State Uses of the PFAS Exposure Assessment Technical Tools
Poll Question #1
Today’s Speakers

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New York State Department of Health

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Bureau of Epidemiology
Pennsylvania Department of Health
Westhampton Beach / Quogue, NY
PFAS Exposure Assessment

Using CDC/ATSDR’s PFAS Exposure Assessment Technical Tools

New York State Department of Health
Center for Environmental Health
Background
Background: What are PFAS

• Perfluoroalkyl and Polyfluoroalkyl Substances
  • Include more commonly known PFAS, such as PFOA, PFOS, PFHxS along with 1000s of others
• Human-made
  • In use since the 1940s
  • Voluntarily phased out in 2000s
• Persistent in the environment
  • Found in animals around the world
• Some have a long half-life
  • PFOA – 2 to 4 years
  • PFOS – 5 to 6 years
Background: PFAS - Uses

- Firefighting foam
- Non-stick cookware
- Stain, water, grease resistant coatings
  - Clothing
  - Carpeting
  - Furniture
- Food packaging
- Paints, varnishes, sealants
- Ski wax
Background: PFAS and People’s Health

- Elevated cholesterol
- Increased risk of thyroid disease
- Decreased immune system response
- Decreased birth weight
- Decreased fertility
- Increased hypertension during pregnancy
Background: Gabreski Air National Guard Base

- Gabreski Air National Guard Base (a former DOD site) lies immediately to the north of the Westhampton Beach & Quogue
  - Firefighting foam containing PFOS was used on the base for firefighting and fire training exercises
- In November 2015 two public drinking water wellfields in the area were found to have high levels of PFOS.
  - Meetinghouse Rd wells – 2,400 ppt (well #19)
  - Gus Guerra wells – 550 ppt (well #2)
- Wells were taken out of service
- It was not known how long levels had been this high
  - Nor how extensively the water was distributed
Background: Westhampton Beach/Quogue Community

- SCWA estimated 4,250 service connections within this study area
  - However, 70% of homes in the area are seasonally occupied homes
- 2010 Census estimates
  - 3,500 year round residents in 1,400 households
- Previously, SCWA identified ~65 private well owners in the area
  - In 2017 NYSDOH offered them water and blood testing
    - Water results for PFOS ranged from ND (~70%) to 1,600 ppt
    - Serum results for PFOS ranged from <3 ug/L to >80 ug/L
PFAS Exposure Assessment Technical Tools (PEATT)

• A set of tools developed by ATSDR/CDC to help state and local health departments conduct PFAS exposure assessments
  • Includes
    • Study design considerations
    • Survey questions
    • Examples of invitation and results letters
    • Communication materials
Goals:

• Use CDC/ATSDR’s PFAS Exposure Assessment Technical Tools (PEATT) to evaluate exposure to PFAS in the Westhampton Beach/Quogue community

• Evaluate components of the PEATT and provide feedback to ASTHO and ATSDR/CDC
Methods
Sample selection:

- Using the PEATT (and Census information) we determined that ~150 participants in 60 households would be needed to complete the assessment.

- Households in the study area were identified using a commercially available database - from ReferenceUSA.
  - Other options considered:
    - Suffolk County Water Authority billing address records
    - Real Property (Tax) records

- Commercial data source had some limitations:
  - Area with no postal delivery
  - Missing records
Invitation package

Information for participants about the study

This study is called an exposure assessment. The main goal for this exposure assessment is to measure PFAS and other PFAS-like level blood levels in residents of the Westhampton Beach and Quiogue area, who were exposed to contaminated drinking water. The New York State Department of Health (NYSDOH) will conduct this exposure assessment from April through June 2023.

Procedures, risks, and benefits of our study to help you decide if you will participate.

Procedures for the Exposure Assessment
First, we will ask you to answer a few questions; the questionnaire should take less than 20 minutes to complete. We will also give you a blood test order to have your blood drawn at the Christian & Richard Hugel Healthcare Center in Windham Beach. A phlebotomist at the Healthcare Center will draw a small amount of your blood for testing. Only staff at the Healthcare Center and NYSDOH project staff will have access to the sample (and only NYSDOH staff will know the results). The Healthcare Center will then send your blood sample to the Health Sciences Laboratory at the NYSDOH to measure the levels of PFAS. There will be no charge to you for the blood draw or the laboratory analysis. Each participant in your household will receive up to $50 cash card as compensation for their time.

At the completion of the exposure assessment, NYSDOH will mail your blood test results to you at the address you provided on the questionnaire. If you would like to talk with NYSDOH staff about your results, or if you are not responsible for the results, you can call the NYSDOH at 518-402-7950. The NYSDOH staff will be happy to answer any questions you might have. Your blood sample will not be tested for any other chemicals or agents without your consent. Your PFAS-like test results (not including any information that may identify you personally) will also be used by the NYSDOH and the Centers for Disease Control and Prevention for long-term understanding of PFAS exposure in the general population.

What are PFAS?
Per- and Polyfluoroalkyl Substances (PFAS) are a large group of man-made chemicals that were used in a wide range of industries.

Use of PFAS has greatly decreased in the past 30 years, but you can still be exposed to PFAS that are in the environment (soil, soil, etc.) and in consumer products (food, clothing products, personal care products, paints, and more).

PFAS are widely found in the environment and present in the human body for years. Scientists are not sure about the health effects of human exposure to PFAS. Why does the health department want my blood for PFAS?
We detected elevated levels of PFAS in the drinking water supply in your community. We want to determine the PFAS blood levels of people exposed to the contaminated water.
Invitation package

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)
Frequently Asked Questions

What are PFAS?
Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a large group of man-made chemicals that have been used in industry and consumer products worldwide since the 1970s.
- PFAS do not occur naturally, but are widespread in the environment.
- PFAS are found in people, wildlife, and fish all over the world.
- Some PFAS can stay in people's bodies for a long time.
- Some PFAS do not break down easily in the environment.

