina Department of Environmental Quality – Fayetteville Regional Office

225 Green Street, Suite 714
Fayetteville, NC 28301-5095

Project Date: June 25-28, 2018

Report Date: August 2nd, 2018

Science & Ecosystem Support Division

Project Leader: Cornell D. Gayle, PE
Enforcement Section
Field Services Branch
Science & Ecosystem Support Division
USEPA – Region 4
980 College Station Road
Athens, Georgia 30605-2720

The activities depicted in this report are accredited under the US EPA Region 4 Science and Ecosystem Support Division ISO/IEC 17025 accreditation issued by the ANSI-ASQ National Accreditation Board. Refer to certificate and scope of accreditation AT-1644.

Requestor:
Gracy Danois, Acting Chief
NPDES Permitting and Enforcement Branch
Water Protection Division
USEPA – Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303-8960

Approvals:
SESD Project Leader:

8/1/18

Cornell D Gayle, PE
Enforcement Section
Field Services Branch

Date

Approving Official:

8/7/2018

Mike Bowden, Chief
Enforcement Section
Field Services Branch

Date

State NPDES Overview Evaluation for the North Carolina Department of Environmental Quality (NCDEQ): Fayetteville Regional Office (FRO)

Introduction

During the week of June 25-28, 2018, the United States Environmental Protection Agency (USEPA) conducted a National Pollutant Discharge Elimination System (NPDES) overview of the North Carolina Department of Environmental Quality (NCDEQ) Fayetteville Regional Office (FRO). The overview was conducted to determine if the FRO was meeting their NPDES inspection requirements. The overview included the following:

- Interviewing office personnel responsible for scheduling, planning, and conducting NPDES inspections.
- Reviewing records regarding:
  - NPDES program personnel.
  - Personnel training and qualifications.
  - NPDES self-monitoring equipment.
  - Equipment maintenance and storage.
- Observing office personnel conducting an NPDES inspection.

Summary

The NPDES program was evaluated and found to be acceptable. Table 1 shows the inspections conducted as part of the overview.

Table 1: NCDEQ Lead NPDES Compliance Inspections

Inspection Type	Facility Name	Inspector
Compliance Sampling Inspection	Smithfield Farmland Corp (Tar Heel, NC / NC0078344)	Mark Brantley and Johnathan Watts
Compliance Evaluation Inspection	Town of Clarkton (Clarkton, NC / NC0021610)	Mark Brantley
Compliance Sampling Inspection	Chemours (Fayetteville, NC / NC0003573)	Johnathan Watts

The following comments are provided to enhance the overall NPDES inspection program.

Comments:

- The FRO inspectors demonstrated excellent communication skills explaining compliance issues with facility staff. The inspectors were familiar with the various aspects of the NPDES inspection requirements. Inspectors understood the importance for ensuring the quality and accuracy of analytical data obtained from the Compliance Evaluation Inspections.

- The FRO conducted Compliance Sampling Inspections (CSIs). However, most of these inspections were at Municipal facilities, using the facility's sampling equipment. The FRO should consider conducting a representative number of CSIs across all facility types (Industrial and Municipal), and using their own equipment. This will help verify that facilities are within permit limits, provide a cross-check of the facility's historical self-reported data, and provide a significant regulatory presence. Additionally, CSIs help to ensure that the inspectors maintain proficiency in the area of sampling, including the installation of automatic sampling equipment.

- The FRO should have facility personnel demonstrate the calibration and function of laboratory and field measurement equipment. The FRO should also have facility personnel demonstrate sampling procedures. When applicable, this would include having facility personnel demonstrate automatic sampler programing, operation, and aliquot volume. This is to ensure the 100mL aliquot minimum volume is being collected, a pre- and post-purge cycle occurs, and there is adequate sampler intake velocity of approximately 2ft/second.

- The FRO should consider purchasing additional automatic samplers and pH/DO/Conductivity meters for use in NPDES sampling inspections. Currently, there is one reliable sampler in the district. Should this one malfunction, or the need arise for multiple sampling events, duplicate samples, and general redundancy, the district does not have an additional sampler or components to complete the work.

- The FRO should consider using a designated bound logbook or checklist for each NPDES inspection or facility. Currently, staff use various individual methods for recording inspection findings. Unifying the recording process simplifies the discovery process in the event of litigation.

Regional Field Office Program

1. Staffing Review Workload

Table 2 shows the FRO's NPDES personnel, their positions, educational background, and their years of experience. The staff scheduled and conducted inspections on a timely basis in order to complete assignments. Table 3.1 below shows the workload conducted by the FRO during the FY2017 inspection year. Table 3.2 shows the workload conducted by the FRO during the FY2018 inspection year at the time of the overview evaluation. Included in the Industrial facility count are facilities which discharge Non-Contact cooling water only. Included in the Municipal facility count are water plant discharges. Bioassy Compliance Inspections are counted as Compliance Sampling Inspections. Other inspections not tabulated, but conducted by staff include Pre-Treatment Inspections and Groundwater Remediation Discharge Inspections.

2. Training

The initial training for the NPDES inspectors consisted of self-study, in-house, and on the job training activities. Included in training for new inspectors is the Basic Inspector Training for Conducting NPDES Compliance Inspections, when available. Six hours of continued education

is provided, annually for anyone who would like to attend. Trainees were encouraged to read the current NPDES Compliance Inspection Manual for additional information regarding sampling, records, and flow measurement requirements as part of their NPDES training in addition to any other changes in applicable laws.

