

Studying PFC Exposures in Community: An On-going Case Study in Southern, NJ

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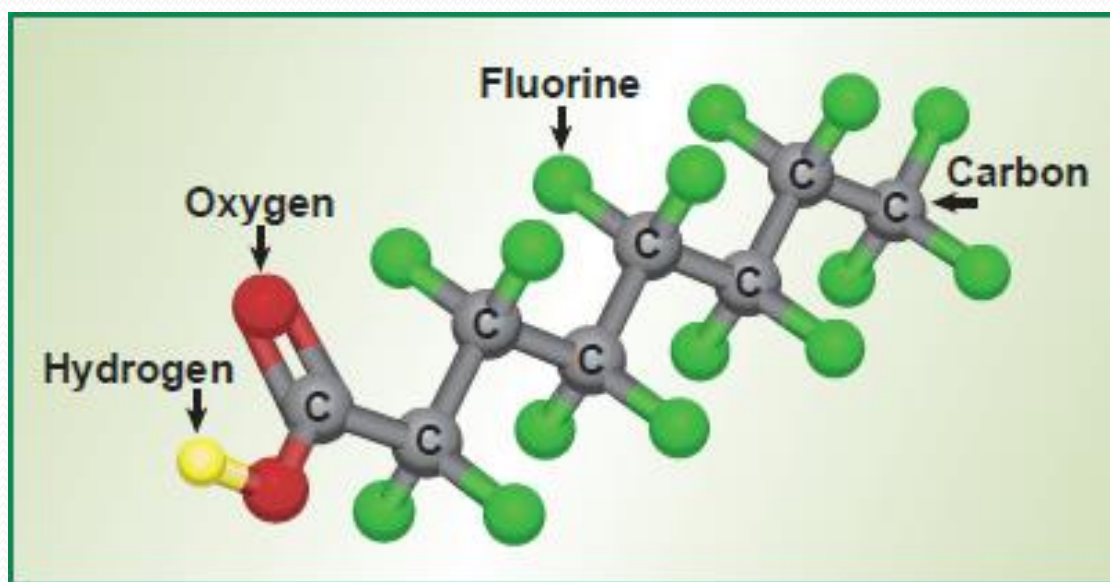
**Symposium: Environmental Justice and the
Future of Environmental Health Research**

April 28, 2017



What are PFCs?

- Polyfluorochemicals (perfluoroalkyl compounds) - used in everyday products to make them resistant to stains, grease and water.



PFOA, also known as C8, has 8 carbons.

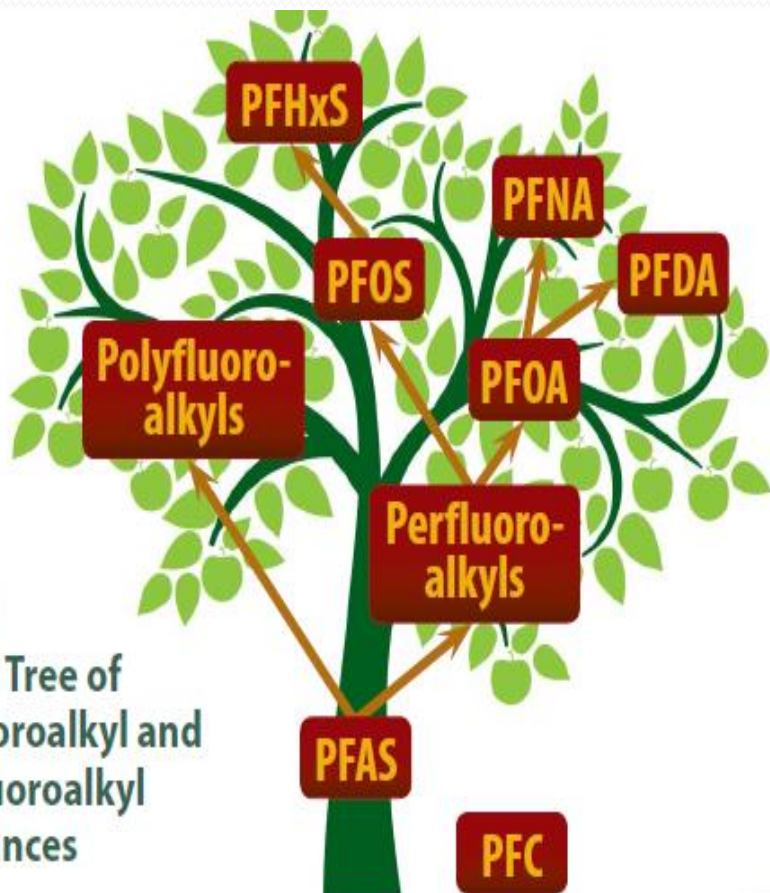


Figure 1.
Family Tree of
Perfluoroalkyl and
Polyfluoroalkyl
Substances

Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations



Common PFC or PFAS

Abbreviation	Chemical Name
PFOS	Perfluorooctane sulfonic acid
PFOA	Perfluorooctanoic acid
PFNA	Perfluorononanoic acid
PFDA	Perfluorodecanoic acid
FOSA	Perfluorooctane sulfonamide
MeFOSAA	2-(N-Methyl-perfluorooctane sulfonamido) acetic acid
EtFOSAA	2-(N-Ethyl-perfluorooctane sulfonamido) acetic acid
PFHxS	Perfluorohexane sulfonic acid