How can I be exposed to PFAS?
PFAS contamination may be in drinking water, food, indoor dust, some consumer products, and workplaces. Most exposure occurs through drinking contaminated water or eating food that contains PFAS.
Although some types of PFAS are no longer used, some products may still contain PFAS:
- Food packaging materials
- Nonstick cookware
- Stain-resistant carpet treatments
- Water resistant clothing
- Cleaning products
- Paints, varnishes, and sealants
- Firefighting foams
- Some cosmetics

How can I reduce my exposure to PFAS?
PFAS are present at low levels in some food products and in the environment (air, water, soil, etc.), so you probably cannot prevent PFAS exposure altogether. However, if you live near known sources of PFAS contamination, you can take steps to reduce your risk of exposure.
- If your drinking water contains PFAS above the EPA Lifetime Health Advisories, consider using an alternative or treated water source for any activity in which you might swallow water.
  - Drinking
  - Food preparation
  - Cooking
  - Bathing foods, and
  - Preparing infant formula
- Check for fish advisories for water bodies where you fish.
- Follow fish advisories that tell people to stop or limit eating fish from waters contaminated with PFAS or other compounds.
- Research has shown the benefits of eating fish so continue to eat fish from safe sources as part of your healthy diet.
- Read consumer product labels and avoid using those with PFAS.
Survey and informed consents

• Participants were screened for eligibility
  – Live in the study area year round
  – Have lived in study area two years
  – Served by public water

• Field staff then visited homes to administer survey and collect consent/assent forms
  – Used HIPAA compliant version of Survey Monkey to collect survey data electronically
Survey Collection
Serum collection

• At the time of the interview participants were given a test order for blood testing at a local health care clinic.
Participant recruitment

- Addresses retrieved from ReferenceUSA database and geocoded within study area
- Households randomly selected to send invitation letter
  - 54 undeliverable letters for households in Quogue
  - 244 letters returned
- Potentially delivered invitation letters
- Households called to participate and completed eligibility survey
- Eligible households
  - 22 ineligible households
- Households including 161 individuals completed the interview and provided blood samples
Analysis and reporting

• Samples were analyzed for 11 PFAS by NYSDOH’s Wadsworth Center Labs
• Participants first received their individual results
  – Compared to NHANES
• Group and multivariate results sent out at later date
Analysis and reporting

<table>
<thead>
<tr>
<th>Name</th>
<th>Date sample taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFHxS</td>
<td>Below LOD *</td>
</tr>
<tr>
<td>PFOA</td>
<td>Below LOD *</td>
</tr>
<tr>
<td>PFBS</td>
<td>Below LOD *</td>
</tr>
<tr>
<td>PFHxS</td>
<td>2.55</td>
</tr>
<tr>
<td>PFOA</td>
<td>0.714</td>
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<tr>
<td>PFAS</td>
<td>3.89</td>
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<tr>
<td>PFOS</td>
<td>4.69</td>
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<tr>
<td>PFOSA</td>
<td>Below LOD *</td>
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</table>

**U.S. population in mg/L**

<table>
<thead>
<tr>
<th>Type of PFAS</th>
<th>Geometric Mean</th>
<th>95th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFHxS</td>
<td>1.55</td>
<td>6.60</td>
</tr>
<tr>
<td>PFOA</td>
<td>0.714</td>
<td>3.80</td>
</tr>
<tr>
<td>PFBS</td>
<td>2.55</td>
<td>6.70</td>
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</tbody>
</table>

**Notes:**
- For PFAS levels in mg/L, refer to the PFAS MEDIANS and PFAS levels for POPULATION in mg/L.
- PFAS levels in mg/L are based on the U.S. population age 12 and up.
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**PFAS Exposure Assessment for the Westchase Beach and Quizano area**

**Information Sheet**

October 2018

Per-and Polyfluoroalkyl Substances (PFAS) Exposure Assessment for the Westchase Beach and Quizano area

What chemicals were measured in my blood?

A list of per- and polyfluoroalkyl substances (PFAS) measured in people’s blood for this study. Full chemical names and common names are provided.

**PFAS**

- Perfluorooctane sulfonate (PFOS)
- Perfluorooctanoic acid (PFOA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluoromethyl sulfonic acid (PFMFS)
- Perfluorooctane sulfonic acid (PFOSA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluoromethyl sulfonic acid (PFMFS)
- Perfluorooctanoic acid (PFOA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluoromethyl sulfonic acid (PFMFS)
- Perfluorooctanoic acid (PFOA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluoromethyl sulfonic acid (PFMFS)

What were the sources of information for the U.S. population comparison PFAS levels?

The Centers for Disease Control and Prevention (CDC) collects survey information and tocals the blood samples from an estimated 5,000 people across the country as part of a survey called NHANES (the National Health and Nutrition Examination Survey). CDC tests the blood samples for chemicals like PFAS as well as many other chemicals. The NHANES blood results are from a representative sample of men, women, and children between the ages of 12 and older, as well as adults. The NHANES blood results are from a representative sample of men, women, and children between the ages of 12 and older, as well as adults. The NHANES blood results are from a representative sample of men, women, and children between the ages of 12 and older, as well as adults.

What does the PFAS exposure mean for my health?