Table 2: FRO NPDES Personnel

Personnel (Name)	Education (Degree)	Experience (Years)
Trent Allen	B.S. Civil Engineering Technology	23
Mark Brantley	B.S. Chemistry	14
Tony Honeycutt	B.S. Biology	14
Chad Turlington	B.S. Fish and Wildlife Management	14
Johnathan Watts	B.S. Environmental Management	2
Hughie White	B.S. Environmental Studies	19

Table 3.1: FRO Workload Activities: FY2017

Facility Type	Total Number of Facilities	CEI	CSI	% Complete of Total
Major Municipal	22	4	7	50
Minor Municipal	36	23	2	69
Major Industrial	6	3	0	50
Minor Industrial	16	12	0	75

Table 3.2: FRO Workload Activities: FY2018 through June 2018

Facility Type	Total Number of Facilities	CEI	CSI	% Complete of Total
Major Municipal	22	0	4	18
Minor Municipal	36	0	0	0
Major Industrial	6	0	1	17
Minor Industrial	16	3	0	19

3. Inspection Procedures

Generally, unannounced inspections were conducted for all NPDES inspections. The inspectors were familiar with all aspects of the NPDES inspection requirements. The inspections were conducted in a satisfactory manner. During the overview, both inspectors demonstrated excellent communications skills explaining the compliance issues with facility managers and process operators. The field monitoring equipment was calibrated in the field offices and rechecked prior to use in the field. Calibration records were kept in bound notebooks. Field notes were written in a variety of notebook types, and checklists. Inspection findings were identified during the walk-through and summarized at the end of the inspection. The compliance inspection procedures consisted of the following components:

- Opening Conference
- Walk-through
- Sampling Review
- Flow Measurement Review
- Closing Conference
- Reporting

4. NCDEQ Inspection Reports

The final reports were stated to generally be completed within 30 days after the initial inspection, pending sampling results. At the time of this report, the State Facility inspection reports have not been received. As a result, a review of the reports has not been conducted.

5. Sampling

In FY2017, several CSIs were completed. It is the FROs practice to conduct five CSIs per year. However, all the CSIs took place during municipal inspections. No industrial facilities were sampled in FY2017.

During the inspection FRO personnel were observed collecting samples. The sample collection method met the NPDES requirements. Samples were packed and preserved as required by state lab requirements. Samples are delivered to the appropriate laboratory (state or contract laboratory) with accompanying chain of custody.

6. NPDES Equipment

NPDES supplies, including monitoring equipment, sample containers, and preservatives. Not all devices were in working condition. Each inspector had access to a vehicle from the motor pool for conducting NPDES-related activities. The sampling staff coordinated equipment decontamination, cleaning and storage of instrumentation used in investigations amongst themselves.

Tables 4 shows the equipment used by the FRO for conducting NPDES sampling activities. Most of the FRO field equipment appeared to be in satisfactory condition.

Table 4: FRO Field Equipment

Equipment	Quantity	Model Number
Accumet pH meter	5	AP62 (needs servicing)
YSI DO meter	2	PRO ODO (needs servicing)
YSI pH/DO Conductivity	1	Signature
ISCO Autosampler	2	6712 with Flow Meter ISCO 710 Ultrasonic Meter attached (1 of 2 need servicing)

7. Work Area/Storage Space

The FRO office had adequate office work space for personnel, equipment, maintenance, cleaning, calibration, and storage. The approximate space available for calibration, maintenance, cleaning, and storage is 650 square feet.

North Carolina
Department of Environment and Natural Resources

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Matthews, Director

C. Palmer

NCDENR

5

ORIGINAL

July 17, 2003

Mr. Michael E. Johnson
Environmental Manager
E. I. Dupont
22828 NC Highway 87 W
Fayetteville, North Carolina 28306-7332

Re: RCRA Permit Class 1 Modification
Emergency Coordinator List Changes in Contingency Plan
EPA ID # NCD 047 368 642

Dear Mr. Johnson:

Your request for a permit modification received on July 9, 2003 to change the emergency coordinator information in the contingency plan has been processed as a class one (1) permit modification under 40 CFR 270.42 as adopted in 15A NCAC 13A .0113. To comply with 40 CFR 270.42 you must notify all persons on the enclosed mailing list with the exception of the State and EPA who have already been notified. Please replace the page G-2 of the Application with the enclosed revised pages G-2a and G-2b.

Approval of this modification is therefore granted and has been incorporated into your permit. If you have any questions, please contact Karim Pathan at (919) 733-2178 extension 228.

Sincerely,

for

Jill B. Pafford
Hazardous Waste Section

Enclosures

cc: Narindar Kumar, US EPA, Region 4
Alan Klimek, DWQ
Bobby Nelms

rc: Bud McCarty
Robert L. Glaser
Larry Stanley
Kathy Lawson
Karim Pathan

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facilities but applies to emergency situations in any operating facility on the plant site. As much as possible, the Contingency Plan described in the following sections has been condensed to present the organizational response if an emergency situation would develop in the hazardous waste facilities. If an emergency situation developed in another part of the plant, the basic response mechanisms would be the same but some personnel would be different - e.g. the Emergency Director would be the shift supervisor of the area involved.

G-2 Emergency Directors (Regulatory Emergency Coordinator)

Pursuant to 40 CFR 264.52(d), this Contingency Plan "must list names, addresses, and phone numbers (office and home) of all persons qualified to act as emergency coordinator, and this list must be kept up to date. Where more than one person is listed, one must be named as primary emergency coordinator and others must be listed in the order in which they will assume responsibility as alternates."

The DuPont – Fayetteville Works site is comprised of four shifts of workers, and at any given time one of those shifts is present at the site. This is true 24-hours per day, and includes weekends, holidays, and work outages. The site's Emergency Directors are defined as the two Nafion® Division first-line supervisors and the one Butacite® first-line supervisor for each of the four separate shifts. The primary Emergency Director is defined as the Nafion® Products Area first-line supervisor for each of the four separate shifts, and would direct the response to an emergency. However, if the emergency was in either the Nafion® Monomers Area or the Butacite® manufacturing area, then the first-line supervisor of the affected area would become the Emergency Director.

The Emergency Director is responsible for dealing with the emergency situation on the scene. If additional resources are needed, the off-duty management will be called in. However, the Emergency Director is in full charge of the emergency unless relieved and has complete authority to commit all necessary resources on the plant site to implement the contingency plan and call for assistance from off-plant emergency agencies. He/she has the authority of the Plant Manager throughout an emergency situation.