PFCs Exposures



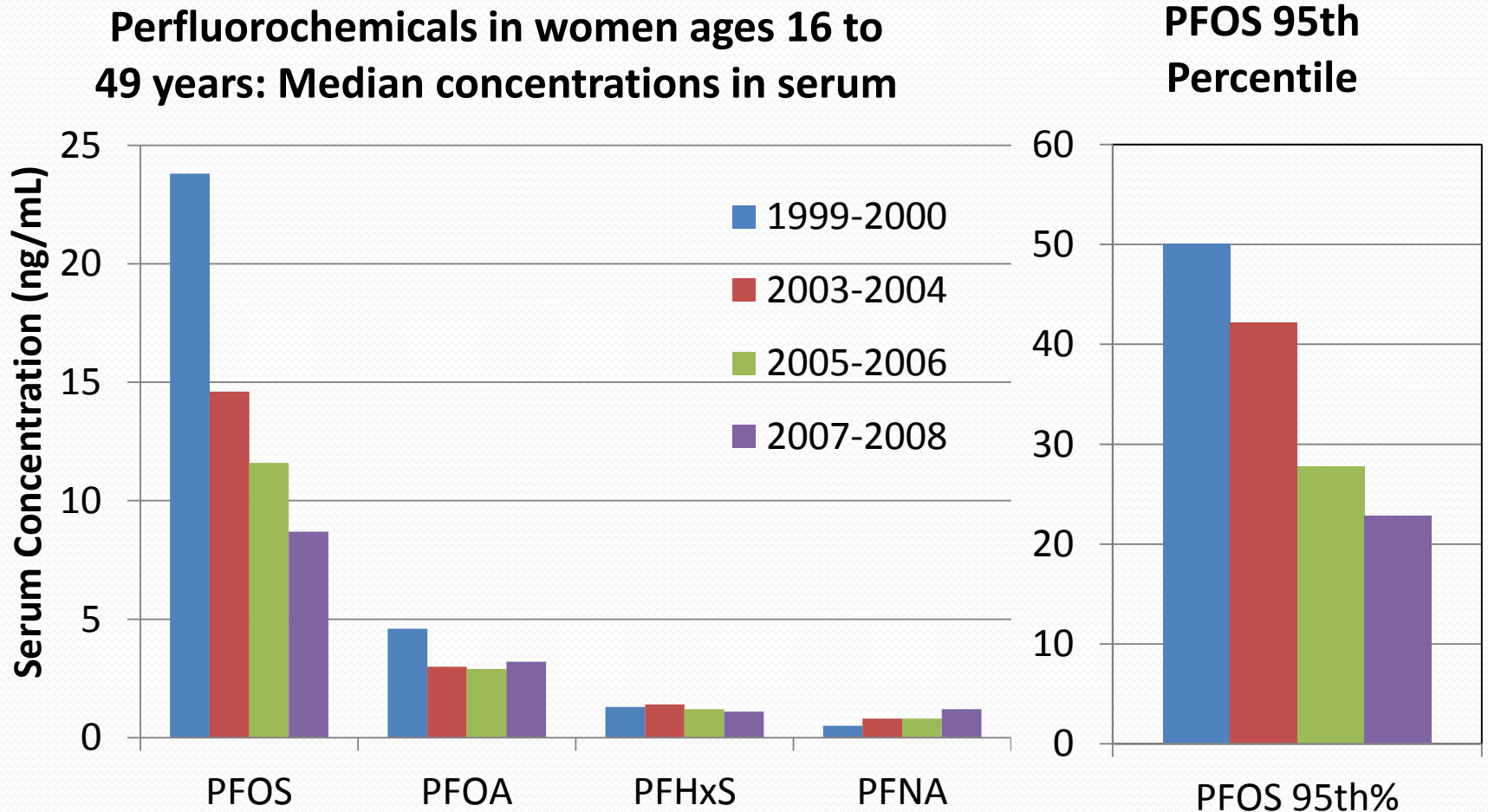
- Widely used since 1950s due to unique thermal & surfactant properties
 - Non-stick pans, stain resistant textiles, household cleaners, food packaging, polishes, fire fighting foams, etc.
- People contact them regularly but only minor absorption through skin
- However, PFCs have contaminated the environment – particularly water supplies
- Found in the serum of the majority of the US population



PFCs Exposures

- Voluntary phase out PFOS then PFOA in ~2000
 - Then mandatory by 2015
- Highly stable in the environment – halflife of decades
 - Are persistent organic contaminants
 - Bioaccumulate in wildlife and animals
 - Biological half-lives also years - so will remain in the body more decades after an exposure
- Ingestion is the primary route identified to date, though inhalation of dust possible

How has the phase-out worked?



<https://www.epa.gov/sites/production/files/2015-05/documents/biomonitoring-pfcs-data.pdf>

Are There Health Concerns?

