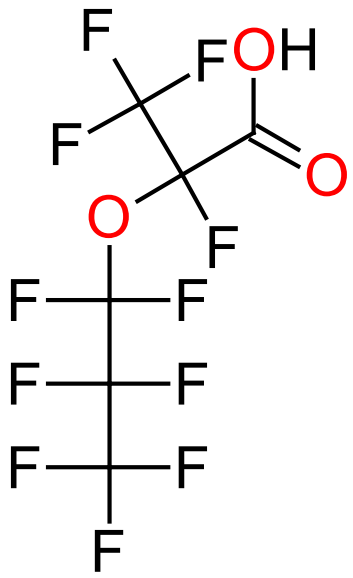
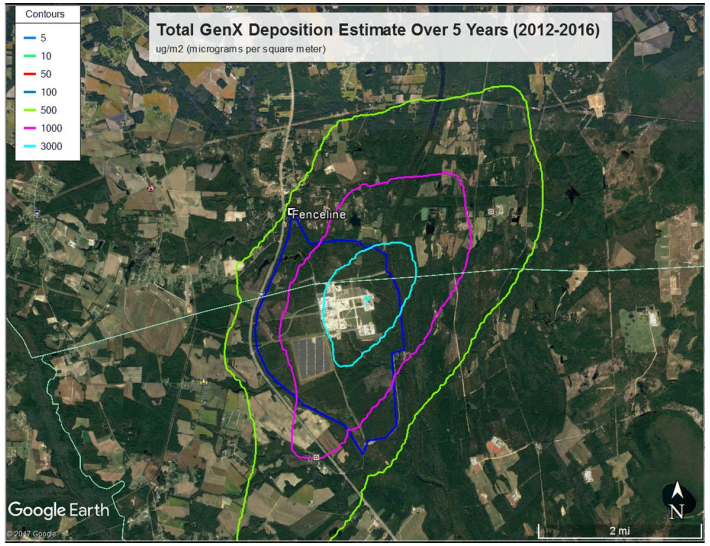
PFAS Air Emissions, Atmospheric Deposition, and Source Control
How is NC addressing it?

November 12, 2020

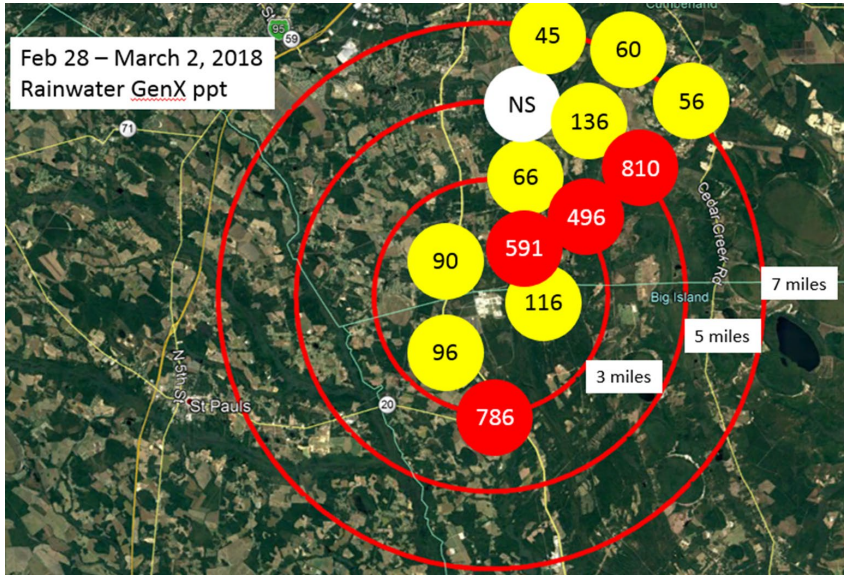
Mike Abraczinskas, Director, NC Division of Air Quality

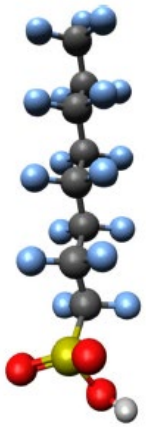
Department of Environmental Quality





Emerging Compounds





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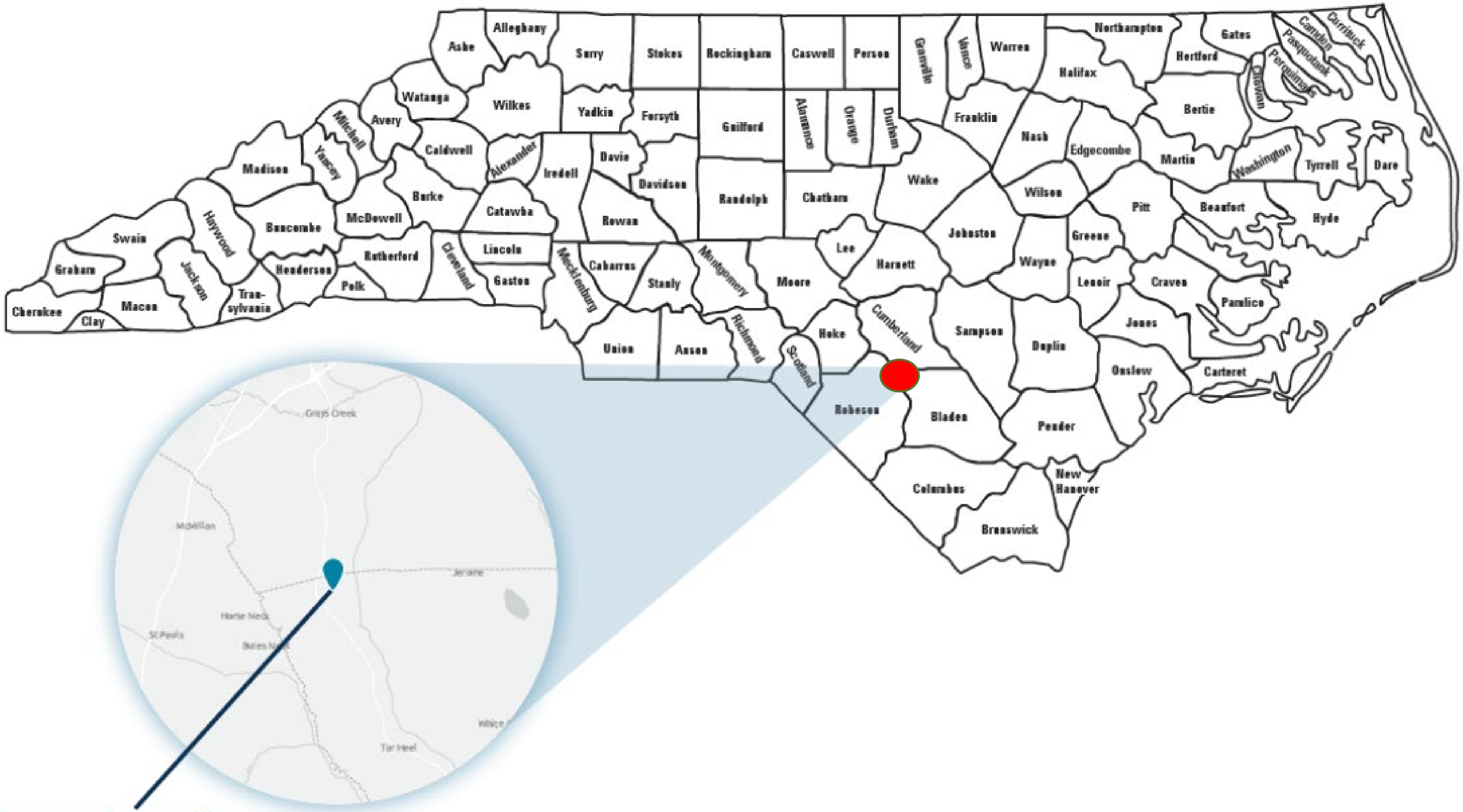