To comply with the requirement of 40 CFR 264.52(d), the following table lists the twelve (12) Emergency Directors of the DuPont – Fayetteville Works site:

DuPont – Fayetteville Works Emergency Directors			
Name	**Address**	**Office Phone**	**Home Phone**
Otis Evans	22828 NC Highway 87 W Fayetteville, NC 28306-7332	910-678-1653	910-863-4662
Ken McMillan (See Note 1)	22828 NC Highway 87 W Fayetteville, NC 28306-7332	910-678-1616	910-486-4524
Andy Hood	22828 NC Highway 87 W Fayetteville, NC 28306-7332	910-678-1180	910-863-4251
Boyce Lennon	22828 NC Highway 87 W Fayetteville, NC 28306-7332	910-678-1682	910-863-3072
Rufus McQueen	22828 NC Highway 87 W Fayetteville, NC 28306-7332	910-678-1695	910-433-4688
Harvey Inman (See Note 1)	22828 NC Highway 87 W Fayetteville, NC 28306-7332	910-678-1504	910-856-1256
Charles Rogers	22828 NC Highway 87 W Fayetteville, NC 28306-7332	910-678-1674	910-866-4311
Bill Smith (See Note 1)	22828 NC Highway 87 W Fayetteville, NC 28306-7332	910-678-1535	910-485-0157
Greg Strebel	22828 NC Highway 87 W Fayetteville, NC 28306-7332	910-678-1253	910-648-2379
Faye Godwin	22828 NC Highway 87 W Fayetteville, NC 28306-7332	910-678-1683	910-655-9149
Gene Welch (See Note 1)	22828 NC Highway 87 W Fayetteville, NC 28306-7332	910-678-1553	910-425-2367
Darrell Forte	22828 NC Highway 87 W Fayetteville, NC 28306-7332	910-678-1574	910-425-1326

Note 1 – Primary Emergency Director for his/her specific shift.

ICIS Facility Report

NPDES ID	NC0003573
FRS Facility Site ID	269001
Permit Name	The Chemours Company Fc LLC
City	FAYETTEVILLE

Permit Type Desc	NPDES Individual Permit
Curr. Major Minor Status	Major
Permit Status Desc	Expired
Issuing Agency Type Desc	State

Issue Date	2/6/12
Effective Date	3/1/12
Expiration Date	10/31/16

Latitude in Decimal Degrees	34.831111
Longitude in Decimal Degrees	-78.823611
Horizontal Accuracy Measure	
Geometric Type Desc	

Horizontal Collect Method Desc	
Horizontal Reference Datum Desc	
Source Map Scale Number	
Reference Point Desc	

Total App. Design Flow (MGD)	0
Total Actual Average Flow (MGD)	
State Water Body	
State Water Body Name	

Location Address	22828 NC HIGHWAY 87 WEST
Supplemental Address	NULL
City	FAYETTEVILLE
State Code	NC
Zip	283067332

DMR Cognizant Official	
DMR Cognizant Offcl Telephone	
Primary Permit SIC Desc	Plastics Materials And Resins

Component Type Desc

Inspections in Last 5 Years

Actual End Date	Compliance Monitoring Type Desc	Agency Type Desc
3/21/03	Evaluation	State
6/16/04	Evaluation	State
8/16/05	Evaluation	State
5/18/06	Evaluation	State
6/5/07	Evaluation	State

ICIS Facility Report

Actual End Date	Compliance Monitoring Type Desc	Agency Type Desc
6/12/08	Evaluation	State
6/25/09	Evaluation	State
6/4/10	Evaluation	State
2/15/11	Biomonitoring	State
1/27/12	Evaluation	State
4/12/13	Evaluation	State
8/27/14	Evaluation	State
9/16/15	Evaluation	State
5/20/16	Evaluation	State
6/28/18	Oversight	U.S. EPA

Enforcement in Last 5 Years

Issued By	EA Type Desc	Final Order Issued Date	Informal Achieved Date
EPA	CWA 309A AO For Compliance	10/14/92	
State	Letter of Violation/ Warning Letter		5/8/12
State	Notice of Violation		11/13/17
State	Notice of Violation		6/1/18

DMR Summary

Permit NC0003573

Permit Name	Version Nmbr	Curr. Major Minor Status	Issue Date	Effective Date	Expiration Date
The Chemours Company Fc LLC	0	Major	2/6/12	3/1/12	10/31/16

Version # 0

Outfall 001M

00010 Temperature, water deg. centigrade / Location 8 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit	
Limit Unit Desc	Degrees Centigrade
Statistical Base	DAILY MX
Limit Value	
DMR Values	
7/31/16	32
8/31/16	32
9/30/16	29
10/31/16	24
11/30/16	24
12/31/16	22
1/31/17	21
2/28/17	21
3/31/17	23
4/30/17	24
5/31/17	27
6/30/17	31
7/31/17	32
8/31/17	32
9/30/17	29
10/31/17	29
11/30/17	21
12/31/17	23
1/31/18	22
2/28/18	23
3/31/18	19
4/30/18	23
5/31/18	29
6/30/18	30
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

00310 BOD, 5-day, 20 deg. C / Location 8 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

DMR Summary

Permit NC0003573

Version # 0

Outfall 001M

00310 BOD, 5-day, 20 deg. C / Location 8 / Season 9 / Base

Limit		
Limit Unit Desc	Pounds per Day	Pounds per Day
Statistical Base	30DA AVG	DAILY MX
Limit Value	182.6	484.7
DMR Values		
7/31/16	Not Received	Not Received
8/31/16	Not Received	Not Received
9/30/16	Not Received	Not Received
10/31/16	Not Received	Not Received
11/30/16	17.3	17.3
11/30/16	6.0428	6.0428
12/31/16	26.225	26.225
12/31/16	59.2	59.2
1/31/17	31.3571	31.3571
1/31/17	77.8	77.8
2/28/17	39.7333	39.7333
2/28/17	77.4	77.4
3/31/17	Not Received	Not Received
4/30/17	Not Received	Not Received
5/31/17	Not Received	Not Received
6/30/17	33.2416	33.2416
6/30/17	82.3	82.3
7/31/17	169.6	169.6
7/31/17	29.723	29.723
8/31/17	115.6	115.6
8/31/17	22.0857	22.0857
9/30/17	17.8	17.8
9/30/17	47.5	47.5
10/31/17	166.9	166.9
10/31/17	52.6909	52.6909
11/30/17	109.3153	109.3153
11/30/17	338	338
12/31/17	24.3666	24.3666
12/31/17	47.1	47.1
1/31/18	28.9	28.9
1/31/18	8.7933	8.7933
2/28/18	32.7	32.7
2/28/18	8.9916	8.9916
3/31/18	19.0166	19.0166
3/31/18	47.7	47.7
4/30/18	30	30
4/30/18	57.3	57.3
5/31/18	11.45	11.45
5/31/18	26.9	26.9
6/30/18	1.1833	1.1833
6/30/18	14.2	14.2
7/31/18		
8/31/18		
9/30/18		
10/31/18		
11/30/18		
12/31/18		