- In laboratory animals at high PFOS/PFAS doses and *in vitro*:
 - Changes in liver, thyroid and pancreatic function
 - Changes in hormone levels
 - Neurodevelopment effects
 - Liver, testicles, mammary glands, pancreas tumors
 - Immune effects on human blood cells

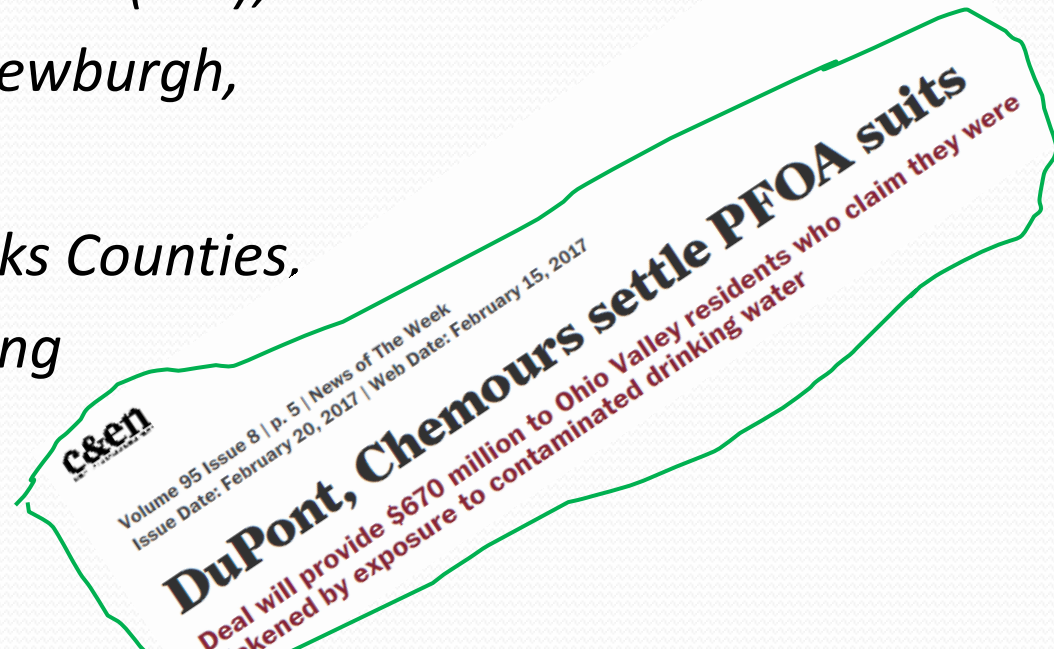
Are There Health Concerns?

- Some, but not all humans studies
 - Developing fetus/child – effects on growth, learning, behavior
 - Decreased fertility and interferes with natural hormones
 - Increase cholesterol
 - Thyroid disease
 - Affects immune system
 - Increased cancer risk

From: https://www.atsdr.cdc.gov/pfc/health_effects_pfcs.html
https://www.niehs.nih.gov/health/materials/perflourinated_chemicals_508.pdf

Locations that have expressed concerns?

- Serum Blood Monitoring Program in NH
- Fish advisories in Minnesota, Michigan, Alabama
- Lawsuits over contaminate drinking water:
 - *Minnesota Class Action Suit (3M);*
 - *El Paso, CO; Du Pont; Newburgh,*
 - *NY; Paulsboro,*
 - *NJ; Montgomery & Bucks Counties,*
 - *PA; NH; and more coming*



What are the issues with drinking water?

- High levels found in ground and drinking water:
 - near PFC facilities
 - Waste Water Treatment Plants
 - military bases
 - airports where fire fighting foams used
 - urban groundwater etc.

[EWG Map of PFC Water Contamination](#)



Gloucester County PFC Water Contamination Information

Community information and help regarding the Solvay PFC water contamination. Individual community tabs across the top appear according to order of contamination discovered.

Last Updated: Aug 22, 2016 | URL: <http://guides.gcls.org/PFCWaterContamination> | [Print Guide](#) | [RSS Updates](#)

[Paulsboro](#) | [West Deptford](#) | [Woodbury](#) | [Greenwich](#) | [East Greenwich](#) | [Selected Websites](#)

N.J. a hot spot for 'Teflon' chemical in drinking water

- [N.J. a hot spot for 'Teflon' chemical in drinking water, study says](#)

They're called "Teflon" chemicals, but they could just as easily be called stain-resistant carpet chemicals, or waterproof parka chemicals.

While they may produce items valued by consumers, they also show up in New Jersey's drinking water with greater frequency than any state except California, according to a Harvard University analysis of water samples nationwide.