Chemours Fayetteville
Works Facility

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State Perspective – NC's PFAS Experience

- **Around 1980, DuPont began manufacturing products using fluorinated compounds.**

- **GenX**
  - **Commercial manufacturing began after a 2009 Consent Agreement under TSCA was signed by EPA and the company.**
  - **Has been a byproduct of the vinyl ether production line for many years prior to the commercial manufacturing.**

- **DuPont transitions site ownership to Chemours in 2015.**

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State Perspective – NC's PFAS Experience

- **Summer 2017 –**
  - **DEQ presented with Cape Fear river sample analysis demonstrating high levels of PFAS (including GenX) in water downstream of Chemours facility**
  - **Downstream drinking water utilities measured high levels of PFAS in drinking water**

- **October 2017 –**
  - **Chemours wastewater discharge to Cape Fear River is severed**

- **Nearfield to the facility**
  - **Private citizen wells, up-gradient of the facility were sampled and high levels of PFAS were measured**
  - **Air deposition identified as the contamination method**

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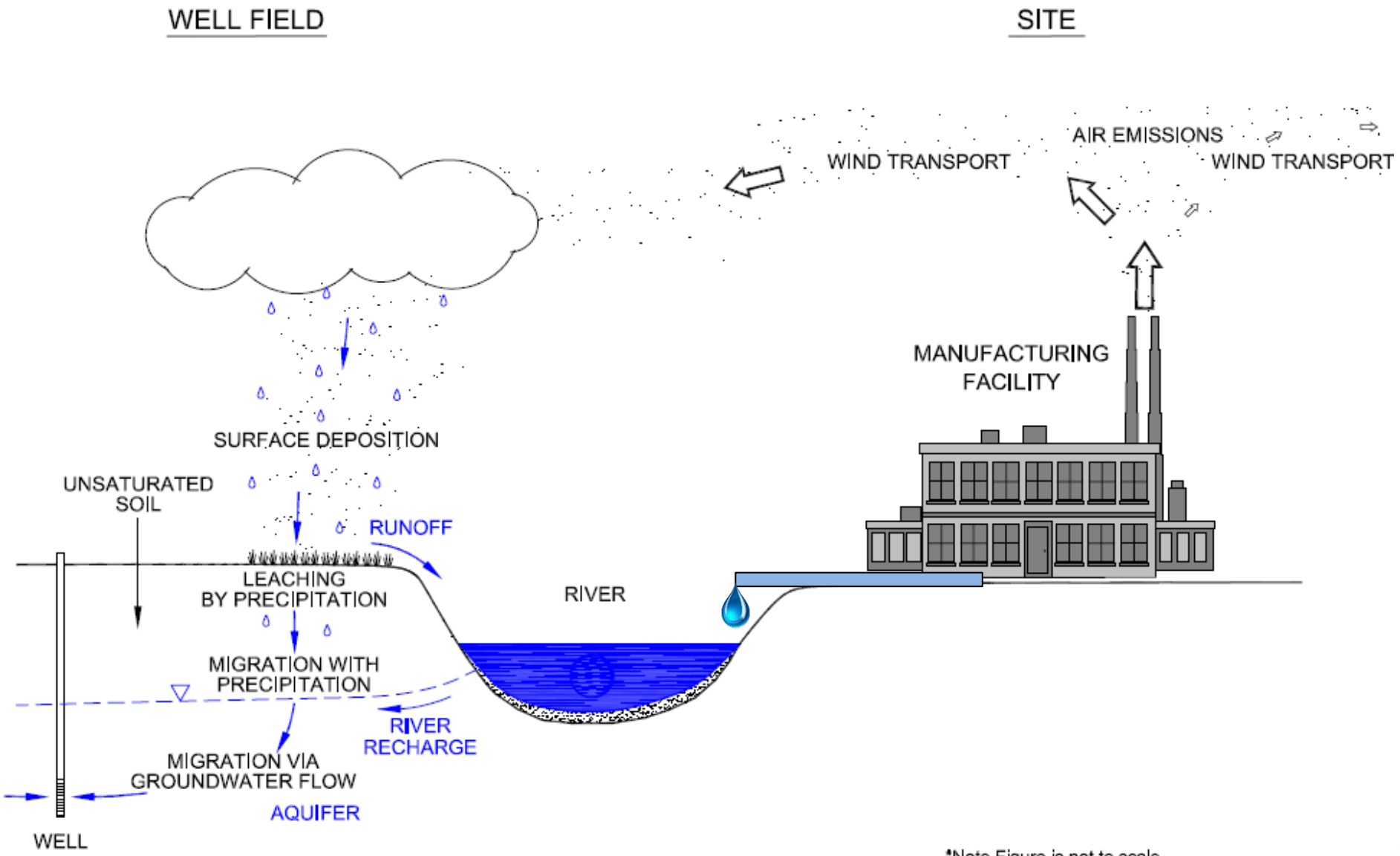
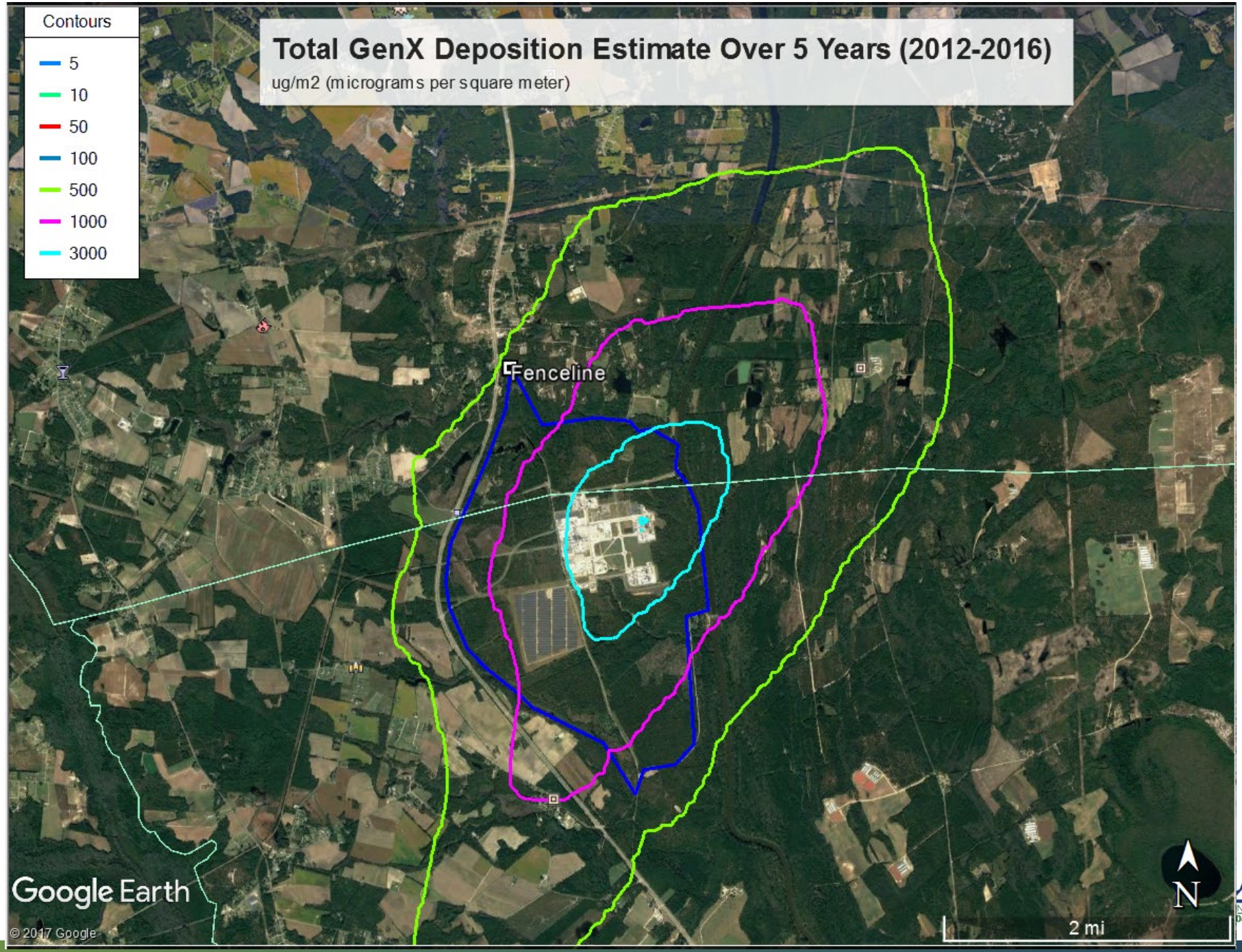


*Note Figure is not to scale

GenX Investigation – Three Key Questions

1. **How much is being emitted?**
2. **How much is in ambient air?**
3. **What's the source's ability to control?**



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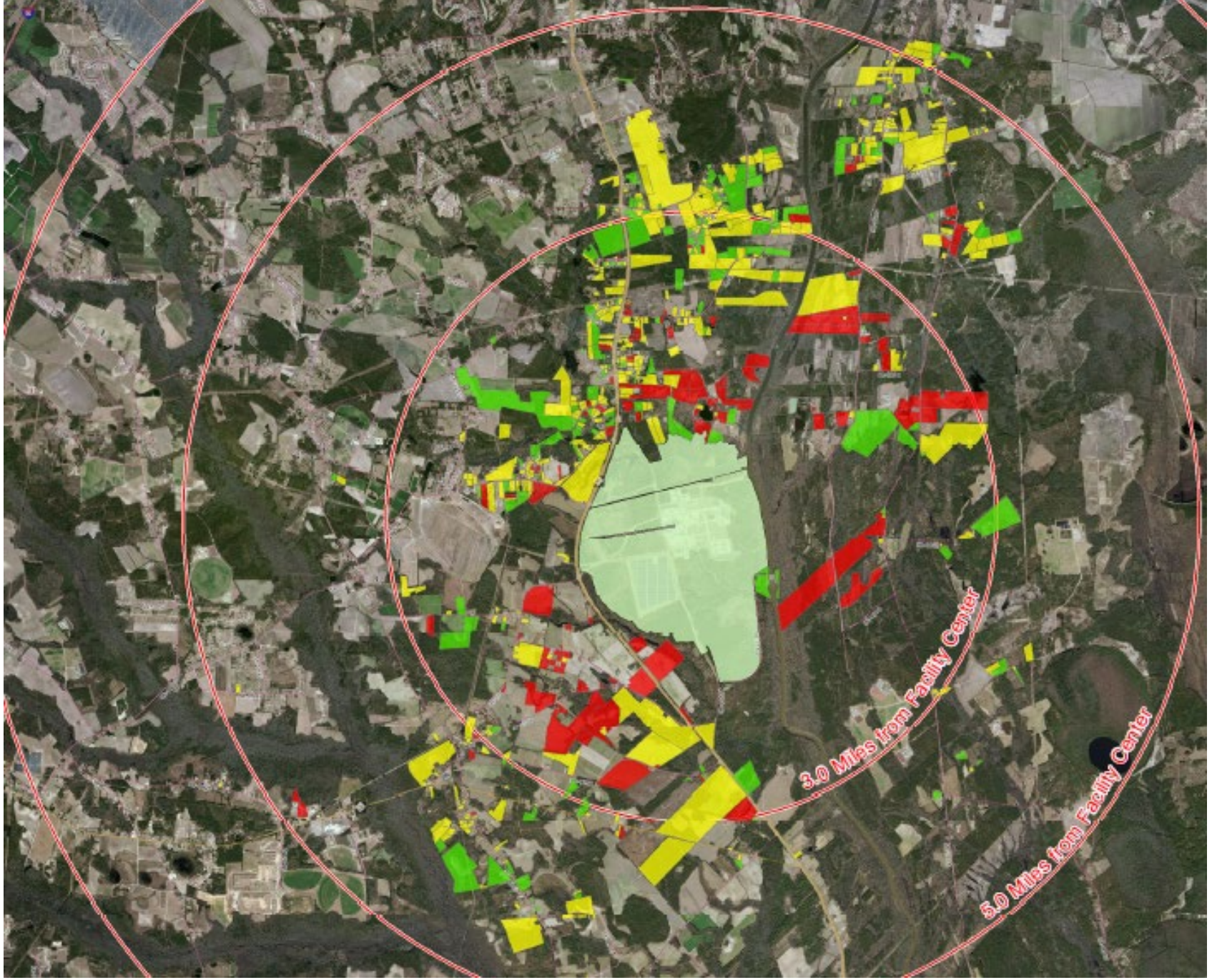