These results tell you how your PFAS levels compare to the national average for the U.S. population. Your PFAS levels may affect your health, including:

- **Positive health effects:**
  - Changes in birth outcomes (e.g., low birth weight, preterm birth)
  - Increased risk of cancer
  - Developmental effects (e.g., learning disabilities, behavior problems)

- **Negative health effects:**
  - Changes in birth outcomes (e.g., low birth weight, preterm birth)
  - Increased risk of cancer
  - Developmental effects (e.g., learning disabilities, behavior problems)

- **Economic impacts:**
  - Changes in birth outcomes (e.g., low birth weight, preterm birth)
  - Increased risk of cancer
  - Developmental effects (e.g., learning disabilities, behavior problems)

- **Environmental impacts:**
  - Changes in birth outcomes (e.g., low birth weight, preterm birth)
  - Increased risk of cancer
  - Developmental effects (e.g., learning disabilities, behavior problems)

Scientists are still learning about the health effects of perfluorochemicals (PFAS). Some studies in humans have shown that PFAS may affect development, fertility, and other processes in the body, including changes in hormone levels, immune function, and metabolism. It is important to understand that PFAS levels in your blood are not indicative of your overall health status, and that the NFAS blood results are not a comprehensive assessment of your health.

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Physician Outreach

- Sent ATSDR’s PFAS Clinician Guidance to all local physicians and practices
- Worked with Dr. Kenneth, Spaeth at Northwell Health's Occupational and Environmental Medicine Center to provide additional consultation for physicians
Results
Demographics

Age Groups
- 19 and under: 40.4%
- 20-39: 30.4%
- 40-59: 18.0%
- 60 and older: 11.2%

Gender
- Males: 57.8%
- Females: 42.2%
## Results

<table>
<thead>
<tr>
<th>PFAS</th>
<th>% of samples with PFAS detected</th>
<th>Geometric Mean (mcg/L)</th>
<th>95th percentile (mcg/L)</th>
<th>Geometric Mean (mcg/L)</th>
<th>95th percentile (mcg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Westhampton Beach/Quogue</td>
<td></td>
<td>U.S. population (mcg/L)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2015-2016</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PFBuS</td>
<td>-</td>
<td>*</td>
<td>**</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>PFDeA</td>
<td>9%</td>
<td>*</td>
<td>0.58</td>
<td>0.154</td>
<td>0.70</td>
</tr>
<tr>
<td>PFDaO</td>
<td>-</td>
<td>*</td>
<td>**</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>PFHpaA</td>
<td></td>
<td>*</td>
<td>**</td>
<td>*</td>
<td>0.20</td>
</tr>
<tr>
<td>PFHxS</td>
<td>100%</td>
<td>** 3.03 **</td>
<td>** 12.26 **</td>
<td>1.18</td>
<td>4.90</td>
</tr>
<tr>
<td>PFNA</td>
<td>70%</td>
<td>** 0.64 **</td>
<td>** 1.42 **</td>
<td>0.577</td>
<td>1.90</td>
</tr>
<tr>
<td>PFOA</td>
<td>99%</td>
<td>** 1.54 **</td>
<td>** 3.48 **</td>
<td>1.56</td>
<td>4.17</td>
</tr>
<tr>
<td>PFOS</td>
<td>100%</td>
<td>** 6.56 **</td>
<td>** 18.37 **</td>
<td>4.72</td>
<td>18.30</td>
</tr>
<tr>
<td>PFOSA</td>
<td></td>
<td>*</td>
<td>**</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Me-PFOSA-AcOH</td>
<td>8%</td>
<td>*</td>
<td>0.63</td>
<td>*</td>
<td>0.60</td>
</tr>
<tr>
<td>PFUA</td>
<td>9%</td>
<td>*</td>
<td>0.59</td>
<td>*</td>
<td>0.40</td>
</tr>
</tbody>
</table>

* Geometric mean was not calculated because not enough people had results that were detectable.

** 95th percentile was below the limit of detection (LOD).
Results

PFAS Levels by Sex in Westhampton Beach/Quogue (mcg/L)

- PFOS
- PFOA
- PFHxS
- PFNA

Males
Females
Results

PFAS Levels by Age Group (mcg/L)

- PFOS
- PFOA
- PFHxS
- PFNA

19 and under | 20-39 | 40-59 | 60 and older
Results

PFAS Levels by Length of Residence (mcg/L)

- PFOS
- PFOA
- PFHxS
- PFNA

- Less than 10 years
- 10 to 19 years
- 20 to 29 years
- 30 or more years
Demographics – Age and Length of Residence

Age Groups
- 19 and under: 40.4%
- 20-39: 30.4%
- 40-59: 18.0%
- 60 and older: 11.2%

Length of Residence
- < 10 years: 39%
- 10-19 years: 22%
- 20-29 years: 19%
- 30+ years: 21%
## Results: PFOS and PFHxS levels by age

### PFOS and PFHxS blood levels in Westhampton Beach/Quogue area residents and the general U.S. population by age group.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Number of participants</th>
<th>PFOS 50th percentile level (mcg/L) (95% Conf. interval)</th>
<th>PFHxS 50th percentile level (mcg/L) (95% Conf. interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Westhampton Beach/Quogue</td>
<td>General U.S. population 2015-2016</td>
</tr>
<tr>
<td>12-19 years</td>
<td>18</td>
<td>2.82†</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.28-3.35)</td>
<td>(2.7-3.3)</td>
</tr>
<tr>
<td>20-39 years</td>
<td>29</td>
<td>4.37</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.61-5.13)</td>
<td>(3.3-4.1)</td>
</tr>
<tr>
<td>40-59 years</td>
<td>49</td>
<td>6.61</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.23-7.98)</td>
<td>(4.6-6.3)</td>
</tr>
<tr>
<td>60 years and older</td>
<td>65</td>
<td>10.60</td>
<td>7.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(8.86-12.34)</td>
<td>(7.0-9.3)</td>
</tr>
</tbody>
</table>

† Westhampton Beach/Quogue lowest age group was 7-19
* Significantly elevated above NHANES 50th Percentile
Results of Multivariate Model

- **Age** was the strongest predictor of PFOS and PFHxS levels.
- **Sex** was also a significant predictor but to a lesser extent.
- **Length of Residence** results were suggestive of an association but not all significant.
- **Fish consumption** was found to be significantly associated with PFOS and PFHxS levels.
## Regression Coefficients