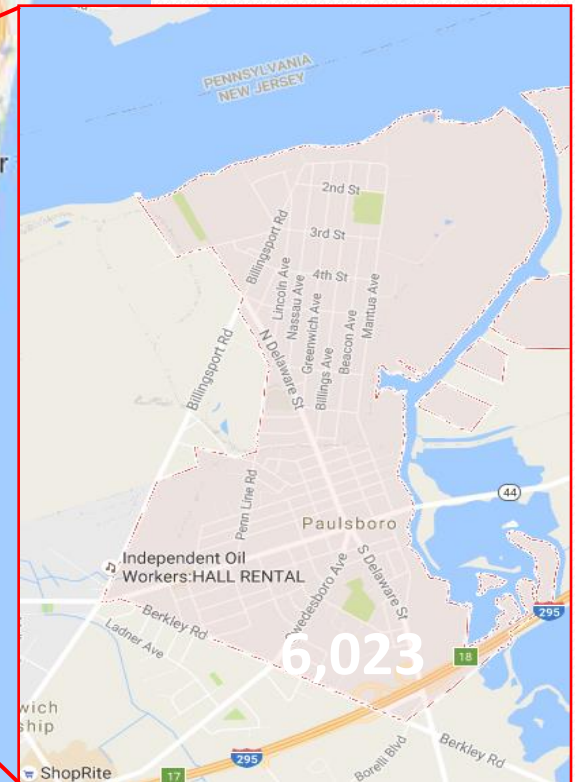
Plastics firm settles Paulsboro suit

- [Plastics firm settles Paulsboro suit](#)

PAULSBORO - A West Deptford plastics company must pay for blood testing of Paulsboro residents who drank from the borough's contaminated water supply.

Solvay Specialty Polymer and Arkema — entities that operated a manufacturing plant at 10 Leonard Lane in West Deptford — have not admitted its operations discharged PFNA (Perfluorononanoic acid) into the borough's water supply, as a class-action lawsuit claims.

A map of the Philadelphia metropolitan area and surrounding regions. Major highways are shown in orange with their respective shields (Interstates 76, 78, 95, 276, 295, 380, 476, 80, 81, 287, 95, 195, 222, 30, 83, 695, 50, 13; and State Routes 1, 222, 30, 83, 695, 50, 13). Cities and towns labeled include Philadelphia, Allentown, Easton, Reading, Lancaster, King of Prussia, Trenton, Bricks, Toms River, Wilmington, Vineland, Atlantic City, Ocean City, Wildwood, Cape May, Dover, Elkton, Bel Air, Towson, Baltimore, and New York. A red location pin is placed in the Philadelphia area, near the intersection of I-76 and I-95. A red line connects this pin to a small inset map in the bottom right corner, which shows a broader view of the region, including parts of New Jersey and Delaware, with labels for 'Ind. W.', 'Ladner', 'Wich ship', and 'ShopRite'.





1904 Incorporated 1904
 1917 First major industry in Paulsboro
 1929 Patterson Oil; further development
 1936 Refinery begins operation
 1954 Eastern Gas & Fuels
 1960 Sinclair Refining Corporation
 1968 Sells to BP

Not environmental
 tion activities
 NJDEP
 Derailment
 (~23,000
 ing deep water



Paulsboro: An abbreviate modern history

<http://www.bpaulsboronj.com/site/history.php>

PFNA Water Contamination in Paulsboro

- NJDEP: that Solvay Specialty Polymers is responsible for PFNA contamination of public water supplies and private wells:
 - The Solvay West Deptford plant is the only industrial facility in the area to use PFNA
 - NOTE: Solvay does not produce PFNA but uses it in their manufacturing processes
 - Solvay stopped using PFNA in 2010

Solvay Specialty Polymers

- The US corporate headquarters for Solvay Inc. is in Princeton
 - A leading chemicals producer worldwide
- The West Deptford site was established in 1986 as Ausimont SpA
- 2012 merged into Solvay Specialty Polymers USA, LLC
- The site employs ~140 people



Solvay, PFCs and Drinking Water

- 2009: Perfluorononanoic acid (PFNA) a PFC was discovered in the community water supply of Paulsboro
 - Result of Delaware River Keepers activities monitoring PFCs in the Delaware River Watershed
 - Also in private well water in Paulsboro and surrounding towns
- PFNA contamination is unique to this site in the US
 - There are many other PFC contamination sites/exposed populations

Water Health Advisories

- *Delaware River Keeper & Delaware River Basin Commission Published a report with PFNA levels as high as 976 ng/L in 2012*
- DEP Measured Paulsboro Water Source of 150ng/L
- EPA Drinking Water Health Advisory (May 2016) PFOS
 - = 70 ng/L, PFOA = 70 ng/L and combined



STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER MONITORING AND STANDARDS

NJ DEP Water Advisories

PFOA = 40 ng/L (2007)

PFNA = 10 ng/L (2015) Interim

Groundwater Quality Criteria



Two Studies Being Conducted

- 1) In partnership with New Jersey Department of Health – CDC Grant to Develop Biomarker Capability:

Assessing PFNA Body Burdens following Drinking Water Intervention

- 2) With NIEHS CEED Funding to *Understand the Serum PFNA Levels of Paulsboro Residents*
 - Serum Levels were tested as part of a Lawsuit Settlement for Paulsboro, NJ
 - Questionnaire administered to gather preliminary exposure and health data

Assessing PFNA Body Burdens following Drinking Water Intervention

Planning of an Exposure Study

- Obtain Human Subjects Board Approval
- Multiple layers of concern
 - Study design for number of expected participants
 - Political issues within NJ DOH and NJ DEP
 - Contacts with local politicians
 - Meeting with community groups
 - Develop risk communication plan

Used a Community Engaged Research Approach

- Research issue identified by NJ DOH
- PFNA drinking water contamination was identified in local news outlets and mayors offices as a community concern
- Study concepts and implementation plans reviewed by oversight committee, included:
 - Community group, State Agencies, Academics
 - Contact with local political officials
 - Advice for identifying approaches in communities

Myths about Risk Communication

- We don't have enough time and resources to have a risk communication program.
- Telling the public about a risk is more likely to unduly alarm people than keeping quiet.
- Communication is less important than education. If people knew the true risks, they would accept them.
- We shouldn't go to the public until we have solutions to environmental health problems.
- These issues are too difficult for the public to understand.
- Technical decisions should be left in the hands of technical people.

