

# **NORTH CAROLINA PER- AND POLYFLUOROALKYL SUBSTANCES TESTING (PFAST) NETWORK**

Progress Report #3 submitted to the North Carolina General Assembly  
Environmental Review Commission, the NC Department of  
Environmental Quality, the NC Department of Health and Human  
Services, and the Environmental Protection Agency (Region 4)

*April 1, 2019*



## 1.0 INTRODUCTION

The North Carolina General Assembly (NCGA), in the passing of Session Law (SL) 2018-5, Sections 13.1.(g), directed the North Carolina Policy Collaboratory (Collaboratory) to *“identify faculty expertise, technology, and instrumentation, including mass spectrometers, located within institutions of higher education in the State, including the Universities of North Carolina at Chapel Hill and Wilmington, North Carolina State University, North Carolina A&T University, Duke University, and other public and private institutions, and coordinate these faculty and resources to conduct nontargeted analysis for PFAS, including GenX, at all public water supply surface water intakes and one public water supply well selected by each municipal water system that operates groundwater wells for public drinking water supplies as identified by the Department of Environmental Quality, to establish a water quality baseline for all sampling sites. The Collaboratory, in consultation with the participating institutions of higher education, shall establish a protocol for the baseline testing required by this subsection, as well as a protocol for periodic retesting of the municipal intakes and additional public water supply wells.”* The term ‘PFAS’, listed above, refers to Per- and Polyfluoroalkyl Substances and the study is sometimes referred to herein as the PFAST Network (PFAS Testing Network).

In addition to the water sampling identified above, additional study parameters are mandated in Section 13.1.(l), which states, *“The Collaboratory shall identify faculty expertise within institutions of higher education in the State, including the Universities of North Carolina at Chapel Hill and Wilmington, North Carolina State University, North Carolina A&T State University, Duke University, and other public and private institutions, and use technology and instrumentation existing throughout the institutions to conduct the following research (i) develop quantitative models to predict which private wells are most at risk of contamination from the discharge of PFAS, including GenX; (ii) test the performance of relevant technologies in removing such compounds; and (iii) study the air emissions and atmospheric deposition of PFAS, including GenX. In addition, Collaboratory may, using relevant faculty expertise, technology, and instrumentation existing throughout institutions identified, evaluate other research opportunities and conduct such research for improved water quality sampling and analyses techniques, data interpretation, and potential mitigation measures that may be necessary, with respect to the discharge of PFAS, including GenX.”*

Research to carry out these legislative mandates has commenced, and progress made to date is summarized in this this document which represents the third [quarterly] report. All provisions passed by the NCGA referring to this project are included in Appendix I of this report.

## 2.0 REPORTING REQUIREMENTS

Section 13.1.(h) of SL 2018-5 states, *“Beginning October 1, 2018, the Collaboratory shall report no less than quarterly to the Environmental Review Commission, the Department of Environmental Quality, and the Department of Health and Human Services on all activities conducted pursuant to this section, including any findings and recommendations for any steps the*

*Department of Environmental Quality, the Department of Health and Human Services, the General Assembly, or any other unit of government should take in order to address the impacts of PFAS, including GenX, on surface water and groundwater quality, as well as air quality in the State.”* This report fulfills the NCGA requirement for the submission of quarterly progress reports and summarizes the work conducted since the last progress report which was submitted on October 1, 2018. Three additional progress reports will be submitted no later than April 1, 2019, July 1, 2019, and October 1, 2019. The project’s final report will be submitted no later than December 1, 2019.

The NCGA-mandated Per- and Polyfluoroalkyl Substances (PFAS) study (herein referred to as the PFAS Testing Network or PFAST Network) was funded by an appropriation from the NCGA. Section 13.1.(i) of SL 2018-5 states, *“Five million thirteen thousand dollars (\$5,013,000) of the funds appropriated in this act for the 2018-2019 fiscal year to the Board of Governors of The University of North Carolina shall be allocated to the Collaboratory to manage and implement the requirements of this section, which shall include distribution to the Collaboratory and participating institutions of higher education (i) to cover costs incurred as a result of activities conducted pursuant to this section, (ii) for acquisition or modification of essential scientific instruments, or (iii) for payments of costs for sample collection and analysis, training or hiring of research staff and other personnel, method development activities, and data management, including dissemination of relevant data to stakeholders. No overhead shall be taken from these funds from the participating institutions that receive any portion of these funds. Funds appropriated by this section shall not revert but shall remain available for nonrecurring expenses.”*