### PFOS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Probt</th>
<th>exp_estimate</th>
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<tbody>
<tr>
<td>Intercept</td>
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<tr>
<td>AgeGroup 7-19 years</td>
<td>&lt;.0001</td>
<td>0.33429</td>
</tr>
<tr>
<td>AgeGroup 20-39 years</td>
<td>&lt;.0001</td>
<td>0.47111</td>
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<tr>
<td>AgeGroup 40-59 years</td>
<td>0.0010</td>
<td>0.65011</td>
</tr>
<tr>
<td>AgeGroup &gt;=60 years</td>
<td>1.00000</td>
<td>1.00000</td>
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<tr>
<td>gender Male</td>
<td>0.0422</td>
<td>1.18801</td>
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<tr>
<td>gender Female</td>
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</tr>
<tr>
<td>RLength &lt;10 years</td>
<td>0.0082</td>
<td>0.67763</td>
</tr>
<tr>
<td>RLength 10 to 19 years</td>
<td>0.8704</td>
<td>0.98083</td>
</tr>
<tr>
<td>RLength 20 to 29 years</td>
<td>0.7842</td>
<td>0.96182</td>
</tr>
<tr>
<td>RLength 30+ years</td>
<td>1.00000</td>
<td>1.00000</td>
</tr>
<tr>
<td>Ate locally caught fish</td>
<td>0.0465</td>
<td>1.18274</td>
</tr>
<tr>
<td>Never ate locally caught fish</td>
<td>1.00000</td>
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### PFHxS

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<tbody>
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<td>Intercept</td>
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<td>AgeGroup 40-59 years</td>
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<tr>
<td>gender Male</td>
<td>0.0150</td>
<td>1.29864</td>
</tr>
<tr>
<td>gender Female</td>
<td>1.00000</td>
<td>1.00000</td>
</tr>
<tr>
<td>RLength &lt;10 years</td>
<td>&lt;.0001</td>
<td>0.44013</td>
</tr>
<tr>
<td>RLength 10 to 19 years</td>
<td>0.1526</td>
<td>0.79628</td>
</tr>
<tr>
<td>RLength 20 to 29 years</td>
<td>0.1973</td>
<td>0.79173</td>
</tr>
<tr>
<td>RLength 30+ years</td>
<td>1.00000</td>
<td>1.00000</td>
</tr>
<tr>
<td>Ate locally caught fish</td>
<td>0.0455</td>
<td>1.23684</td>
</tr>
<tr>
<td>Never ate locally caught fish</td>
<td>1.00000</td>
<td>1.00000</td>
</tr>
</tbody>
</table>
Conclusions
PFOS Serum Concentrations in Other Populations

Geometric Mean Serum Concentration of PFOS (mcg/L)

- 3M Workers, Decatur, AL (2000): 910 mcg/L
- Decatur, AL (2010): 40 mcg/L
- East Metro, MN (2008): 36 mcg/L
- Decatur, AL (2016): 23 mcg/L
- East Metro, MN (2014): 19 mcg/L
- Newburgh, NY (2017): 16 mcg/L
- Pease Tradeport, NH (2015): 9 mcg/L
- Westhampton Beach/Quogue, NY (2018): 6.6 mcg/L
- NHANES (1999-2000): 30 mcg/L
- NHANES (2013-2014): 5 mcg/L
PFHxS Serum Concentrations in other Populations

Geometric Mean Serum Concentration of PFHxS (mcg/L)

- 3M Workers, Decatur, AL (2000): 180 mcg/L
- Newburgh, NY (2017): 10 mcg/L
- East Metro, MN (2008): 8 mcg/L
- Decatur, AL (2010): 6 mcg/L
- East Metro, MN (2014): 5 mcg/L
- Pease Tradeport, NH (2015): 4 mcg/L
- Westhampton Beach/Quogue, NY (2018): 3 mcg/L
- NHANES (1999-2000): 2 mcg/L
- NHANES (2013-2014): 1 mcg/L
Conclusions

- Although we did see statistically significant elevations of PFOS and PFHxS in the community the excesses were small
  - Age may have played a role
  - Fish consumption may have played a role
- We don’t really know how these levels compare to other New Yorkers and more specifically other Long Island residents
  - Would need a NYS statewide biomonitoring program to determine this
- In general, the results are not indicative of long-term, high-level exposure to PFAS in the Westhampton Beach/Quogue community
- A full report for the project is forthcoming and will be shared with participants and the community.
Partners

- ASTHO
- CDC/ATSDR
- NYSDOH’s Wadsworth Laboratory
- Stony Brook University
- Stony Brook/Southampton Hospital
  - Hiegel Healthcare Center in Westhampton Beach
Thanks – staff

Steve Forand
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Judy Liu

Field Staff
Nandee Aung
Sarah Davis
Leila Esmailzada
Kelsey Reardon
Sam Yagudayev

https://www.health.ny.gov/environmental/investigations/drinkingwaterresponse/

Contact NYSDOH - beoe@health.ny.gov  518-402-7950
Community Level Biomonitoring for Per and Polyfluoroalkyl Substances (PFAS) in Pennsylvania

Sharon Watkins, PhD., Anil Nair, Ph.D., MPH.
Bureau of Epidemiology
Pennsylvania Department of Health

PEATT Pilot Project Webinar
August 6, 2019
Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)

- Man-made chemicals
- Used in protective surfaces and things that have water-repellant coatings
- PFAS-containing firefighting foam
EPA Health Advisory Levels

2009 - Provisional Health Advisory Levels (PHAL)

• 0.4 ug/L for PFOA and 0.2 microgram per liter (ug/L) for PFOS (400 and 200 parts per trillion, respectively)

May 2016 - Lifetime Health Advisory Level (LHAL)

• 70 parts per trillion or 0.07 ug/L for PFOS and PFOA combined.