Key Components

- Need to formulate plan approved at multiple levels within governmental agency
- Contact interested community groups to organize small group meetings of residents
- Collaborative with community
 - Address multiple townships affected
 - Identify consumers of public and private well water
 - Different SES
- Formulate communication strategy

Establishing Communication

needs for recruitment/dissemination of study results

- Communication is two-way
- Currently identifying partners and appropriate forum and type of communication
 - Contact with mayors' offices
 - Work with local environmental and religious groups for organizing meetings and recruiting subjects
- Recruitment also through flyers, mailings, advertisement, social media and word of mouth
- Need to translate the scientific findings into understandable terms and explain gaps in knowledge

Considerations of Communication

- Situation in community is a high-concern and emotionally charged, thus both negative and positive information has been put out
 - Recognize that negative information receives significantly greater weight and remembered
- Want to focus on what can be done than not being done
- Needs to be an on-going process
 - Requires listening, caring, empathy
 - Competence, expertise , knowledge
 - Honesty, opening and transparency
- Plan on establishing multiple meetings



Current Status of Project

- IRB Approved
- NJDOH and NJDEP agree with sampling plan and process
- Discussed with mayors and administrators of Paulsboro and West Deptford and state assemblyman
- Will be presenting to town commission
- Work with Delaware River Keepers
- Finalizing communication plans
- Field team to start

Exposure to PFNA contaminated drinking water in Paulsboro New Jersey; A preliminary study



Study Team

- **Epidemiology**

- Judith Graber, PhD, MS
- Betsy Marshall, PhD, MS
- Cora Alexander

- **Study implementation**

- Kathy Black, PhD
- Shahnaz Alimokhtari
- Clarimel Cepeda
- Jennifer Gilman
- Marta Hernandez
- Alan Perez

- **Exposure science**

- Clifford Wiesel, PhD
- Panos Georgopoulos, PhD
- Zhongyuan (Wheat) Mi, MPH
- Omkar Bhawmik