### **3.0 QUARTERLY PROGRESS**

During 1Q'19, PFAST Network research teams have been collecting and analyzing field samples, conducting laboratory experiments, and interfacing with the public through presentations at a number of meetings. For reference, the PFAST Network organizational structure and team leaders were provided in Appendix II of the January 1, 2019 quarterly report, and the specific aims of the research projects were described in Appendix III. The following accomplishments are highlighted for the period covering Jan.1, 2019 through Mar. 31, 2019:

#### **Overall Program Activities**

- PFAST Network scientists submitted the letter provided in Appendix II to the NC Policy Collaboratory and NC General Assembly requesting a 1-year extension of the study and final reporting deadline and supplemental budget to ensure sufficient time for comprehensive analysis and interpretation of non-targeted data and to enable additional sampling of drinking water supply intakes during different seasons.
- In consultation with scientists at the US EPA, the PFAST Network’s synthetic organic chemist devised a synthetic route for 2 PFAS chemical standards (Nafion By-products 1 and 2) and is currently working on a third (Hydro Eve acid).
- The risk communications team has been meeting with representatives of the NC Coastal Federation to plan a public forum on PFAS emerging contaminants to be held at UNC

Wilmington in late May 2019. They are also coordinating Science Café talks, developing communications training for Network scientists, and organizing content for the launch of a new NC PFAST Network website in early April.

- A data policy agreement has been finalized and approved by the Executive Advisory Committee. The data science and management team has been evaluating data management platforms and are coordinating with the risk communications team to create a link to the data portal from the new website. All data for public dissemination will be reviewed for quality, accuracy, and appropriateness in accordance with the data policy agreement prior to upload. The team has developed a global map of PFAS research that will be continually expanded and integrated into the data repository platform and continues to provide GIS mapping and integration support to the research teams.
- PFAST Network investigators, postdocs, and students have participated in national conferences, local workshops, and meetings to raise awareness of the NC PFAST Network study and to share goals of the various research projects, workflow strategies, and updates with legislative and regulatory committees and key community stakeholders. A listing of recent meetings is provided in Appendix III.

#### **PFAST Water Sampling and Analysis**

- Sampling at drinking water treatment facilities is underway. Standardized questionnaires (for recording Meta data) and sample chain of custody forms were created, and all sampling supplies were acquired. The team has been contacting water treatment facilities regularly to schedule sampling visits. A complete listing of the 358 sampling sites was included in Appendix V of the Jan. 1, 2019 quarterly report.
- Water intake samples collected at Pittsboro, Chatham County North, Cary/Apex, Harnett County, and Sanford water treatment facilities have been analyzed on both the triple quadrupole and high resolution Orbitrap mass spectrometers and have been assayed for total adsorbable fluorine content. Data are being processed and reviewed while more samples are collected and analyzed.
- The targeted, quantitative analysis method has been updated to include 10 additional PFAS and continues to expand as new standards become available. Further optimization is currently in progress to add 2 more compounds to the method.
- On-line and off-line solid phase extraction methods for sample clean-up and concentration are being evaluated for their ability to enhance signals and improve method detection limits for targeted and suspect or non-targeted screening.

#### **Private Well Risk Modeling**

- Water has been sampled from all accessible streams near Chemours that are tributaries to the Cape Fear River (CFR) for determination of PFAS concentrations. In each stream, salt tracer releases were carried out in order to quantify volumetric stream discharge. The results will provide a snapshot of the PFAS discharge into the CFR from all tributary streams near Chemours, at essentially a moment in time (one hydrologic condition in mid-winter). This type of information is critical for quantifying the PFAS output from local

watersheds to the CFR, a surface water hydrologic process likely driven mostly by the discharge of PFAS-contaminated groundwater into the tributary streams.