Private Well Sampling Results near Chemours:

GenX: NC health goal = 140 ppt

Red = > 140 ppt
Yellow = 10 –140 ppt
Green = non-detected

No color = not tested

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GenX Investigation – Three Key Questions

Q1: How much GenX is being emitted?

- **Started with only estimates.** **3 pounds**
- **Required stack tests**
- **Method development**
- **First of its kind measurements**

Chemours 2016 emissions estimates as originally reported to DAQ	Chemours revised 2016 emissions estimates as of October 2017	Latest calculations of annual emissions, including stack test measurements
66.6 lb/yr	594 lb/yr	2302.7 lb/yr

GenX Investigation – Three Key Questions
Q1: How much GenX is being emitted?

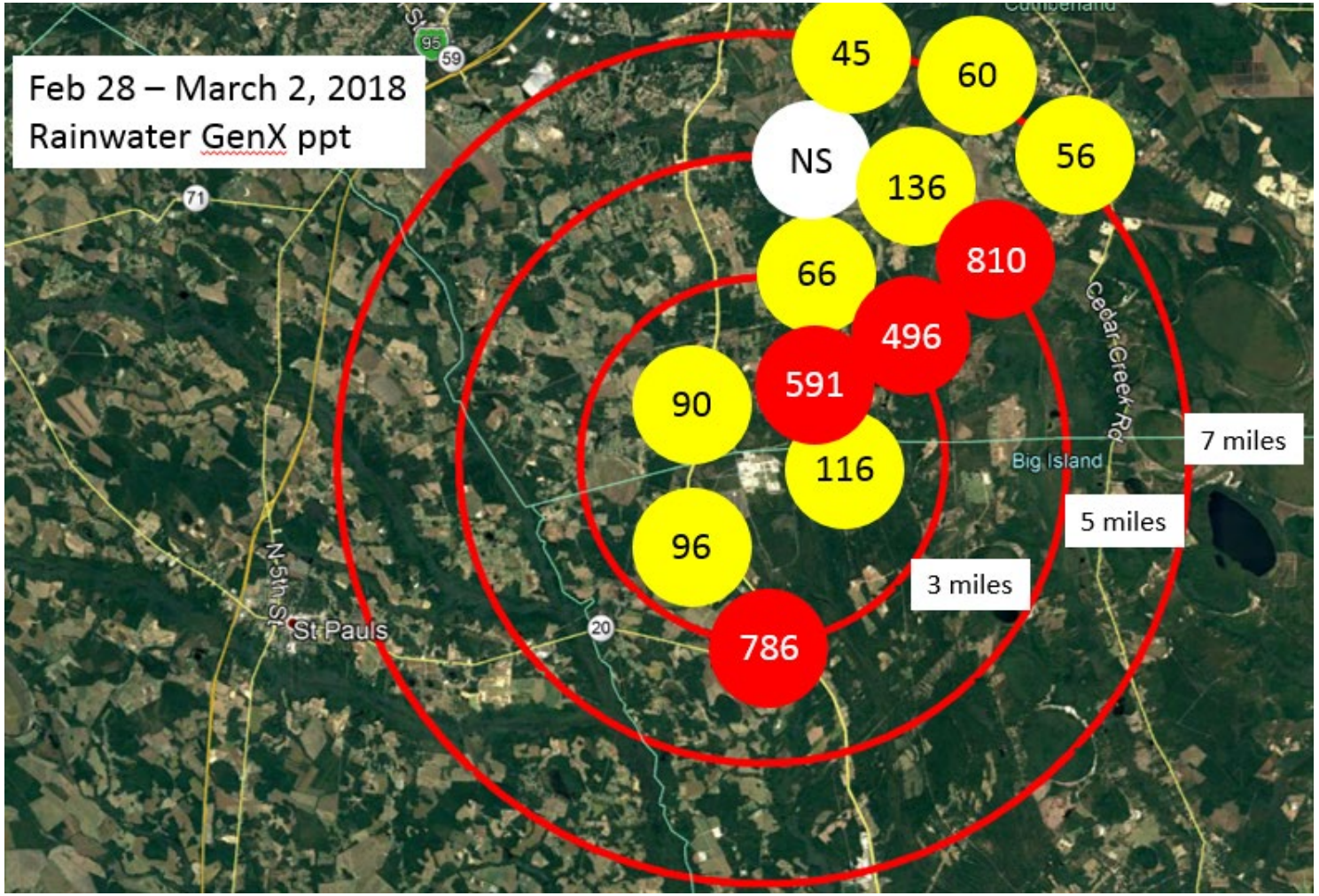
Air Emissions Testing or "Stack Testing" Target compound – C_3 Dimer Acid (GenX) Week of:

1/8/18 – PPA & Vinyl Ethers (VE) North
1/22/18 - PPA & VE North
2/26/18 - PPA & VE South
3/19/18 - VE North, Polymers, Semiworks
4/3/18 – VE South & VE North for HFPO
4/23/18 – VE North HFPO
5/14/18 – Polymers for E1
6/11/18 – PPA & VE North Carbon bed
7/16/18 – PPA scrubber efficiency
VE North carbon bed & Scrubber
7/23/18 – PPA scrubber & carbon bed efficiency
8/20/18 – VE South & VE North
11/12/18 – VE North
12/3/18 – VE North
1/7/19 – VE South, PPA & Semiworks
1/14/19 – Polymers, VE North & Semiworks
1/21/19 – Polymers
1/28/19 – Semiworks
4/14/19 – VEN & PPA – Scubber, Stack, Carbon Bed
4/30/19 - PPA – Scubber, Stack, Carbon Bed
5/22/19 – VES
6/10/19 – Inlet control device testing VEN, PPA,
7/15/19 – VES & VES Carbon Bed Efficiency
9/9/19 – PPA & PPA Carbon Bed Efficiency
9/23/19 – Polymers, VEN & VEN Carbon Bed Efficiency
11/20/19 – VES Carbon Bed
12/2/19 – VEN, E-2 Stack
2/28/20 – Thermal Oxidizer: HFPO-DAF, HFPO Monomer, HFPO-DA , Fluoroether E-1, Carbonyl Fluoride.

https://deq.nc.gov/news/key-issues/genx-investigation/air-quality-samplingConsent order

GenX Investigation – Three Key Questions

Q2: How much GenX is in ambient air?



GenX Investigation – Three Key Questions

Q2: How much GenX is in ambient air?

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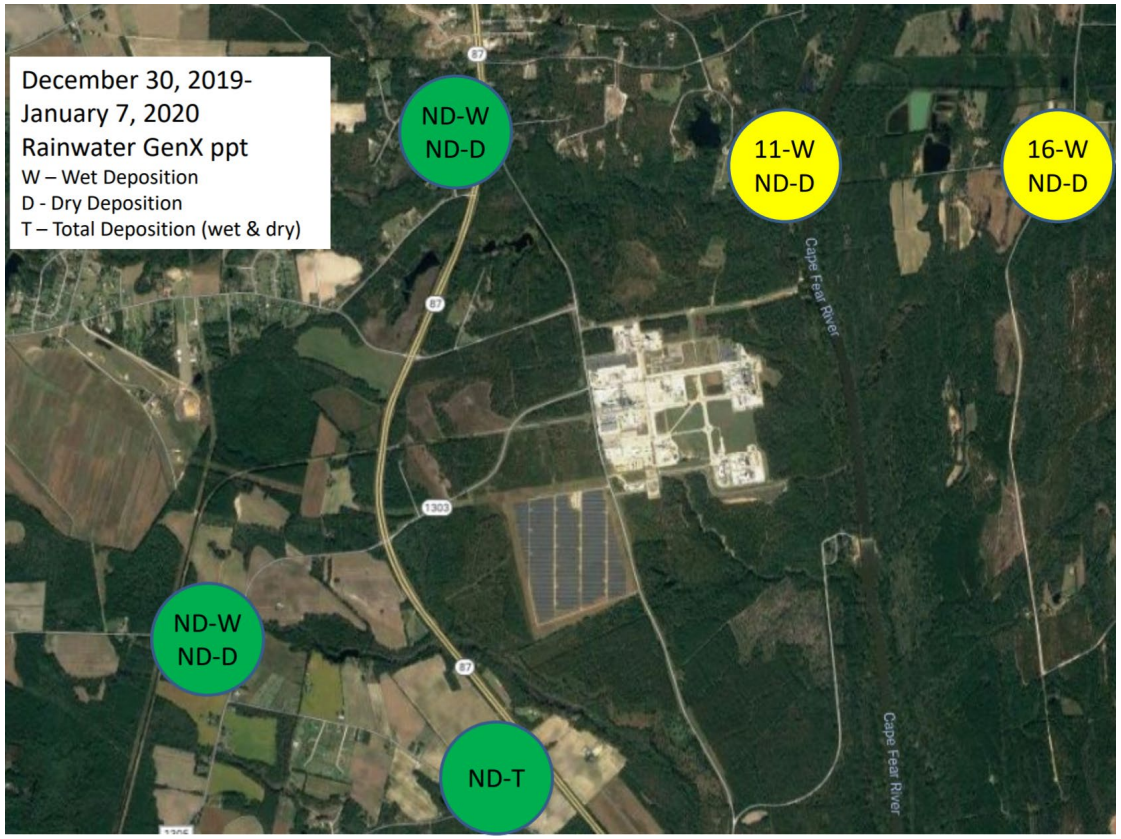
GenX Investigation – Three Key Questions
Q2: How much GenX is in ambient air?

5 monitoring sites are 1.0 – 2.1 miles from Chemours



https://deq.nc.gov/news/key-issues/genx-investigation/air-quality-sampling

GenX Investigation – Three Key Questions
Q3: What's the source's ability to control?

- **Source reduction, rather than understanding specific health impacts of these compounds that were prevalent in the environment, was a much shorter timeline to providing necessary relief to the public**

- **Research on control methods**

GenX Investigation – Data, then action

As our investigation progressed… we determined:

- **The measured air emissions of GenX compounds are significantly higher than previously understood and reported.**
  - **See answers to Q1**
- **DAQ has measured GenX deposition through rainfall 20 miles from the facility and the evidence of atmospheric deposition of GenX shows a geographic footprint that is similar to the detection of GenX in groundwater samples.**
  - **See answers to Q2**
- **Technically feasible air emission controls.**
  - **See answers to Q3**

DAQ established a link between the air emissions of GenX, the deposition through rainwater and dry deposition, and contributions to GenX in the groundwater nearfield to the facility.

GenX Investigation – Data, then action

April 6, 2018:

- **60 day notice of intent to modify Chemours' air permit:**
  - **Required demonstration that emissions of GenX compounds do not or will not cause or contribute to violations of groundwater rules.**

Air quality permit was opened based on authorities in 02Q .0519(a)…

"The conditions under which the permit or permit renewal was granted have changed."