DMR Summary

Permit NC0003573

Version # 0

Outfall 001M

00400 pH / Location 8 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit		
Limit Unit Desc	Standard Units	Standard Units
Statistical Base	DAILY MN	DAILY MX
Limit Value	6	9
DMR Values		
7/31/16	7.21	7.21
7/31/16	7.75	7.75
8/31/16	7.4	7.4
8/31/16	7.9	7.9
9/30/16	6.88	6.88
9/30/16	7.66	7.66
10/31/16	6.8	6.8
10/31/16	7.39	7.39
11/30/16	7.3	7.3
11/30/16	7.94	7.94
12/31/16	7.36	7.36
12/31/16	7.85	7.85
1/31/17	7.46	7.46
1/31/17	7.78	7.78
2/28/17	7.5	7.5
2/28/17	7.7	7.7
3/31/17	7.41	7.41
3/31/17	7.6	7.6
4/30/17	7.19	7.19
4/30/17	8.02	8.02
5/31/17	7.19	7.19
5/31/17	7.8	7.8
6/30/17	7.3	7.3
6/30/17	7.76	7.76
7/31/17	7.33	7.33
7/31/17	7.79	7.79
8/31/17	7.35	7.35
8/31/17	7.95	7.95
9/30/17	7.36	7.36
9/30/17	7.85	7.85
10/31/17	7.22	7.22
10/31/17	7.75	7.75
11/30/17	6.43	6.43
11/30/17	8.02	8.02
12/31/17	7.02	7.02
12/31/17	7.8	7.8
1/31/18	7.04	7.04
1/31/18	7.44	7.44
2/28/18	7.19	7.19
2/28/18	7.72	7.72
3/31/18	7.28	7.28
3/31/18	7.72	7.72
4/30/18	7.51	7.51
4/30/18	7.85	7.85

DMR Summary

Permit NC0003573

Version # 0

Outfall 001M

00400 pH / Location 8 / Season 9 / Base

DMR Values		
5/31/18	7.55	7.55
5/31/18	8.23	8.23
6/30/18	7.32	7.32
6/30/18	7.91	7.91
7/31/18		
8/31/18		
9/30/18		
10/31/18		
11/30/18		
12/31/18		

00530 Solids, total suspended / Location 8 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit		
Limit Unit Desc	Pounds per Day	Pounds per Day
Statistical Base	30DA AVG	DAILY MX
Limit Value	303.1	981.5
DMR Values		
7/31/16	Not Received	Not Received
8/31/16	Not Received	Not Received
9/30/16	Not Received	Not Received
10/31/16	Not Received	Not Received
11/30/16	11.4857	11.4857
11/30/16	68.8	68.8
12/31/16	19.675	19.675
12/31/16	46.5	46.5
1/31/17	29.8714	29.8714
1/31/17	54.5	54.5
2/28/17	121.4	121.4
2/28/17	49.125	49.125
3/31/17	Not Received	Not Received
4/30/17	Not Received	Not Received
5/31/17	Not Received	Not Received
6/30/17	23.55	23.55
6/30/17	45	45
7/31/17	17.923	17.923
7/31/17	38.7	38.7
8/31/17	21.95	21.95
8/31/17	55.3	55.3
9/30/17	26.5666	26.5666
9/30/17	62.2	62.2
10/31/17	27.6636	27.6636
10/31/17	43.4	43.4
11/30/17	101.4	101.4
11/30/17	41.3307	41.3307
12/31/17	22.9583	22.9583
12/31/17	62.8	62.8
1/31/18	16.3466	16.3466

DMR Summary

Permit NC0003573

Version # 0

Outfall 001M

00530 Solids, total suspended / Location 8 / Season 9 / Base

DMR Values		
1/31/18	36.8	36.8
2/28/18	18.0416	18.0416
2/28/18	32.4	32.4
3/31/18	39.1583	39.1583
3/31/18	69.1	69.1
4/30/18	45.2692	45.2692
4/30/18	95.9	95.9
5/31/18	30.5857	30.5857
5/31/18	74.8	74.8
6/30/18	17.0916	17.0916
6/30/18	36.7	36.7
7/31/18		
8/31/18		
9/30/18		
10/31/18		
11/30/18		
12/31/18		

00556 Oil & Grease / Location 8 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit	
Limit Unit Desc	Milligrams per Liter
Statistical Base	DAILY MX
Limit Value	
DMR Values	
7/31/16	
8/31/16	4.8
9/30/16	
10/31/16	
11/30/16	
12/31/16	
1/31/17	
2/28/17	
3/31/17	
4/30/17	
5/31/17	
6/30/17	
7/31/17	
8/31/17	
9/30/17	
10/31/17	
11/30/17	
12/31/17	
1/31/18	
2/28/18	
3/31/18	
4/30/18	
5/31/18	

DMR Summary

Permit NC0003573

Version # 0

Outfall 001M

00556 Oil & Grease / Location 8 / Season 9 / Base

DMR Values	
6/30/18	
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

50050 Flow, in conduit or thru treatment plant / Location 8 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit	
Limit Unit Desc	Million Gallons per
Statistical Base	30DA AVG
Limit Value	2
DMR Values	
7/31/16	.9882
8/31/16	.8598
9/30/16	.621
10/31/16	.373
11/30/16	.6013
12/31/16	.6591
1/31/17	.5935
2/28/17	.7454
3/31/17	Not Received
4/30/17	Not Received
5/31/17	Not Received
6/30/17	.7861
7/31/17	.746
8/31/17	.6459
9/30/17	.6742
10/31/17	.5154
11/30/17	.5711
12/31/17	.533
1/31/18	.522
2/28/18	.4718
3/31/18	.5622
4/30/18	.5089
5/31/18	.6875
6/30/18	.624
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