- A field campaign focused on the streambed of Georgia Branch (a contaminated tributary) was completed to simultaneously measure: PFAS concentration in groundwater beneath Georgia Branch; groundwater and PFAS flux into Georgia Branch; and groundwater age. Water flux calculations have been completed, and PFAS concentration analysis is in progress. Water samples have been shipped to a laboratory at the University of Nebraska for noble gas and tritium analysis.
- Additional layers of information acquired from national and local databases and local county health departments have been added to the spatial model which will be used in the Bayesian network model for predicting private well contamination risk. Data include aquifer water level, tree/land cover, wind direction, and well construction information. In consideration of other potential sources of contamination near the private wells in the area, more information has also been layered into the model including data from waste management sites, wastewater treatment plants, and proximity to airports, rivers, and major fire incidents. Septic tank information is also being collected and will be incorporated once available.

### **PFAS Removal Performance Testing**

- Rapid, small-scale column tests were conducted to evaluate PFAS removal by two granular activated carbons (GAC) and one ion exchange (IX) resin using water collected at the Sweeney water treatment plant in Wilmington. The experiments also tested the effects of empty bed contact times (EBCT) on PFAS removal and breakthrough. Currently, five bench-scale column designs are being tested to identify an approach that effectively describes PFAS removal in field-scale IX treatment processes.
- Ten commercial membranes were chosen and procured for testing the removal performance of 29 selected PFAS. Water pretreatment, sample collection, and sample storage protocols have been established, membrane testing rigs have been assembled, and preliminary testing has begun. Membrane modification procedures are also being evaluated for effects on contaminant passage.
- New reactors have been constructed using reduced graphene oxide membrane anodes and titanium mesh cathodes to concentrate PFAS-contaminated water and subsequently remove PFAS via electrochemical oxidation (mineralization). Additional reactors containing a titanium/ruthenium oxide anode are also being built for evaluation.
- Drinking water samples have been collected from more than 70 homes in Durham, Raleigh, Cary, Apex, Chapel Hill and Pittsboro for the study “PFAS removal from finished drinking water by in-home filters in NC households”. The study is testing the efficiency of various in-home treatments (carbon filters and reverse osmosis systems) for removal of 11 targeted PFAS. With the assistance of the Haw Riverkeeper, monthly samples are also being collected from several sites along the Haw River to understand the temporal and spatial variability in the levels these PFAS.
- The two Ionic Fluorogels (developed and tested at UNC Chapel Hill) demonstrating the highest sorption of PFAS were compared against commercially available powder activated

carbon (PAC), granular activated carbon (GAC), and ion exchange (IX) resins and were shown to outperform the commercial materials under the conditions tested, especially for short-chain PFAS compounds (PFHxA and GenX). Two optimized formulations were selected for further capacity testing.

#### **Air Emissions and Atmospheric Deposition**

- Aerosol samplers have been installed and are collecting weekly (6-day) composite samples at 5 sites (Fayetteville, Wilmington (UNC-W), Greenville (ECU), Research Triangle Park, and Charlotte (UNC-C). The samplers collect gases on a polyurethane foam (PUF) plug upstream of a quartz filter (QF) which collects particles. Monthly rotation of field blanks collection among the sites enables determination of PFAS detection limits for particle-bound and aqueous PFAS. In addition, gaseous PFAS breakthrough is being evaluated by operating 2 PUFs in series at one site, also rotating on a monthly basis.
- Together with air sample collection for PFAS analyses, the team is monitoring airborne fine particulate matter (PM<sub>2.5</sub>) at two sites. Equipment (nephelometers) for measuring particle concentrations is running at the RTP site in Morrisville and the Honeycutt site in Fayetteville. This site is hosted by the NC DEQ's Division of Air Quality and conducts routine monitoring of ozone and sulfur dioxide.
- Recovery tests and optimization of QF and PUF sample extractions are in progress as well as evaluation of the analytical method (mass spectrometry) detection limits to determine whether weekly samples need to be combined for analysis.
- More than 30 rain events have been sampled at the main UNC Wilmington collection station. Extreme rain events including a low pressure system, hurricanes Florence and Michael, and a winter wet-deposition event have been sampled at the participating sites across the state (UNC-W, Bald Head Island, ECU, UNC-C, UNC-CH, and Appalachian State). Despite an extremely wet winter, all sites have collected at least one dry deposition sample for the winter season. Samples are currently being processed and analyzed to quantify PFAS, and extracts are also being analyzed by fluorine nuclear magnetic resonance (NMR) spectroscopy in addition to high resolution mass spectrometry to aid in determining the structures of previously unidentified fluorinated compounds.