GenX Investigation – Data, then action

April 27, 2018:

- **Chemours response to 60 day notice**
  - **Chemours committed to:**
    - **Install & operate a Thermal Oxidizer/Scrubber system by 2020**
      - **Expected 99% reduction of GenX emissions**

GenX Investigation – Data, then action

CHEMOURS TO PAY $13M PENALTY, SETTLES WITH DEQ, RIVER WATCH

CHEMICALS

Chemours must pay large fine, slash GenX emissions in N.C.

Consent order would make chemical plant reduce emissions

Opinion

EDITORIAL, Fayetteville Observer: Chemours deal one step on a long road

Chemours to pay $12 million fine as part of GenX agreement

Cumberland County News

DEQ: Chemours fined $13 million, must provide permanent drinking water

GenX Investigation – Data, then action

Consent Order

- **2/25/19 - Court order approved.**
- **Comprehensive resolution regarding PFAS originating from Chemours.**
- **Requires Chemours to pay a $12 million civil penalty and $1 million for investigative costs.**
- **https://deq.nc.gov/news/key-issues/genx-investigation**

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STATE OF NORTH CAROLINA
COUNTY OF BLADEN

BLADEN COUNTY, C.S.C.
BY

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,

CAPE FEAR RIVER WATCH,

Plaintiff-Intervenor,

v.

THE CHEMOURS COMPANY FC, LLC,

Defendant.

CONSENT ORDER

DAQ Required Chemours to Complete the Following Actions Through the Consent Order

- ***Control Technology Improvements:*** **Thermal Oxidizer/Scrubber system**
- **By December 31, 2019, control all PFAS in process streams routed to the control system at an efficiency of 99.99%.**
- **Perform Stack Tests and submit a report to DAQ within 90 days.**
  - **Thermal Oxidizer/Scrubber system - installed and operational on December 27, 2019**
  - **Testing for the 99.99% control efficiency - occurred in February 2020**
  - **Test report submitted to DAQ in March 2020**
  - **DAQ reviewed results: 99.99% control efficiency confirmed**

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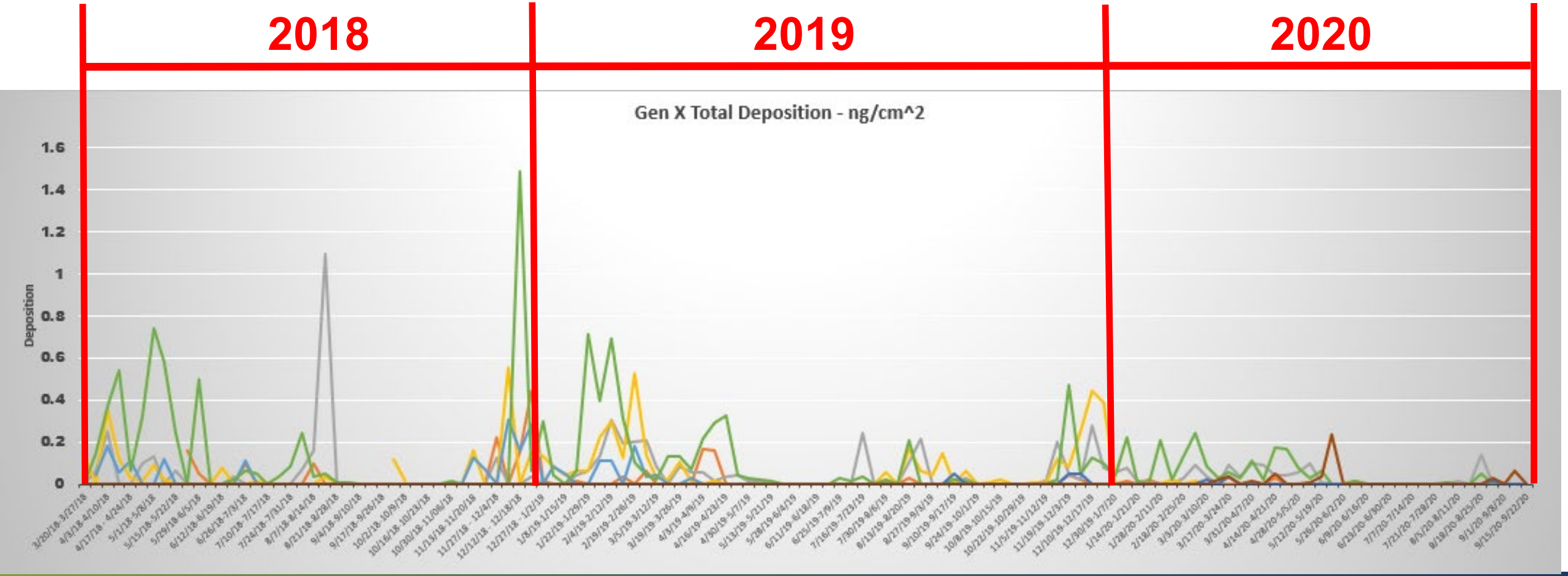
Near-field Atmospheric Deposition of GenX in North Carolina

5 monitoring sites are 1.0 – 2.1 miles from Chemours



Background Atmospheric Deposition Network
PFAS in North Carolina

- **Network of seven background sites generally oriented near our regional offices**
  - **Asheville – start 11/20/18**
  - **Fayetteville (Candor) – start 10/24/18**
  - **Mooresville – start 3/12/19**
  - **Raleigh – start 4/24/18**
  - **Washington – start 2/12/19**
  - **Wilmington – start 1/8/19**
  - **Winston Salem – start – 3/19/19**