PFOA - Perfluorooctanoic acid
PFOS - Perfluorooctanesulfonic acid
Background

- Former Naval Air Warfare Center (NAWC)-Warminster Twp. Bucks County (840 acre site)
  - In operation from 1940s-1997
  - Firefighter training activities using foams containing PFAS
NAWC

- 2013: PFAS detected in ground water
- 2014: all contaminated public wells taken out of service
- 2015: PFAS found in 93 out of 100 private wells within a 1-3 mile radius
- Private well owners were given bottled water
Background

- Former Naval Air Station Joint Reserve base and Horsham Air Guard Station (1,200 acre site)
  - In operation from 1920s-2011

Contamination in two public water systems
- 2014 - Five public wells were taken out of service

- 2016- EPA released LHAL, additional wells were taken out of service, private well owners were given bottled water
PFAS Exposure in Community

- Levels 21 times higher (1,440 ppt) than EPA’s health advisory level (70 ppt) found in a municipal well in one PWS area
- Assumed to have been exposed for a long time - nearly 50 years
- Wide range of exposure:
  - Some municipal wells had no levels of PFAS
  - Some municipal wells much higher than national guideline
• CDC/ATSDR has developed a toolkit to conduct biomonitoring for PFAS
• Pennsylvania was chosen for the pilot program to evaluate the toolkit
• Feedback from this project-
  ▶ Will be used to improve the toolkit
  ▶ Will support a larger, national study
PFAS Exposure in Southeastern PA

- Affected area = population of 84,184 (2010 census)
Participant Selection

- Aimed to select 500 participants
- We mailed eligibility information form and invitation letter to 600 randomly selected households

Eligibility form
- How many in each household?
- How many lived there prior to July 1, 2016?
- How many willing to participate?
Participant Selection - Response Rates

- Total households contacted: 600
- Total households responded: 276
- Household level response rate: **46%**
- Number of eligible participants identified: 584 (including 113 kids aged 3-17 years)
- Number of eligible participants who completed the questionnaire and the informed consent form: 305
- Number of eligible participants who completed paperwork **AND** provided blood samples: 235 – from 118 households
- Individual participation rate: **40%** (235 out of 584)
- Household level participation rate: **19.6%** (118 out of 600 contacted)
PEATT Pilot Project

• Weekly clinics in Bucks and Montgomery Counties to draw the blood samples

• From May through September 2018

• 235 samples obtained and sent to Wadsworth Laboratory in the New York State Health Department

• Wadsworth returned all results to DOH, and all 235 participants were notified of their individual results along with information on national and community averages
PEATT Pilot Project Timeline

April
- April 30th: Weekly conference calls established between DOH and stakeholders in NY, BOL, Bucks County, Montgomery County

May
- May 1st: Initial Letters and Eligibility Forms sent to 350 households in affected water supply area
- May 16th: First Community Meeting to describe PEATT Pilot Project
- May 25th: Initial Letters and Eligibility Forms sent to additional 250 households in affected area
- May 29th: First Blood Draw clinic scheduled
  - Clinics continued through September 22nd
- May 30th: Community update with DOH presentation at Dept of Defense Restoration Advisory Board Meeting (RAB)

June
- June 7th: Began reminder emails and phone calls to participants who had not returned paperwork
- June 21st: Began reminder emails and phone calls to participants who returned paperwork, but had not scheduled clinic appointments
  - Reminders continued through September

July
- July 25th: DOH presentation at EPA community meeting
- Aug 6th: First test results received from laboratory
- Aug 22nd: Second round of test results received from laboratory

August
- Sept 5th: Final Notices sent to participants to return paperwork

September
- Sept 13th: Community update with DOH presentation at Dept of Defense Restoration Advisory Board Meeting (RAB)
- Sept 17th: Final Notices sent to participants for clinic appointments
- Sept 19th: PFAS Action Team created by PA Governor’s Office
- Sept 21st: Third round of test results received from laboratory
- Sept 25-26th: Individual Results sent to most participants

October
- Oct 18th: DOH presents to PFAS Action Team
- Oct 22nd: Fourth round of test results received from laboratory
- Oct 23rd: Individual Results sent to remaining participants

November
- Nov 19th: Community level analysis sent to participants
- Nov 30th: PFAS Action Team public meeting

December
- Dec 18th: Final call with AASTHO with feedback on PEATT Pilot Project
- Dec 19th: Final Project Report released to community
- Dec 19th: Final Community Meeting to present results/analysis to community
Reading Individual Results (first letter)

For an ADULT age 20 or older (unit: microgram/L)

<table>
<thead>
<tr>
<th>PFAS chemicals measured in your blood</th>
<th>Concentration found in your blood</th>
<th>US Population - Age groups</th>
<th>US Population - Age groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Geometric mean</td>
<td>95th percentile</td>
<td>Geometric mean</td>
</tr>
<tr>
<td>Perfluorooctanoic acid (PFOA)</td>
<td>3.52</td>
<td>1.92</td>
<td>4.19</td>
</tr>
<tr>
<td>Perfluorooctanesulfonic acid (PFOS)</td>
<td>9.60</td>
<td>3.88</td>
<td>11.00</td>
</tr>
<tr>
<td>Perfluorohexane sulfonic acid (PFHxS)</td>
<td>8.37</td>
<td>0.84</td>
<td>3.12</td>
</tr>
<tr>
<td>Perfluorononanoic acid (PFNA)</td>
<td>0.80</td>
<td>0.79</td>
<td>3.26</td>
</tr>
<tr>
<td>Perfluorobutanesulfonic acid (PFBuS)</td>
<td>ND</td>
<td>*</td>
<td>&lt;0.10**</td>
</tr>
<tr>
<td>Perfluorodecanoic acid (PFDeA)</td>
<td>ND</td>
<td>*</td>
<td>0.37</td>
</tr>
<tr>
<td>Perfluorodecanoic acid (PFDoA)</td>
<td>ND</td>
<td>*</td>
<td>&lt;0.10**</td>
</tr>
<tr>
<td>Perfluoroheptanoic acid (PFHpA)</td>
<td>ND</td>
<td>*</td>
<td>0.21</td>
</tr>
<tr>
<td>Perfluoroctane sulfonamide (PFOSA)</td>
<td>ND</td>
<td>*</td>
<td>&lt;0.10**</td>
</tr>
<tr>
<td>2-(N-Methyl-perfluorooctane sulfonamido) acetic acid (MeFOSAA)</td>
<td>ND</td>
<td>*</td>
<td>1.02</td>
</tr>
<tr>
<td>Perfluoroundecanoic acid (PFUA)</td>
<td>0.95</td>
<td>*</td>
<td>0.28</td>
</tr>
</tbody>
</table>