#### **Other Applied Research Opportunities:**

##### ***Novel PFAS Inputs into the environment: landfill leachates:***

- Meetings and calls were held with DEQ staff and waste industry representatives and letters were sent to landfill owners and operators requesting access to their facilities. At the time of this report, 11 landfills have given permission to sample at their sites. In addition, a creek adjacent to an unlined construction and demolition (C&D) landfill has been sampled, 1 lined C&D landfill has given permission to sample there, and plans have been made to obtain leachate from at least one unlined C&D landfill.
- Requests to sample were also sent to wastewater treatment plants. Twenty-four have decided to participate in this study, and samples have already been collected from 11 of these. Two treatment plants are being sampled weekly to assess temporal variability.

- Several wastewater treatment plant and landfill operators are reluctant to allow sampling at their facilities and have denied requests to participate.

***PFAS bioaccumulation in aquatic environments: alligator and fish studies:***

- In collaboration with the US EPA, serum samples from alligators and striped bass have been reanalyzed for PFAS. Total levels of PFAS were higher in Cape Fear River striped bass than in aquaculture-raised (unexposed) striped bass. In addition to PFAS levels, blood chemistry, enzyme levels and immunological function were measured to evaluate possible associations with detected exposures. Non-targeted analysis identified longer chain PFAS compounds that can be quantified once analytical standards are acquired.
- An organizational meeting was held with the NC Wildlife Commission to plan for the spring 2019 sample collections in the Cape Fear and Roanoke rivers, and all permitting is in place. Geospatial mapping of the previous sampling and methods for inclusion of exposure data are in progress.

***Health effects following exposure: mouse model of immunotoxicity:***

- A second dosing study has been initiated for immunotoxicity assessment in mice. Data have been analyzed from the first study in which mice were dosed with PFMOAA, one PFAS previously found in high concentrations in the Cape Fear River. A poster describing the PFMOAA immunotoxicity study was recently presented at the 2019 annual meeting of the Society of Toxicology held in Baltimore, MD in March.

***PFAS bioaccumulation and distribution in crop plants: greenhouse studies:***

- Greenhouse experiments incorporating PFAS-contaminated water and various ratios of compost in soil have been initiated with lettuce as the first crop growing. A competitive proposal has been submitted to the Canadian Light Source to obtain access to beamline for PFAS distribution mapping in plant tissues.

***Health effects following exposure: placental inflammation and immune cell signaling:***

- For the assessment of potential association of PFAS exposure with adverse birth outcomes, enrollment of subjects in the EPOCH-PLUS and EPOCH-CASE studies continued. To date, 38 pregnant women have enrolled during the period of 11/1/18 through 3/19/19. Initial water samples have been received from 16 of the 27 EPOCH-PLUS participants and 5 of the women have provided a second water sample, and 3 have sent a third sample. Of the 11 EPOCH-CASE participants, 4 have submitted water samples. Additional demographics, health history, and outcome data have been entered for enrolled subjects, and method optimization for sample extraction and PFAS analysis in both water and placenta samples is in progress.
- Laboratory experiments have been conducted using placental cell lines treated with a range of doses of selected PFAS to investigate potential PFAS-induced inflammatory effects. Gene and protein expression analysis were performed as well as protein content measurements to assess cellular accumulation resulting from exposure.

# APPENDIX I

## LEGISLATIVE LANGUAGE PASSED BY THE NORTH CAROLINA GENERAL ASSEMBLY

*(Session Law 2018-5, Sections (f) through (l), effective June 12, 2018)*

### FUNDING TO ADDRESS PER- AND POLY-FLUOROALKYL SUBSTANCES, INCLUDING GENX/USE OF EXPERTISE AND TECHNOLOGY AVAILABLE IN INSTITUTIONS OF HIGHER EDUCATION LOCATED WITHIN THE STATE

**SECTION 13.1.(f)** The General Assembly finds that (i) per- and poly-fluoroalkyl substances (PFAS), including the chemical known as "GenX" (CAS registry number 62037-80-3 or 13252-13-6), are present in multiple watersheds in the State, and impair drinking water and (ii) these contaminants have been discovered largely through academic research not through systematic water quality monitoring programs operated by the Department of Environmental Quality or other State or federal agencies. The General Assembly finds that the profound, extensive, and nationally recognized faculty expertise, technology, and instrumentation existing within the Universities of North Carolina at Chapel Hill and Wilmington, North Carolina State University, North Carolina A&T State University, Duke University, and other public and private institutions of higher education located throughout the State should be maximally utilized to address the occurrence of PFAS, including GenX, in drinking water resources.