Background Atmospheric Deposition Network
PFAS in North Carolina

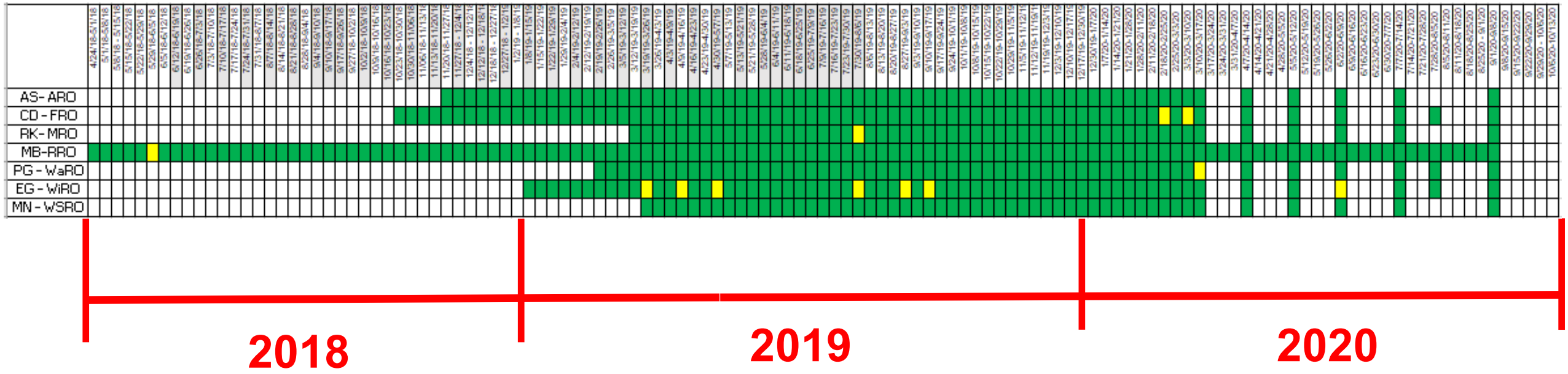
North Carolina: Background Rainwater PFAS Concentrations

Measured in ppt; ND = Not detected; NS = No sample for the time period

Background Atmospheric Deposition Network

PFAS in North Carolina

Each block is a week-long sample



= PFAS not detected

= PFAS detected

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State Perspective – Challenges ahead?

Challenges ahead?

- Landfills
  - Leachate
- Air emissions??
  - Leachate evaporator
  - Flares
  - RICE

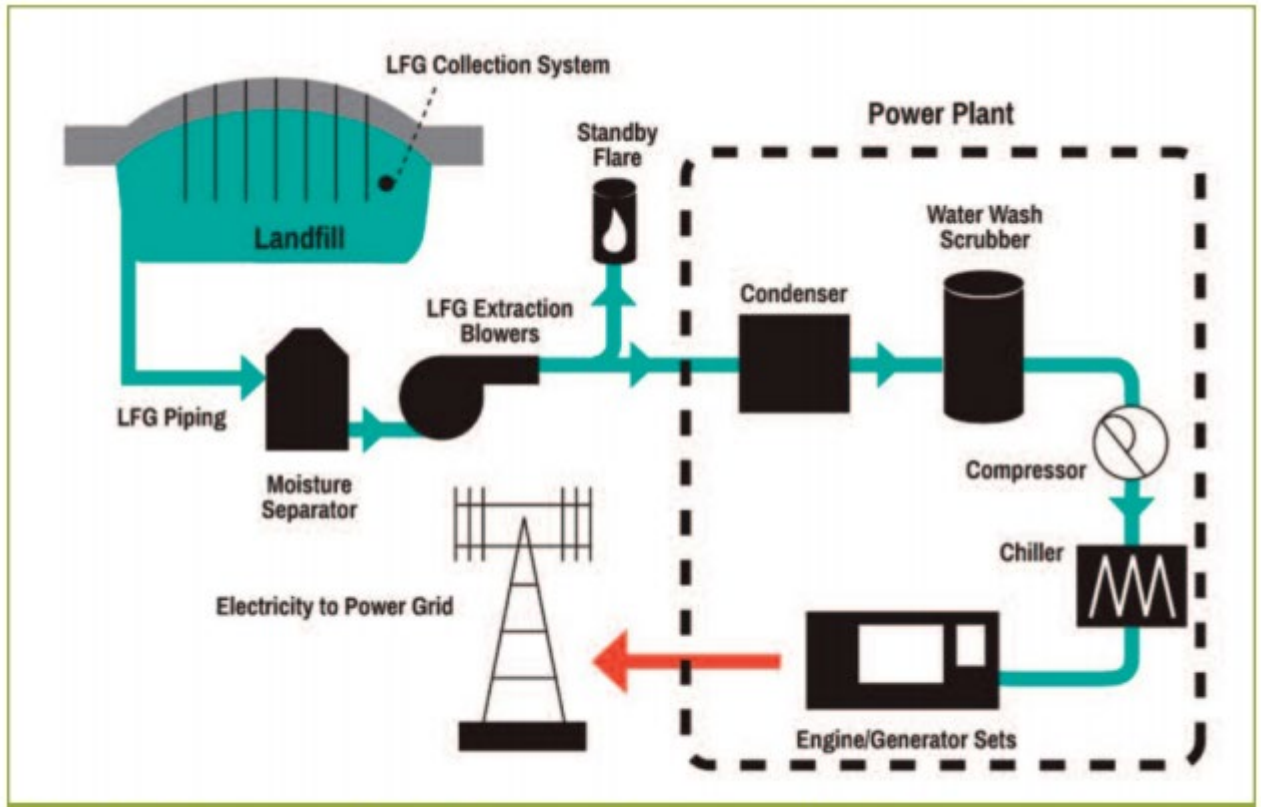

Figure 1. Landfill gas to energy (LFGTE) facility schematic. *Graphic courtesy of Dresser Waukesha.*

Challenges ahead?

- **Sewage Sludge Incinerators (SSI)**
  - **PFAS laden sludge?**
  - **Time, Temperature, Turbulence? Additional removal controls?**
  - **Sufficient to destroy & capture PFAS?**