This is the NHANES average
95 percent of pop. is below this number

ND or * means “non detect”-levels are so tiny they cannot be detected

For an ADULT age 20 or older

Your number was in italicized bold if it exceeded the 95th percentile

Above results from NHANES 2013-2014, except PFOSA which is from 2011-2012.
<table>
<thead>
<tr>
<th></th>
<th>Study Participants (%)</th>
<th>Community (%)</th>
<th>U.S. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 12 years</td>
<td>5.1</td>
<td>14.9</td>
<td>15.8</td>
</tr>
<tr>
<td>12 to 19 years</td>
<td>8.1</td>
<td>10.9</td>
<td>11.2</td>
</tr>
<tr>
<td>20+ years</td>
<td>86.8</td>
<td>74.2</td>
<td>73.0</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>44.3</td>
<td>48.8</td>
<td>49.2</td>
</tr>
<tr>
<td>Female</td>
<td>55.7</td>
<td>51.2</td>
<td>50.8</td>
</tr>
<tr>
<td><strong>Race/Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>0</td>
<td>5.1</td>
<td>16.3</td>
</tr>
<tr>
<td>White</td>
<td>94.5</td>
<td>85.6</td>
<td>63.7</td>
</tr>
<tr>
<td>Black</td>
<td>0</td>
<td>3.0</td>
<td>12.2</td>
</tr>
<tr>
<td>Asian</td>
<td>0.4</td>
<td>4.8</td>
<td>4.7</td>
</tr>
<tr>
<td>Other</td>
<td>5.1</td>
<td>1.5</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Education Level (18+ years old)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower than College</td>
<td>20.6</td>
<td>34.7</td>
<td>40.5</td>
</tr>
<tr>
<td>Some College or more</td>
<td>74.2</td>
<td>65.3</td>
<td>59.5</td>
</tr>
<tr>
<td>Other</td>
<td>5.3</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Study group determined by water service area, community determined by Warrington, Warminster, Horsham Twps., and Ivyland Borough.
Study Demographics

Mostly adults 20+ years old

- Age groups:
  - 3 to 11 years: 5.10%
  - 12 to 19 years: 8.10%
  - 20+ years: 86.80%

More females than males

- Gender:
  - Male: 44.30%
  - Female: 55.70%

- Average age – 49 years
- 66 percent had college education or higher
- 12 percent were ever employed on a military base
Study Demographics

Most are long-term residents (>10 years)

- Estimated Tap Water Consumed Daily
  - < 4 cups: 23.80%
  - 4-7 cups: 20.40%
  - 8+ cups: 18.70%
  - unknown: 37%

- Length of Residence
  - less than 10 yrs: 14.60%
  - 10-39 yrs: 17.60%
  - 40+ yrs: 67%

- 82 percent used public water
11 PFAS tested for

- Perfluorobutanesulfonic acid (PFBS)
- Perfluoroheptanoic acid (PFHxPa)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluorononanoic acid (PFNA)
- Perfluorooctanoic acid (PFOA)
- Perfluorooctanesulfonic acid (PFOS)
- Perfluorodecanoic acid (PFDeA)
- Perfluoroundecanoic acid (PFUA)
- Perfluorododecanoic acid (PFDoA)
- Perfluorooctane sulfonamide (PFOSA)
- 2-(N-Methyl-perfluorooctane sulfonamido) acetic acid (MeFOSAA)
PFAS Detected

- Tested for 11 PFAS compounds
  - Four compounds were commonly detected
    - PFOS in 235 participants (100%)
    - PFHxS in 233 participants (99.1%)
    - PFOA in 232 participants (98.7%)
    - PFNA in 185 participants (78.7%)
  - All four detected in 79 percent of participants
PFAS Detected

• Of the remaining seven compounds-
  - PFDeA was found in 14 participants
  - MeFOSAA was found in nine participants
  - PFUA in eight participants
  - PFHpa in one participant
## Serum PFAS Levels (ug/L)

### Four most commonly found PFAS

<table>
<thead>
<tr>
<th>PFAS Compound</th>
<th>Community Results (n=235)</th>
<th>NHANES Results (2013-2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>95% Confidence Interval</td>
</tr>
<tr>
<td>PFOA</td>
<td>3.13</td>
<td>2.81-3.50</td>
</tr>
<tr>
<td>PFOS</td>
<td>10.24</td>
<td>8.86-11.83</td>
</tr>
<tr>
<td>PFHxS</td>
<td>6.64</td>
<td>5.51-7.99</td>
</tr>
<tr>
<td>PFNA</td>
<td>0.74</td>
<td>0.67-0.80</td>
</tr>
</tbody>
</table>

Range excludes <LOD
Serum PFAS Levels – Univariate Analyses

- Age
- Male gender
- Residence time
- BMI
- Private well use
- Quantity of tap water consumed
- Water service area’s proximity to military base
PFAS Exposure in Southeastern PA