**SECTION 13.1.(g)** The North Carolina Policy Collaboratory at the University of North Carolina at Chapel Hill (Collaboratory) shall identify faculty expertise, technology, and instrumentation, including mass spectrometers, located within institutions of higher education in the State, including the Universities of North Carolina at Chapel Hill and Wilmington, North Carolina State University, North Carolina A&T State University, Duke University, and other public and private institutions, and coordinate these faculty and resources to conduct nontargeted analysis for PFAS, including GenX, at all public water supply surface water intakes and one public water supply well selected by each municipal water system that operates groundwater wells for public drinking water supplies as identified by the Department of Environmental Quality, to establish a water quality baseline for all sampling sites. The Collaboratory, in consultation with the participating institutions of higher education, shall establish a protocol for the baseline testing required by this subsection, as well as a protocol for periodic retesting of the municipal intakes and additional public water supply wells. No later than December 1, 2019, Collaboratory shall report the results of such sampling by identifying chemical families detected at each intake to the Environmental Review Commission, the Department of Environmental Quality, the Department of Health and Human Services, and the United States Environmental Protection Agency.

**SECTION 13.1.(h)** Beginning October 1, 2018, the Collaboratory shall report no less than quarterly to the Environmental Review Commission, the Department of Environmental Quality, and the Department of Health and Human Services on all activities conducted pursuant to this section, including any findings and recommendations for any steps the Department of Environmental Quality, the Department of Health and Human Services, the General Assembly, or any other unit of government should take in order to address the impacts of PFAS, including GenX, on surface water and groundwater quality, as well as air quality in the State.



**SECTION 13.1.(i)** Five million thirteen thousand dollars (\$5,013,000) of the funds appropriated in this act for the 2018-2019 fiscal year to the Board of Governors of The University of North Carolina shall be allocated to the Collaboratory to manage and implement the requirements of this section, which shall include distribution to the Collaboratory and participating institutions of higher education (i) to cover costs incurred as a result of activities conducted pursuant to this section, (ii) for acquisition or modification of essential scientific instruments, or (iii) for payments of costs for sample collection and analysis, training or hiring of research staff and other personnel, method development activities, and data management, including dissemination of relevant data to stakeholders. No overhead shall be taken from these funds from the participating institutions that receive any portion of these funds. Funds appropriated by this section shall not revert but shall remain available for nonrecurring expenses.

**SECTION 13.1.(j)** The Collaboratory should pursue relevant public and private funding opportunities that may be available to address the impacts of PFAS, including GenX, on surface water and groundwater quality, as well as air quality, in order to leverage funds appropriated by this section, or any other funds provided to the Collaboratory, including the Challenge Grant authorized in Section 27.5 of S.L. 2016-94, as amended by Section 10.4(a) of S.L. 2017-57.

**SECTION 13.1.(k)** In the event that the United States Environmental Protection Agency no longer provides access to its analytical instrumentation at no cost to the State for water quality sampling analysis related to per- and poly-fluoroalkyl substances (PFAS), including the chemical known as "GenX" (CAS registry number 62037-80-3 or 13252-13-6), or if the Department of Environmental Quality determines that such analysis is not being performed in a sufficiently timely manner, the Collaboratory shall coordinate such analysis in the most cost-effective manner using relevant faculty expertise, technology, and instrumentation, including mass spectrometers, existing throughout institutions of higher education located throughout the State, until such time as the Department of Environmental Quality is able to perform such analysis with instrumentation acquired pursuant to subsection (q) of this section. The Collaboratory, in consultation with the Department and relevant experts across institutions of higher education in the State, including the Universities of North Carolina at Chapel Hill and Wilmington, North Carolina State University, North Carolina A&T State University, Duke University, and other public and private institutions, shall establish a protocol for delivery of such samples taken by the Department to the entity designated to perform analysis of the samples, chain of custody protocols, and other matters to ensure proper handling and processing of the samples, which protocols shall be subject to approval by the United States Environmental Protection Agency, if such approval is required pursuant to authority delegated from the United States Environmental Protection Agency to the Department to administer federal environmental law.