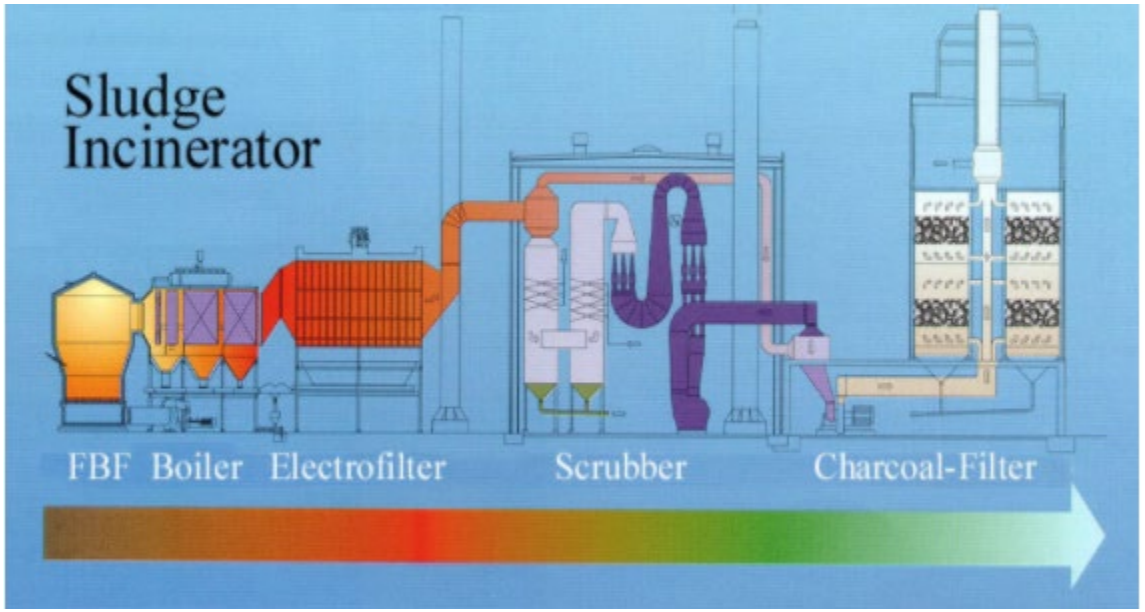

Image courtesy of: https://biophysics.sbg.ac.at/waste/sewage.htm

Challenges ahead?

Aqueous film forming foam (AFFF)

- **Primarily a water issue?**

- **Manufacturing/mixing sites**
- **Training sites**
- **Locations where it has been applied**

Can you Regulate Emerging Compounds?

- **Common thought initially was…**
  "This is an unregulated compound. We can't do anything."
- **"Regulations" specific to PFAS air emissions do not exist**
- **However… positive environmental outcomes can result from using existing authority, sound science and quality data.**
- **We could do something… and we did do something.**

NC's PFAS Experience – Final Thoughts…

- **Eye-opening experience to the world of emerging compounds.**
- **Having real data and following the scientific process is very powerful.**
- **Industry: Know what's in your air emissions, waste and water streams!**
- **EPA: We need each other!**
  - **Emissions stack test method development**
    - **Source attribution starts with good emissions data**
  - **Ambient air monitoring**
    - **Does EPA have capabilities that states don't?**
  - **How to prioritize emerging compounds?**
    - **Prevalence, concentrations, toxicity.**

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NC's PFAS Experience– Final Thoughts…

- **Regulatory Agencies:**
  - Have some awareness that "the water issue" may not be just a water issue.
  - Relatively modest amounts of emissions can lead to widespread groundwater issues via atmospheric deposition.
  - Monitoring and surveillance is a must!
  - Emerging/unregulated compounds are prevalent in the environment.
  - At what concentration? Can you measure? Can someone else measure it?
  - Do we have the lab and field equipment that we need?
    - Do you know who does?
  - What are you going to do with that measurement when you get it?
  - What are they going to do with that measurement when they get it?
  - Risk communication is a must !!!

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Emerging Compounds

144,000,000

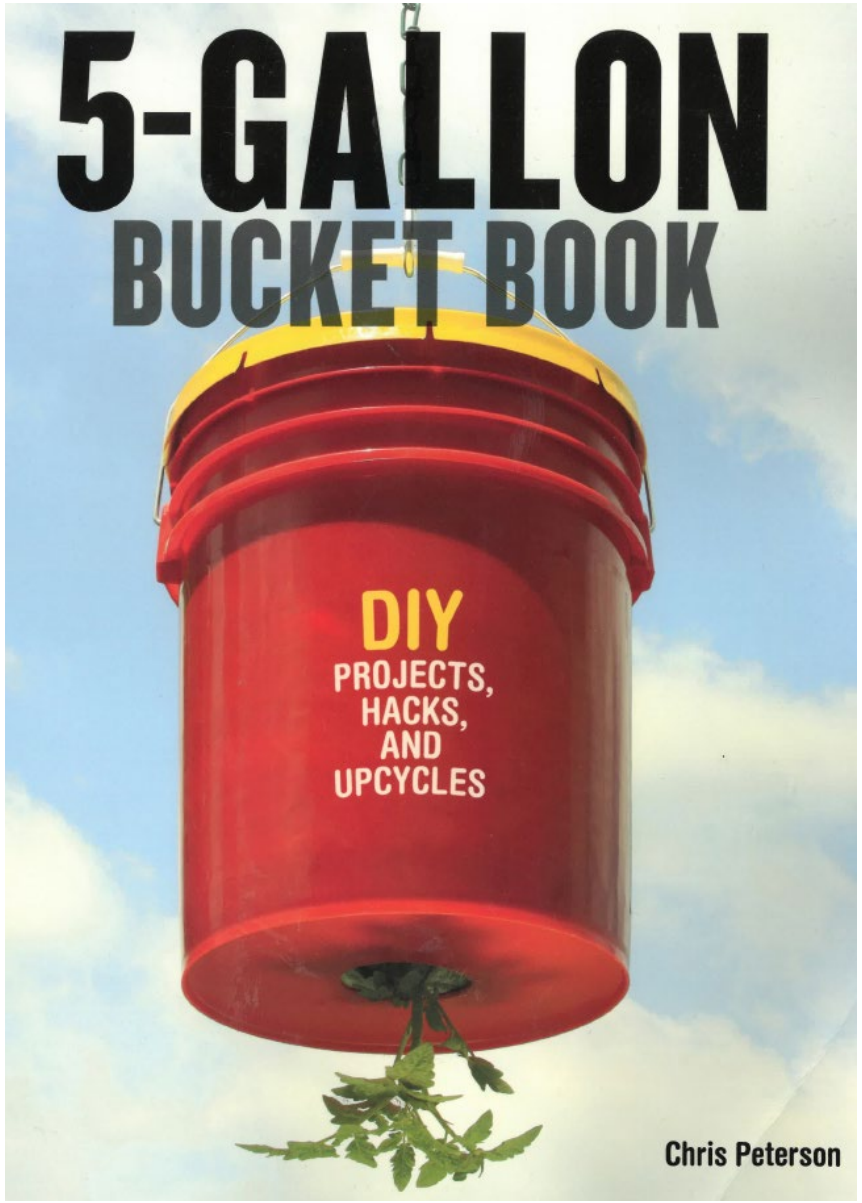
83,000

5,000

187

91

6



Thanks!

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