Outfall 002M

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

00010 Temperature, water deg. centigrade / Location 1 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit	
Limit Unit Desc	Degrees Centigrade
Statistical Base	DAILY MX
Limit Value	
DMR Values	
1/31/14	16
2/28/14	16
3/31/14	22
4/30/14	24
5/31/14	28
6/30/14	31
7/31/14	31
8/31/14	32
9/30/14	32
10/31/14	23
11/30/14	20
12/31/14	18
1/31/15	14
2/28/15	16
3/31/15	20
4/30/15	26
5/31/15	30
6/30/15	33
7/31/15	32
8/31/15	33
9/30/15	29
10/31/15	26
11/30/15	28
12/31/15	22
1/31/16	16
2/29/16	19
3/31/16	23
4/30/16	26
5/31/16	27
6/30/16	31
7/31/16	33
8/31/16	33
9/30/16	31
10/31/16	23
11/30/16	23
12/31/16	19
1/31/17	19
2/28/17	21
3/31/17	22
4/30/17	25
5/31/17	27
6/30/17	32
7/31/17	32
8/31/17	32

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

00010 Temperature, water deg. centigrade / Location 1 / Season 9 / Base

DMR Values	
9/30/17	29
10/31/17	26
11/30/17	19
12/31/17	24
1/31/18	14
2/28/18	20
3/31/18	18
4/30/18	21
5/31/18	29
6/30/18	32
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

00010 Temperature, water deg. centigrade / Location 5 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit	
Limit Unit Desc	Degrees Centigrade
Statistical Base	DAILY MX
Limit Value	
DMR Values	
1/31/14	NODI=9
2/28/14	NODI=9
3/31/14	NODI=9
4/30/14	NODI=9
5/31/14	NODI=9
6/30/14	NODI=9
7/31/14	NODI=9
8/31/14	NODI=9
9/30/14	NODI=9
10/31/14	NODI=9
11/30/14	NODI=9
12/31/14	NODI=9
1/31/15	NODI=9
2/28/15	NODI=9
3/31/15	NODI=9
4/30/15	NODI=9
5/31/15	NODI=9
6/30/15	NODI=9
7/31/15	NODI=9
8/31/15	NODI=9
9/30/15	NODI=9
10/31/15	NODI=9
11/30/15	NODI=9
12/31/15	NODI=9

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

00010 Temperature, water deg. centigrade / Location 5 / Season 9 / Base

DMR Values	
1/31/16	NODI=9
2/29/16	NODI=9
3/31/16	NODI=9
4/30/16	NODI=9
5/31/16	NODI=9
6/30/16	NODI=9
7/31/16	
8/31/16	
9/30/16	
10/31/16	
11/30/16	
12/31/16	
1/31/17	
2/28/17	
3/31/17	
4/30/17	
5/31/17	
6/30/17	
7/31/17	
8/31/17	
9/30/17	
10/31/17	
11/30/17	
12/31/17	
1/31/18	
2/28/18	
3/31/18	
4/30/18	
5/31/18	
6/30/18	
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

00010 Temperature, water deg. centigrade / Location 6 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit	
Limit Unit Desc	Degrees Centigrade
Statistical Base	DAILY MX
Limit Value	
DMR Values	
1/31/14	NODI=9
2/28/14	NODI=9
3/31/14	NODI=9
4/30/14	NODI=9

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

00010 Temperature, water deg. centigrade / Location 6 / Season 9 / Base

DMR Values	
5/31/14	NODI=9
6/30/14	NODI=9
7/31/14	NODI=9
8/31/14	NODI=9
9/30/14	NODI=9
10/31/14	NODI=9
11/30/14	NODI=9
12/31/14	NODI=9
1/31/15	NODI=9
2/28/15	NODI=9
3/31/15	NODI=9
4/30/15	NODI=9
5/31/15	NODI=9
6/30/15	NODI=9
7/31/15	NODI=9
8/31/15	NODI=9
9/30/15	NODI=9
10/31/15	NODI=9
11/30/15	NODI=9
12/31/15	NODI=9
1/31/16	NODI=9
2/29/16	NODI=9
3/31/16	NODI=9
4/30/16	NODI=9
5/31/16	NODI=9
6/30/16	NODI=9
7/31/16	
8/31/16	
9/30/16	
10/31/16	
11/30/16	
12/31/16	
1/31/17	
2/28/17	
3/31/17	
4/30/17	
5/31/17	
6/30/17	
7/31/17	
8/31/17	
9/30/17	
10/31/17	
11/30/17	
12/31/17	
1/31/18	
2/28/18	
3/31/18	
4/30/18	
5/31/18	
6/30/18	
7/31/18	
8/31/18	

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

00010 Temperature, water deg. centigrade / Location 6 / Season 9 / Base

DMR Values	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

00094 Conductivity / Location 5 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit	
Limit Unit Desc	micromhos per cent
Statistical Base	DAILY MX
Limit Value	
DMR Values	
1/31/14	
2/28/14	
3/31/14	
4/30/14	
5/31/14	
6/30/14	
7/31/14	
8/31/14	
9/30/14	
10/31/14	
11/30/14	
12/31/14	
1/31/15	
2/28/15	
3/31/15	
4/30/15	
5/31/15	
6/30/15	
7/31/15	
8/31/15	
9/30/15	
10/31/15	
11/30/15	
12/31/15	
1/31/16	
2/29/16	
3/31/16	
4/30/16	
5/31/16	
6/30/16	
7/31/16	
8/31/16	
9/30/16	
10/31/16	
11/30/16	
12/31/16	

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

00094 Conductivity / Location 5 / Season 9 / Base

DMR Values	
1/31/17	
2/28/17	
3/31/17	
4/30/17	
5/31/17	
6/30/17	
7/31/17	
8/31/17	
9/30/17	
10/31/17	
11/30/17	
12/31/17	
1/31/18	
2/28/18	
3/31/18	
4/30/18	
5/31/18	
6/30/18	
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

00094 Conductivity / Location 6 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit	
Limit Unit Desc	micromhos per cent
Statistical Base	DAILY MX
Limit Value	
DMR Values	
1/31/14	
2/28/14	
3/31/14	
4/30/14	
5/31/14	
6/30/14	
7/31/14	
8/31/14	
9/30/14	
10/31/14	
11/30/14	
12/31/14	
1/31/15	
2/28/15	
3/31/15	
4/30/15	