**SECTION 13.1.(l)** The Collaboratory shall identify faculty expertise within institutions of higher education in the State, including the Universities of North Carolina at Chapel Hill and Wilmington, North Carolina State University, North Carolina A&T State University, Duke University, and other public and private institutions, and use technology and instrumentation existing throughout the institutions to conduct the following research (i) develop quantitative models to predict which private wells are most at risk of contamination from the discharge of PFAS, including GenX; (ii) test the performance of relevant technologies in removing such compounds; and (iii) study the air emissions and atmospheric deposition of PFAS, including GenX. In addition, Collaboratory may, using relevant faculty expertise, technology, and instrumentation existing throughout institutions identified, evaluate other research opportunities and conduct such research for improved water quality sampling and analyses techniques, data interpretation, and potential mitigation measures that may be necessary, with respect to the discharge of PFAS, including GenX.

## **APPENDIX II**

**LETTER FROM THE NC PFAST NETWORK PROGRAM DIRECTOR AND CO-CHAIRS OF THE EXECUTIVE ADVISORY COMMITTEE TO THE RESEARCH DIRECTOR OF THE NC POLICY COLLABORATORY REQUESTING A STUDY EXTENSION FROM THE NORTH CAROLINA GENERAL ASSEMBLY**



March 13, 2019

Jeffrey Warren, PhD  
Research Director  
North Carolina Policy Collaboratory  
400 Roberson Street  
Carrboro, NC 27510

Dear Dr. Warren:

Research being conducted by the seven academic teams from across the State (NCSU, UNCCH, UNCC, UNCW, NCA&T, ECU, and Duke) that comprise the North Carolina Poly- and Perfluoroalkyl Substances Testing (PFAST) Network is well underway in order to achieve the broad research goals set forth by the North Carolina General Assembly (NCGA) in Session Law 2018-5 (Sections 13.1(f) through (l)). However, after the PFAST Network Executive Advisory Committee meeting held on March 6<sup>th</sup> (co-chaired by Drs. Detlef Knappe and Lee Ferguson from NCSU and Duke, respectively), there was unanimous support to request a one-year extension of the study deadline of December 1, 2019 set forth in Section 13.1(g) of Session Law 2018-5 (i.e., a new deadline of December 1, 2020).

With regards to analysis of public drinking water supplies, the initial goal was to collect and analyze two discrete samples at each of the 348 sampling sites identified by the NC Department of Environmental Quality (DEQ) spread across the State with a third round focused on a yet-to-be-determined subset of those sites that merited additional analysis. This goal is potentially too aggressive noting the extensive geographic footprint of the sampling locations and unforeseen impacts of adverse weather events on the sampling schedule. Furthermore, the proposed sampling plan does not allow for the evaluation of temporal variability. Preliminary work by the team indicates that PFAS levels may show significant variability in drinking water sources based on seasonal and meteorological conditions. A one-year extension of the study would not only provide more time to analyze, quality check, synthesize, and interpret the non-targeted data but also allow for two more rounds of sampling to achieve one sample at each location during each of our four seasons, capturing a broader range of hydrological conditions. Duplicate samples for quality assurance, field blanks, and trip blanks also add a tremendous number of additional analyses well above the 348 required sample sites. Also note that PFAST Network labs currently are helping to train DEQ scientific staff for PFAS analysis as well as assisting the DEQ in running water monitoring samples from numerous sites to help clear the backlog that occurred when the Environmental Protection Agency was no longer able to perform the analyses dating back to November 2018.

With regards to air analysis, an extension would allow our five monitoring stations, currently in place and operating across the State, to collect at least a year of continuous data for better temporal resolution that will, in turn, provide a more robust understanding of the atmospheric fate, transport, and deposition of PFAS across the State. Likewise, investigators from our other research teams (who are not members of the Executive Advisory Committee) have also expressed their desire to have more time for building relationships with key stakeholders and cultivating trust with local utilities and community partners. Additional time on the back end of the project will allow the researchers from each of our seven teams to finalize their analyses, discuss their findings with each other, and synthesize what likely will be one of the largest spatial and temporal PFAS datasets in the world. Time spent engaging constituents, anticipating their questions and concerns, and incorporating their feedback into ongoing research and future data sharing represent a strategic investment for the State and will provide robustness to future policy discussions and actions that result from the PFAST Network research study.