- Affected area = population of 84,184 (2010 census)
Serum PFAS Levels (ug/L) by Public Water System (PWS) Area - Current Address

<table>
<thead>
<tr>
<th>PFAS Compound</th>
<th>HWSA (n=69)</th>
<th>WMA (n=98)</th>
<th>WTWSD (n=41)</th>
<th>WTWSD/NWWA (n=27)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>95% C.I.</td>
<td>Average</td>
<td>95% C.I.</td>
</tr>
<tr>
<td>PFOA</td>
<td>3.69</td>
<td>2.99-4.56</td>
<td>3.17</td>
<td>2.71-3.71</td>
</tr>
<tr>
<td>PFOS</td>
<td>12.38</td>
<td>9.47-16.19</td>
<td>10.06</td>
<td>8.06-12.57</td>
</tr>
<tr>
<td>PFHxS</td>
<td>8.81</td>
<td>6.28-12.37</td>
<td>6.98</td>
<td>5.32-9.16</td>
</tr>
<tr>
<td>PFNA</td>
<td>0.79</td>
<td>0.68-0.92</td>
<td>0.72</td>
<td>0.62-0.84</td>
</tr>
</tbody>
</table>

Significant difference in levels of all four PFAS (P≤0.05 for all) among PWS areas
WTWSD/NWWA had lower serum PFAS levels
Includes all drinking water sources
Serum PFAS Levels (ug/L) - Private Well Users – Current Address

<table>
<thead>
<tr>
<th>PFAS Compound</th>
<th>HWSA (n=1)</th>
<th>WMA (n=10)</th>
<th>WTWSD (n=3)</th>
<th>WTWSD/NWWA (n=6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>95% C.I.</td>
<td>Average</td>
<td>95% C.I.</td>
</tr>
<tr>
<td>PFOA</td>
<td>7.78</td>
<td>7.78-7.78</td>
<td>3.23</td>
<td>2.30-4.55</td>
</tr>
<tr>
<td>PFOS</td>
<td>23.60</td>
<td>23.60-23.60</td>
<td>12.59</td>
<td>8.36-18.97</td>
</tr>
<tr>
<td>PFHxS</td>
<td>25.90</td>
<td>25.90-25.90</td>
<td>8.05</td>
<td>4.48-14.47</td>
</tr>
<tr>
<td>PFNA</td>
<td>1.44</td>
<td>1.44-1.44</td>
<td>0.76</td>
<td>0.58-0.99</td>
</tr>
</tbody>
</table>

WTWSD/NWWA had lower serum PFAS levels.
### Serum PFAS Levels (ug/L) - Public Water Users - Current Address

<table>
<thead>
<tr>
<th>PFAS Compound</th>
<th>HWSA (n=61)</th>
<th>WMA (n=83)</th>
<th>WTWSD (n=31)</th>
<th>WTWSD/NWWA (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>95% C.I.</td>
<td>Average</td>
<td>95% C.I.</td>
</tr>
<tr>
<td>PFOA</td>
<td>3.65</td>
<td>2.89-4.60</td>
<td>3.24</td>
<td>2.73-3.84</td>
</tr>
<tr>
<td>PFHxS</td>
<td>8.90</td>
<td>6.11-12.96</td>
<td>7.19</td>
<td>5.31-9.73</td>
</tr>
<tr>
<td>PFNA</td>
<td>0.76</td>
<td>0.65-0.89</td>
<td>0.72</td>
<td>0.60-0.85</td>
</tr>
</tbody>
</table>

Significant difference (P≤0.05) in levels of all four PFAS compounds

WTWSD/NWWA had lower serum PFAS levels
Overall, private well users had slightly higher levels of PFOA, PFOS, and PFNA than public water users, but not PFHxS.

Public well (n=193), Private well (n=20)
Differences in levels not statistically significant (P>0.05 for all)
Serum PFAS Levels and Self-Reported Health Conditions

- Elevated cholesterol was the most frequently reported health condition.
- Those reporting elevated cholesterol also had higher PFAS levels (all four compounds).
- Those reporting endocrine disruption had higher levels of PFOA and PFHxS.
- Those with cancer had higher levels of PFOA and PFNA.
Multivariate Analysis (n=204)

- Demographic characteristics
  - age
  - gender
  - education

- Exposure characteristics
  - water source at current address
    - HSWA, WMA, WTWSD, WTWSD/NWWA, private well, other
  - quantity of water consumed at current address
  - total length of residence in the study area
  - employment information - ever employed on a base, in the area

- Health information
  - health status, BMI
Serum PFAS (PFOA, PFOS, PFHxS and PFNA) levels were positively associated with total length of residence in the study area.

Those who lived in the area for 10 years or more had higher PFAS serum levels compared to those who lived in the area less than 10 yrs.

<table>
<thead>
<tr>
<th>Total Length of Residence</th>
<th>PFOA percent higher</th>
<th>PFOS percent higher</th>
<th>PFHxS percent higher</th>
<th>PFNA percent higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-19 yrs</td>
<td>22.5%</td>
<td>89.1%</td>
<td>49.8%</td>
<td>17.3%</td>
</tr>
<tr>
<td>20-29 yrs</td>
<td>27.7%</td>
<td>66.0%</td>
<td>67.6%</td>
<td>5.8%</td>
</tr>
<tr>
<td>30-39 yrs</td>
<td>38.9%</td>
<td>77.9%</td>
<td>65.4%</td>
<td>46.1%</td>
</tr>
<tr>
<td>40+ yrs</td>
<td><strong>55.4%</strong></td>
<td><strong>124.3%</strong></td>
<td><strong>171.8%</strong></td>
<td><strong>17.0%</strong></td>
</tr>
</tbody>
</table>

Bold = statistically significant (p ≤ 0.05)
In general, PFAS levels were higher the closer the water source was to the military base.