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

00094 Conductivity / Location 6 / Season 9 / Base

DMR Values	
5/31/15	
6/30/15	
7/31/15	
8/31/15	
9/30/15	
10/31/15	
11/30/15	
12/31/15	
1/31/16	
2/29/16	
3/31/16	
4/30/16	
5/31/16	
6/30/16	
7/31/16	
8/31/16	
9/30/16	
10/31/16	
11/30/16	
12/31/16	
1/31/17	
2/28/17	
3/31/17	
4/30/17	
5/31/17	
6/30/17	
7/31/17	
8/31/17	
9/30/17	
10/31/17	
11/30/17	
12/31/17	
1/31/18	
2/28/18	
3/31/18	
4/30/18	
5/31/18	
6/30/18	
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

00300 Oxygen, dissolved [DO] / Location 5 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

00300 Oxygen, dissolved [DO] / Location 5 / Season 9 / Base

Limit	
Limit Unit Desc	Milligrams per Liter
Statistical Base	DAILY MX
Limit Value	
DMR Values	
1/31/14	
2/28/14	
3/31/14	
4/30/14	
5/31/14	
6/30/14	
7/31/14	
8/31/14	
9/30/14	
10/31/14	
11/30/14	
12/31/14	
1/31/15	
2/28/15	
3/31/15	
4/30/15	
5/31/15	
6/30/15	
7/31/15	
8/31/15	
9/30/15	
10/31/15	
11/30/15	
12/31/15	
1/31/16	
2/29/16	
3/31/16	
4/30/16	
5/31/16	
6/30/16	Not Received
7/31/16	Not Received
8/31/16	Not Received
9/30/16	Not Received
10/31/16	Not Received
11/30/16	Not Received
12/31/16	Not Received
1/31/17	Not Received
2/28/17	Not Received
3/31/17	Not Received
4/30/17	Not Received
5/31/17	Not Received
6/30/17	Not Received
7/31/17	Not Received
8/31/17	Not Received
9/30/17	Not Received
10/31/17	Not Received
11/30/17	Not Received
12/31/17	Not Received

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

00300 Oxygen, dissolved [DO] / Location 5 / Season 9 / Base

DMR Values	
1/31/18	Not Received
2/28/18	Not Received
3/31/18	Not Received
4/30/18	Not Received
5/31/18	Not Received
6/30/18	
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

00300 Oxygen, dissolved [DO] / Location 6 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit	
Limit Unit Desc	Milligrams per Liter
Statistical Base	DAILY MX
Limit Value	
DMR Values	
1/31/14	
2/28/14	
3/31/14	
4/30/14	
5/31/14	
6/30/14	
7/31/14	
8/31/14	
9/30/14	
10/31/14	
11/30/14	
12/31/14	
1/31/15	
2/28/15	
3/31/15	
4/30/15	
5/31/15	
6/30/15	
7/31/15	
8/31/15	
9/30/15	
10/31/15	
11/30/15	
12/31/15	
1/31/16	
2/29/16	
3/31/16	
4/30/16	

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

00300 Oxygen, dissolved [DO] / Location 6 / Season 9 / Base

DMR Values	
5/31/16	
6/30/16	Not Received
7/31/16	Not Received
8/31/16	Not Received
9/30/16	Not Received
10/31/16	Not Received
11/30/16	Not Received
12/31/16	Not Received
1/31/17	Not Received
2/28/17	Not Received
3/31/17	Not Received
4/30/17	Not Received
5/31/17	Not Received
6/30/17	Not Received
7/31/17	Not Received
8/31/17	Not Received
9/30/17	Not Received
10/31/17	Not Received
11/30/17	Not Received
12/31/17	Not Received
1/31/18	Not Received
2/28/18	Not Received
3/31/18	Not Received
4/30/18	Not Received
5/31/18	Not Received
6/30/18	
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

00400 pH / Location 1 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit		
Limit Unit Desc	Standard Units	Standard Units
Statistical Base	DAILY MN	DAILY MX
Limit Value	6	9
DMR Values		
1/31/14	7.4	7.4
1/31/14	7.8	7.8
2/28/14	7.4	7.4
2/28/14	7.8	7.8
3/31/14	7.3	7.3
3/31/14	7.8	7.8
4/30/14	7	7
4/30/14	7.9	7.9

DMR Summary

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Outfall 002M

00400 pH / Location 1 / Season 9 / Base

DMR Values		
5/31/14	7.1	7.1
5/31/14	7.6	7.6
6/30/14	7.4	7.4
6/30/14	7.8	7.8
7/31/14	7.3	7.3
7/31/14	7.6	7.6
8/31/14	7.1	7.1
8/31/14	7.5	7.5
9/30/14	7.2	7.2
9/30/14	7.6	7.6
10/31/14	6.6	6.6
10/31/14	7.1	7.1
11/30/14	6.5	6.5
11/30/14	7.8	7.8
12/31/14	6.4	6.4
12/31/14	7.8	7.8
1/31/15	6.4	6.4
1/31/15	7.1	7.1
2/28/15	6.3	6.3
2/28/15	7	7
3/31/15	6.3	6.3
3/31/15	7	7
4/30/15	6.5	6.5
4/30/15	7.2	7.2
5/31/15	6.4	6.4
5/31/15	6.8	6.8
6/30/15	6.3	6.3
6/30/15	7.3	7.3
7/31/15	6.9	6.9
7/31/15	7.8	7.8
8/31/15	6.9	6.9
8/31/15	7.6	7.6
9/30/15	6.4	6.4
9/30/15	7.2	7.2
10/31/15	6.1	6.1
10/31/15	7.2	7.2
11/30/15	6.6	6.6
11/30/15	7.5	7.5
12/31/15	6.9	6.9
12/31/15	7.2	7.2
1/31/16	7	7
1/31/16	7.4	7.4
2/29/16	7	7
2/29/16	7.4	7.4
3/31/16	7.3	7.3
3/31/16	7.9	7.9
4/30/16	6.9	6.9
4/30/16	7.7	7.7
5/31/16	7.33	7.33
5/31/16	7.6	7.6
6/30/16	6.19	6.19
6/30/16	7.44	7.44