- **Environmental Medicine**

- Robert Laumbach, MD, MPH, CIH

- **Community outreach**

- Kerry Butch

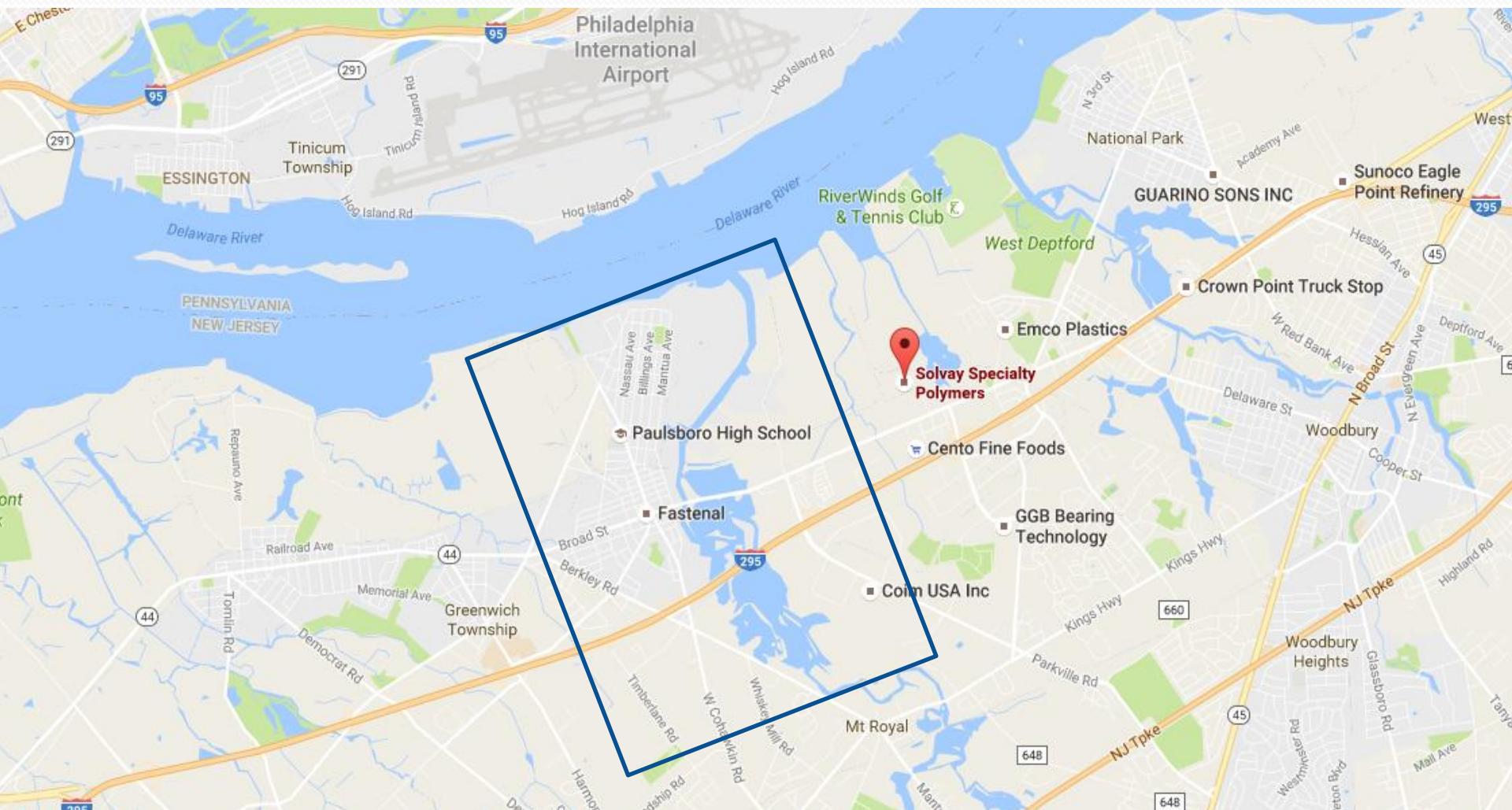
- **MPH Student volunteers**

- Taylor Black
- Prerna Malik, DDS
- Amber Minnick
- Parita Ratnani, DDS
- Darsey Schulaka





Perfluorononanoic acid (PFNA) and Paulsboro



Class Action Lawsuit; 2014

- Filed by 3 residents of Paulsboro against Solvay Specialty Polymers
- Claiming health risk from PFNA contamination of the Paulsboro community water supply
 - Settled in the summer of 2016
- Resident Class - eligibility
 - Lived in the Paulsboro Borough for at least 12 months
 - From August 19, 2009 through April 10, 2014

Class Action Lawsuit

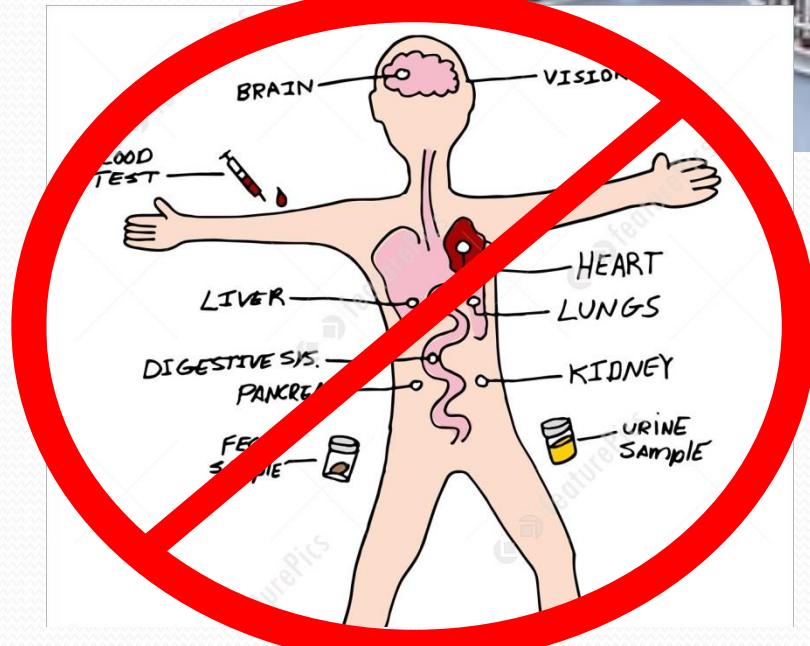
- Award:
 - Receive one blood test of PFC levels
 - Allowed for up to 6,000 persons to have their blood drawn
 - Adults and children
- Solvay set aside:
 - \$1.42 million



PFC testing - So What??

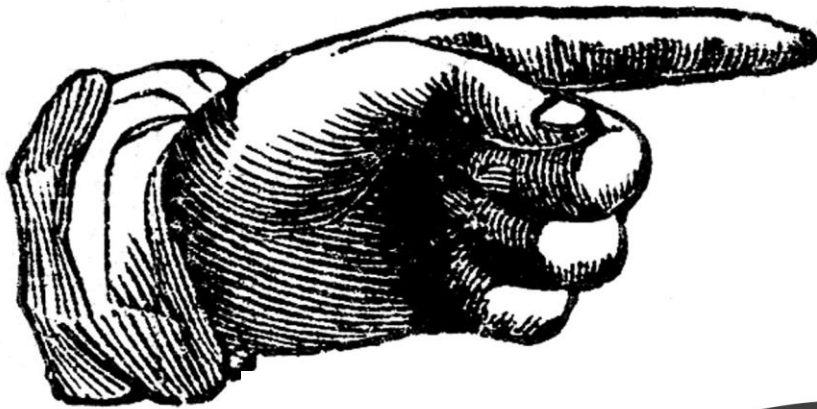
So what was the resident class settlement meant to do?