With these additional data needs, which are critical to achieve the highest levels of confidence, comes additional costs for water sampling and analysis and project logistics. We understand that the Collaboratory may be able to supplement some, but not all, of these costs so the hope is that, along with a one-year extension of the project, the NCGA would note that the cost of these additional recommended sampling campaigns is estimated to cost approximately \$1.5 million. This total includes the cost of two more rounds of water sample acquisition and analysis (348 samples x 2, associated trip and field blanks, duplicate analyses for quality assurance, and funding for related project management including the continued support for a synthetic chemist to create PFAS compounds unavailable for purchase on the open market to use as analytical laboratory standards).

Please feel free to reach out to us, or any PFAST Network Team member, for additional information and insight on the issues outlined herein. We all stand ready to communicate our scopes of work, timelines, initial findings, and the need for additional time and the cost of additional research with all members of the NCGA as well as their staff.

Regards,

A handwritten signature in blue ink, appearing to read "Jason Surratt".

Jason Surratt, PhD  
Professor and PFAST Network Project Director  
Department of Environmental Sciences and Engineering  
Gillings School of Global Public Health  
The University of North Carolina at Chapel Hill

A handwritten signature in blue ink, appearing to read "Detlef Knappe".

Detlef Knappe, PhD  
S. James Ellen Distinguished Professor and PFAST Network Executive Advisory Committee Co-Chair  
Department of Civil, Construction, and Environmental Engineering  
North Carolina State University

A handwritten signature in blue ink, appearing to read "P. Lee Ferguson".

P. Lee Ferguson, PhD  
Associate Professor and PFAST Network Executive Advisory Committee Co-Chair  
Department of Civil and Environmental Engineering  
Pratt School of Engineering  
Duke University

# APPENDIX III

## LIST OF MEETINGS, WORKSHOPS, AND CONFERENCES IN WHICH NC PFAST NETWORK SCIENTISTS WERE INVITED TO PRESENT INFORMATION RELATED TO THE ONGOING RESEARCH STUDY

- Jan. 16, 2019 Kathleen Gray, Megan Rodgers, Victoria Triana, and Wanda Bodnar met with OWASA representatives in Chapel Hill to provide an overview of PFAST Network activities and to start a dialogue around how best to inform the public about emerging contaminants and results from water quality testing
- Jan. 23, 2019 Jamie DeWitt gave a short interview for an NPR affiliate in Michigan briefly describing the NC PFAS Testing Network and what is being done to learn more about PFAS emissions in the air
- Jan. 28, 2019 Jason Surratt and Detlef Knappe presented an overview of PFAST Network research activities during a half-day meeting with NC legislators focused on state-funded research projects at the UNC Gillings School of Global Public Health, Chapel Hill, NC
- Feb. 8, 2019 Jamie DeWitt presented preliminary results from PFAS immunotoxicity experiments to the Chemistry Department at UNC Wilmington
- Feb. 14, 2019 Several PFAST Network investigators participated in a symposium in Raleigh hosted by the NC State University Center for Human Health and the Environment focused on GenX and PFAS emerging contaminants
- Feb. 14, 2019 Wanda Bodnar and Abigail Joyce presented an overview of the PFAST Network and shared results from water sampling and analysis following hurricanes Florence and Michael at the NC Manufacturers' Association Water Quality Workshop in Raleigh
- Feb. 26, 2019 Jason Surratt and Kathleen Gray attended a public screening of the documentary "The Devil We Know" organized by Toxic Free NC at the NC Botanical Gardens in Chapel Hill. Following the film they answered general questions about the PFAST Network
- Feb. 28, 2019 Wanda Bodnar and Detlef Knappe presented an overview the PFAST Network and shared results from water sampling and analysis during the NC Water Quality Association's Drinking Water Committee meeting in Raleigh

- Mar. 5, 2019 Morton Barlaz discussed research plans with landfill operators at the Solid Waste Association of North America (SWANA) conference
- Mar. 10, 2019 Network researchers presented posters at the annual conference of the Society of Toxicology held in Baltimore, MD during the week of March 10th
- Mar. 21, 2019 Scott Belcher spoke about PFAS sampling in striped bass and alligators in a Science Café presentation at the NC Museum of Natural Sciences
- Mar. 21, 2019 David Genereux presented at the annual conference of the UNC Water Resources Research Institute in Raleigh