DMR Summary

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Version # 0

Outfall 002M

00400 pH / Location 1 / Season 9 / Base

DMR Values		
7/31/16	6.42	6.42
7/31/16	7.2	7.2
8/31/16	6.52	6.52
8/31/16	7.04	7.04
9/30/16	6.2	6.2
9/30/16	7.39	7.39
10/31/16	6.08	6.08
10/31/16	7.61	7.61
11/30/16	6.64	6.64
11/30/16	7.57	7.57
12/31/16	6.4	6.4
12/31/16	7.47	7.47
1/31/17	6.39	6.39
1/31/17	7.11	7.11
2/28/17	6.42	6.42
2/28/17	7.06	7.06
3/31/17	6.45	6.45
3/31/17	7.7	7.7
4/30/17	6.4	6.4
4/30/17	7.29	7.29
5/31/17	6.44	6.44
5/31/17	7.79	7.79
6/30/17	6.55	6.55
6/30/17	7.33	7.33
7/31/17	6.21	6.21
7/31/17	7.47	7.47
8/31/17	6.53	6.53
8/31/17	7.33	7.33
9/30/17	6.87	6.87
9/30/17	7.26	7.26
10/31/17	6.76	6.76
10/31/17	7.16	7.16
11/30/17	6.29	6.29
11/30/17	7.31	7.31
12/31/17	6.15	6.15
12/31/17	7.21	7.21
1/31/18	6.25	6.25
1/31/18	7.04	7.04
2/28/18	6.74	6.74
2/28/18	7.38	7.38
3/31/18	6.3	6.3
3/31/18	7.4	7.4
4/30/18	6.61	6.61
4/30/18	7.19	7.19
5/31/18	6.43	6.43
5/31/18	7.68	7.68
6/30/18	6.35	6.35
6/30/18	7.49	7.49
7/31/18		
8/31/18		
9/30/18		
10/31/18		

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

00400 pH / Location 1 / Season 9 / Base

DMR Values		
11/30/18		
12/31/18		

00600 Nitrogen, total [as N] / Location 1 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit	
Limit Unit Desc	Milligrams per Liter
Statistical Base	DAILY MX
Limit Value	
DMR Values	
1/31/14	4.01
2/28/14	1.77
3/31/14	2.93
4/30/14	1.49
5/31/14	3.78
6/30/14	2.19
7/31/14	1.7
8/31/14	5.53
9/30/14	2.16
10/31/14	3.5
11/30/14	1.65
12/31/14	1.71
1/31/15	2.91
2/28/15	1.42
3/31/15	1.47
4/30/15	1.38
5/31/15	21.2
6/30/15	2.56
7/31/15	2.65
8/31/15	3.52
9/30/15	2.24
10/31/15	2.81
11/30/15	1.82
12/31/15	2.01
1/31/16	1.53
2/29/16	1.13
3/31/16	1.35
4/30/16	1.26
5/31/16	1.24
6/30/16	1.19
7/31/16	6.63
8/31/16	2.22
9/30/16	3.2
10/31/16	1.67
11/30/16	2.3
12/31/16	2.66
1/31/17	1.44
2/28/17	1.34

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

00600 Nitrogen, total [as N] / Location 1 / Season 9 / Base

DMR Values	
3/31/17	1.52
4/30/17	1.37
5/31/17	1.54
6/30/17	
7/31/17	.7
8/31/17	2
9/30/17	1
10/31/17	.9
11/30/17	4.2
12/31/17	
1/31/18	1.1
2/28/18	1.6
3/31/18	1.5
4/30/18	1.3
5/31/18	.5
6/30/18	1.6
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

00665 Phosphorus, total [as P] / Location 1 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit	
Limit Unit Desc	Milligrams per Liter
Statistical Base	DAILY MX
Limit Value	
DMR Values	
1/31/14	.94
2/28/14	1.06
3/31/14	1.24
4/30/14	1.14
5/31/14	.63
6/30/14	.83
7/31/14	.67
8/31/14	.78
9/30/14	.71
10/31/14	1.24
11/30/14	1.14
12/31/14	.97
1/31/15	.71
2/28/15	1.1
3/31/15	.81
4/30/15	.09
5/31/15	.67
6/30/15	.79

DMR Summary

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Version # 0

Outfall 002M

00665 Phosphorus, total [as P] / Location 1 / Season 9 / Base

DMR Values	
7/31/15	.66
8/31/15	.74
9/30/15	.63
10/31/15	1.07
11/30/15	.53
12/31/15	.76
1/31/16	1.06
2/29/16	1.03
3/31/16	.56
4/30/16	.78
5/31/16	.932
6/30/16	.428
7/31/16	.578
8/31/16	.515
9/30/16	.539
10/31/16	.659
11/30/16	.649
12/31/16	1.29
1/31/17	.41
2/28/17	1.2
3/31/17	.829
4/30/17	.366
5/31/17	.591
6/30/17	.29
7/31/17	.5
8/31/17	.25
9/30/17	.71
10/31/17	.12
11/30/17	.48
12/31/17	.67
1/31/18	.95
2/28/18	.45
3/31/18	.71
4/30/18	.6
5/31/18	.46
6/30/18	.45
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

50050 Flow, in conduit or thru treatment plant / Location 1 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

DMR Summary

Permit NC0003573

Version # 0

Outfall 002M

50050 Flow, in conduit or thru treatment plant / Location 1 / Season 9 / Base

Limit	
Limit Unit Desc	Million Gallons per
Statistical Base	DAILY MX
Limit Value	
DMR Values	
1/31/14	14.245
2/28/14	10.625
3/31/14	13.752
4/30/14	12.998
5/31/14	31.375
6/30/14	24.005
7/31/14	24.929
8/31/14	28.529
9/30/14	17.323
10/31/14	4.706
11/30/14	10.435
12/31/14	6.806
1/31/15	24.442
2/28/15	18.667
3/31/15	13.084
4/30/15	16.042
5/31/15	21.396
6/30/15	34.791
7/31/15	29.17
8/31/15	31.8
9/30/15	30.224
10/31/15	30.67
11/30/15	19.821
12/31/15	24.176
1/31/16	20.597
2/29/16	21.284
3/31/16	20.514
4/30/16	20.803
5/31/16	29.539
6/30/16	26.999
7/31/16	29.71
8/31/16	29.12
9/30/16	41.522
10/31/16	78.429
11/30/16	19.733
12/31/16	15.119
1/31/17	17.473
2/28/17	17.696
3/31/17	Not Received
4/30/17	Not Received
5/31/17	Not Received
6/30/17	26.76
7/31/17	26.819
8/31/17	26.959
9/30/17	26.477
10/31/17	25.117
11/30/17	29.322
12/31/17	28.824