- Testing was intended to identify:
“the possible presence or absence of 16 PFCs and their relative current concentrations in their blood”
- Not intended to assess:
 - Any possible health effects
 - Long term exposure



Rutgers study – How we got involved

Please Notice This



Paulsboro PFNA Study

Aims: Use the PFC data collected in the context of the law suit to:

1. Describe the distribution of PFCs in blood, including PFNA, of Paulsboro residents
 - By age, sex, and race-ethnicity
 - Compare with U.S. national (NHANES) blood levels
2. Assess the relationship between PFCs blood test results and possible exposure sources including Paulsboro community water and well water
3. Assess associations between PFCs levels and self-reported health outcomes

Paulsboro PFNA Study

“As well, a long-term goal of this project is to develop a relationship with members of the Paulsboro community...in order to enter into a research partnership with them.”



STUDY APPROACH

6,000 Paulsboro current or former residents eligible for blood draw by participating in the law suit

1,329 (22%) had their blood tested
= Eligible for the pilot study

STUDY DESIGN

1,329 people eligible
Informed consent; Enroll in study
= On site or by mail

- Let us make a copy of their blood result
- Complete a short survey

Option to take the online survey
Took about 10 minutes
More detailed exposure and health information

- Age, sex, race/ethnicity
- When first live in Paulsboro?
- Concerns about the PFNA in the water?

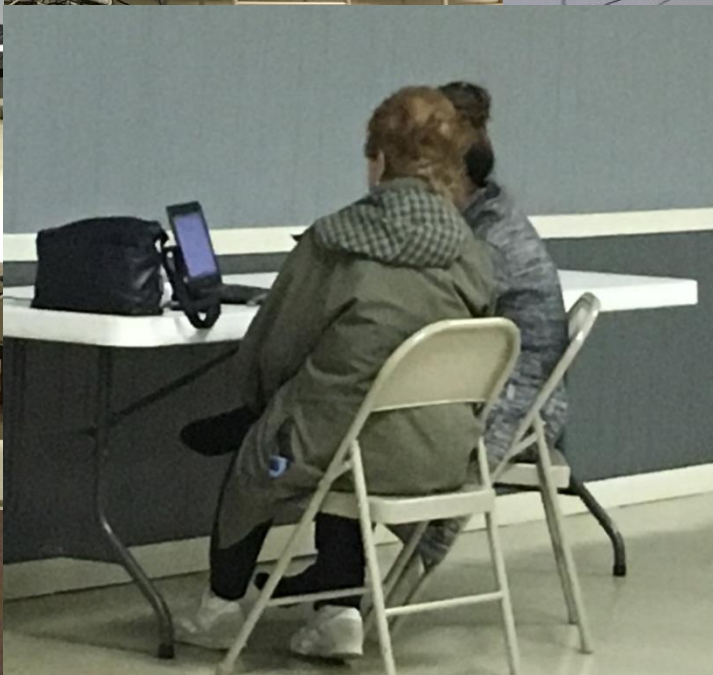
- Residential history
- Water consumption
- Occupations possibly related to PFC exposure
- Health symptoms and conditions

Outreach plan

1. Contact list of interested plaintiffs
2. Community outreach
 - Letter sent to all households
 - Flyers sent to area community and faith-based organizations
 - Posted in community businesses
 - Posted information on Facebook and Craig's list
 - On study days, did street outreach

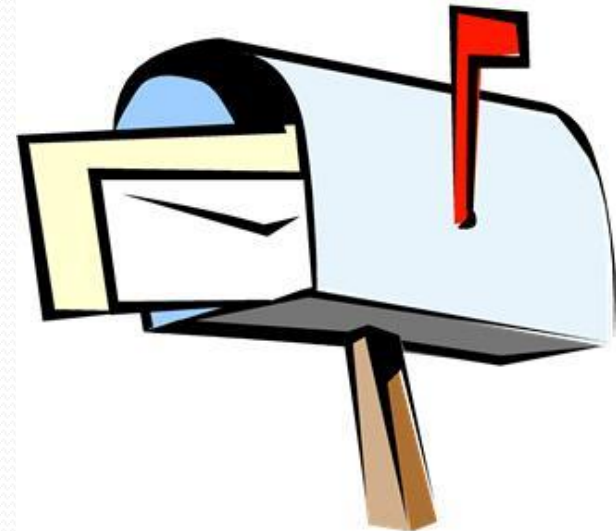






Implementation barriers

- Planned 4 field data collection sessions - **completed 6**
 - Issue: Turnout was low
 - **BUT** results were not being returned in promised timeframe
 - 60 to 75 days – last blood draw was mid September
 - Last results not returned until the end of March!
- Solution:
 - People could participate by mail
 - Ended April 15th



Results

“Describe the distribution of PFCs in blood, including PFNA, of Paulsboro residents”

- Still conducting analysis...