Water sources were compared to the source farthest from the military bases (WTWSD/NWWA reference group):

<table>
<thead>
<tr>
<th>Drinking water source</th>
<th>PFOA percent higher</th>
<th>PFOS percent higher</th>
<th>PFHxS percent higher</th>
<th>PFNA percent higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>HWSA</td>
<td>157.4%</td>
<td>168.5%</td>
<td>257.2%</td>
<td>33.6%</td>
</tr>
<tr>
<td>WMA</td>
<td>104.5%</td>
<td>88.5%</td>
<td>137.4%</td>
<td>15.3%</td>
</tr>
<tr>
<td>WTWSD</td>
<td>94%</td>
<td>98.7%</td>
<td>113.9%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Other (bottled water, unknown)</td>
<td>78.1%</td>
<td>97.84%</td>
<td>77.2%</td>
<td>29.6%</td>
</tr>
<tr>
<td>Private Well</td>
<td>105.9%</td>
<td>101.24%</td>
<td>97.9</td>
<td>38.6%</td>
</tr>
</tbody>
</table>

(Bold = statistically significant p ≤ 0.05)

WTWSD/NWWA reference group
Multivariate Analysis

- Average PFHxS serum levels 32 percent higher in men

- Average PFHxS serum levels 35 percent higher in employed than never employed in study area (self-reported)

- Average PFOA serum level of participants consuming four-seven cups of tap water daily was 29 percent higher than participants consuming zero-three cups daily

- Average serum levels of PFOA, PFOS and PFNA increased with participant age
Summary

- Four PFAS compounds were consistently detected (PFOA, PFOS, PFHxS and PFNA)

- Seventy-five, 81, 94 and 59 percent of the study participants had levels exceeding the national average for PFOA, PFOS, PFHxS and PFNA respectively

- Serum levels associated with
  - receiving water from select public water systems
  - total length of residence in the study area
  - age of the study participants
  - employment in the study area
  - quantity of daily tap water consumption
PA- Specific Changes to PEATT

Sample selection
- Used eligibility information form because of exposure cut-off date
- Modified Consent/Assent form

Questionnaires
- Questionnaires had to be reworded to reflect past exposure
- Questions had to be added considering multiple residences
- Excluded questions on other sources of exposure (soil, fish, food)

Created detailed instructions for collection, handling, storage and shipment of samples

Modified results letter – initial letter and final letter
Recommendations

• **Selection Process**
  - Option to include volunteer participants and special categories of exposure (i.e. veterans)
  - Create initial eligibility form to determine number of participants in a household. This facilitates sending the correct number of forms to a household, along with return postage-paid envelopes

• **Questionnaires**
  - Need to accommodate for long duration of exposure
  - Fewer open-ended questions and more structured, multiple choice questions for health conditions
Recommendations

• **Participant Drop-out**
  - Paper questionnaire visually overwhelming - consider online survey options with built-in “skips” to lessen the perceived burden
  - Streamline the participation process - possible online scheduling for clinics
  - Consider visiting nurses/teams to collect information
  - Possible tokens of appreciation

• **Results Process**
  - Letter templates complete for information and numbers, but limited in psychological comfort for those with high levels
Communicating the Risks of PFAS

- Cancer Data Review (1985–2013) with Addendums 1 and 2
  - A review of cancer incidence rates in Horsham, Warminster and Warrington

- Fact sheets
  - PFAS FAQs

- Presented at five PFAS community meetings including the Willow Grove Air Station Restoration Advisory Board meetings

- Participated in Medical Grand Rounds in hospitals

- Always available to answer citizen emails and phone calls
  env.health.concern@pa.gov or by phone at 717-787-3350
Communicating the Risks of PFAS

- PEATT Pilot Project gave some residents the chance to find out about their own individual exposures.

- PEATT Pilot Project recruitment letter sent to 600 households
  - Included information on the limitations of interpreting the results of PFAS biomonitoring

- Results letters included information to share with physicians

- Responded to several media inquiries
PFAS Responses - Pennsylvania

PFAS Action Team

Governor’s Executive Order in September 2018

Members:

- Secretaries of
  - Department of Environmental Protection
  - Department of Health
  - Department of Military and Veteran Affairs
  - Department of Community and Economic Development
  - Department of Transportation
  - Department of Agriculture AND
  - State Fire Commissioner
PFAS Action Team - Functions

- Ensure drinking water is safe
- Identify impacted locations and develop response protocols for identified sites
- Engage stakeholders to develop site-specific plans
- Reduce risk to drinking water from potential sources
- Establish a site to inform and educate the public about PFAS
- Explore funding avenues for remediation efforts
- Engage with academic institutions, public health and environmental remediation experts
• Regular participation in DoD’s Restoration Advisory Board Community meetings
• Participation in Environmental Exposure Assessment Efforts in Other DoD Sites
• Participation in PEATT Expansion Project
• Multi-site National Health Study
Our Partners

- Centers for Disease Control and Prevention (CDC)
- Association of State and Territorial Health Officials (ASTHO)
- Agency for Toxic Substances and Disease Registry (ATSDR)
- Bucks County Health Department
- Montgomery County Health Department
- New York State Health Department Laboratory
PEATT Pilot Project Team

- Dr. Sharon Watkins
- Dr. Anil Nair
- Dr. Marshal Ma
- Susan Schrack Wood
- Dr. Farhad Ahmed
Contact Information

Should you have any questions, feel free to contact us at env.health.concern@pa.gov or by phone at 717-787-3350

For more information:

https://www.health.pa.gov/topics/envirohealth/Pages/PFAS.aspx
THANK YOU!

Questions?
Poll Question #2
ASTHOConnects
A virtual learning series for public health leaders.

Audience Q/A