DMR Summary

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Outfall 002M

50050 Flow, in conduit or thru treatment plant / Location 1 / Season 9 / Base

DMR Values	
1/31/18	21.216
2/28/18	21.19
3/31/18	16.236
4/30/18	23.615
5/31/18	29.978
6/30/18	30.291
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

51521 Perfluorooctanoic Acid / Location 1 / Season 9 / Base

Limit Start Date	Limit End Date	Sample Type	Frequency of Analysis
3/1/12	10/31/16		

Limit	
Limit Unit Desc	Micrograms per Lite
Statistical Base	DAILY MX
Limit Value	
DMR Values	
1/31/14	.012
2/28/14	.014
3/31/14	.016
4/30/14	.015
5/31/14	.014
6/30/14	.018
7/31/14	.02
8/31/14	.019
9/30/14	.014
10/31/14	.052
11/30/14	.031
12/31/14	.021
1/31/15	.011
2/28/15	.03
3/31/15	.088
4/30/15	.015
5/31/15	.034
6/30/15	.016
7/31/15	.012
8/31/15	.022
9/30/15	.022
10/31/15	.023
11/30/15	.011
12/31/15	.008
1/31/16	Not Received
2/29/16	.011
3/31/16	.01
4/30/16	.017

DMR Summary

Permit NC0003573

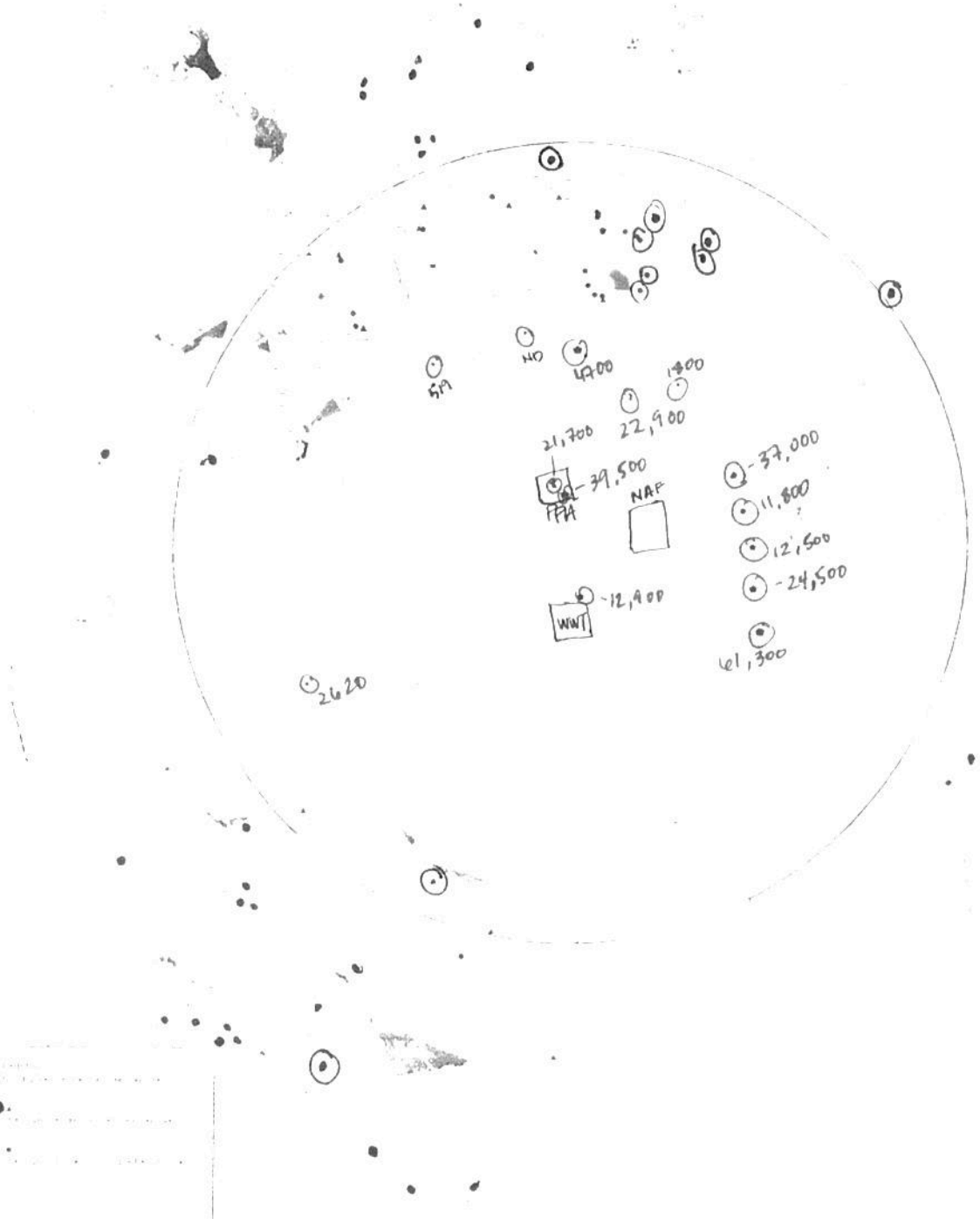
Version # 0

Outfall 002M

51521 Perfluorooctanoic Acid / Location 1 / Season 9 / Base

DMR Values	
5/31/16	.013
6/30/16	.012
7/31/16	.0074
8/31/16	.017
9/30/16	.01
10/31/16	.16
11/30/16	.015
12/31/16	.023
1/31/17	.015
2/28/17	.015
3/31/17	.01
4/30/17	.014
5/31/17	.017
6/30/17	.017
7/31/17	.0094
8/31/17	.018
9/30/17	.021
10/31/17	.025
11/30/17	.02
12/31/17	.018
1/31/18	.013
2/28/18	.005
3/31/18	.0079
4/30/18	.01
5/31/18	.0098
6/30/18	.02
7/31/18	
8/31/18	
9/30/18	
10/31/18	
11/30/18	
12/31/18	

GenX Sampling Results
October 23, 2017



⊙ - onsite

⊙ - HFPO-DA
>700 ppt

248 samples
85 above
163 below
0 ND

⊙ - onsite

⊙ - HFPO-DA >700 ppt