Next steps

- Finish with our analysis PFC blood levels
 - Assess associations with frequency of self-reported health outcomes
 - Assess associations with exposure surrogates
 - Respond to other community concerns

Community Concern Identified

- Blood results are returned with no explanation
- Blood results cover letter excerpt:

“The report does not include any interpretation of the blood test results, and the cost of any potential interpretation of the blood test results by medical or health professionals is not included in the settlement benefits. As Class Administrator, we do not have any information about the interpretation of your test results.”
- We have had numerous inquiries about how to interpret results from worried claimants and frustrated local physicians

Blood result report -BOTTOM (NUMBERS ARE SIMULATIONS)

AXYS ANALYTICAL SERVICES 2045 MIUS RD, SIOUX FALLS, SD 57105 V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811 Contract No.: 4887		Form 1A PERFLUORINATED ORGANICS ANALYSIS REPORT		012345 Sample Collection: 00-Aug-2016	
Matrix:	SERUM	Lab Sample I.D.:	L222222-20		
Sample Receipt Date:	00-Aug-20 16	Sample Size:	0500 ml		
Extraction Date:	00-Aug-2016	Initial Calibration Date:	00-Sep-2016		
Analysis Date:	00-Sep-2016 Time:00:0000	Instrument ID:	LC MS/MS		
Extract Volume (uL):	2000	Column ID:	C18MS		
Injection Volume (uL):	15	Sample Data Filename:	FC6G_221S: 00		
Dilution Factor:	NA	Blank Data Filename:	FC6G_221S: 00		
Concentration Units:	ng/ml	Cal. Ver. Data Filename:	FC6G_221 S:00		

This page is part of a total report that contains information necessary for accreditation compliance.
Results are compliant with GALA accreditation described in the total report. Sample results relate only to the sample tested.

COMPOUND	LAB FLAG ¹	CONC. FOUND	REPORTING LIMIT (RL) ²	RETENTION TIME
PFBA	ND		0.500 (L)	
PFPeA	ND		0.500 (L)	
PFHxA	ND		0.500 (L)	
PFHpA	ND		0.500 (L)	
PFDA		4.31	0.500 (L)	6:11
PFNA		3.80	0.500 (L)	6:11
PFDA		0.677	0.500 (L)	7:11
PFUnA		0.432	0.500 (L)	7:11
PFDoA	ND		0.500 (L)	
PFBS	ND		1.00 (L)	
PFHxS		4.12	1.00 (L)	6:11
PFOS		10.0	1.00 (L)	7:11
PFOSA	ND		0.500 (L)	

(1) Where applicable, custom lab flags have been used on this report; ND = not detected at RL.
(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit = lowest calibration level equivalent; Q = contract defined limit.

NOTE: This revised report replaces any previously dated reports as evidenced by the 'Create Date' and identified by: SJ000000

These data are validated and reported as accurate and in accord with AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

CEED's Community Outreach Engagements Core (COEC) response

- Developing an informational packet including:
 - A one-page explanation of the blood test results
 - NJ Department of Health's Drinking Water Facts: Perfluorinated Chemicals (PFC's) in Drinking Water
 - Answers to "Frequently Asked Questions."
 - Resources as well as names and numbers of people to call for additional information.
- Will send to:
 - Study participants
 - Area physicians
 - Will include CDC's *"Overview of PFAS & interim guidance for clinicians responding to patient exposure concerns"*

Not Real Results

These are the chemical compounds (PFNAs) that were tested in your blood.

ND means "non detect." None of the corresponding chemicals in the compound column were detected in this blood sample.

This column shows when a compound was found in your blood and at what level.

The Reporting Limit is the lowest level that the lab can see.

COMPOUND	LAB FLAG ¹	CONC. FOUND	REPORTING LIMIT (RL) ²	RETENTION TIME
PFBA	ND		0.500 (L)	
PFPeA	ND		0.500 (L)	
PFHxA	ND		0.500 (L)	
PFHpA	ND		0.500 (L)	
PFOA		5.88	0.500 (L)	6:15
PFNA		4.61	0.500 (L)	6:38
PFDA	ND		0.500 (L)	
PFUnA	ND		0.500 (L)	
PFDoA	ND		0.500 (L)	
PFBS	ND		1.00 (L)	
PFHxS		2.60	1.00 (L)	6:28
PFOS		6.16	1.00 (L)	7:32
PFOSA	ND		0.500 (L)	

(1) Where applicable, custom lab flags have been used on this report; ND = not detected at RL.

(2) Reporting Limit (Code): S = sample detection limit; M = method detection limit; L = lowest calibration level equivalent; Q = contract defined limit.

These data are validated and reported as accurate and in accord with AXYS Analytical Services Ltd. ISO17025 compliant quality assurance processes.

Signed: _____ Jason MacKenzie _____



“Do you have any concerns you would like to share with us about the PFNA water contamination that occurred in the Paulsboro public water supply?”

“Yes, I am concerned about the long term effects that it may have on me and my children's health”

“I drink plenty of tap water and have my whole life. I would like to know if doing so has affected my health or may in the future.”

“There was never a time we were educated about the substances in our water. Telling us about contamination but not giving us details is not ok”



• Next Steps?

- Report back to the community this summer
 - Engage the community in next steps
- Disseminate findings to scientific community
- Public health response – depends on findings:
 - More comprehensive studies?
 - Monitor community for health outcomes?



How did the testing work?

