

PEATT Pilot Project  
PFAS Testing  
in the  
Warrington, Warminster and Horsham areas  
Pennsylvania Department of Health

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PFAS Community Meeting    April 29, 2019





# ▶ PFAS Exposure in Southeastern PA

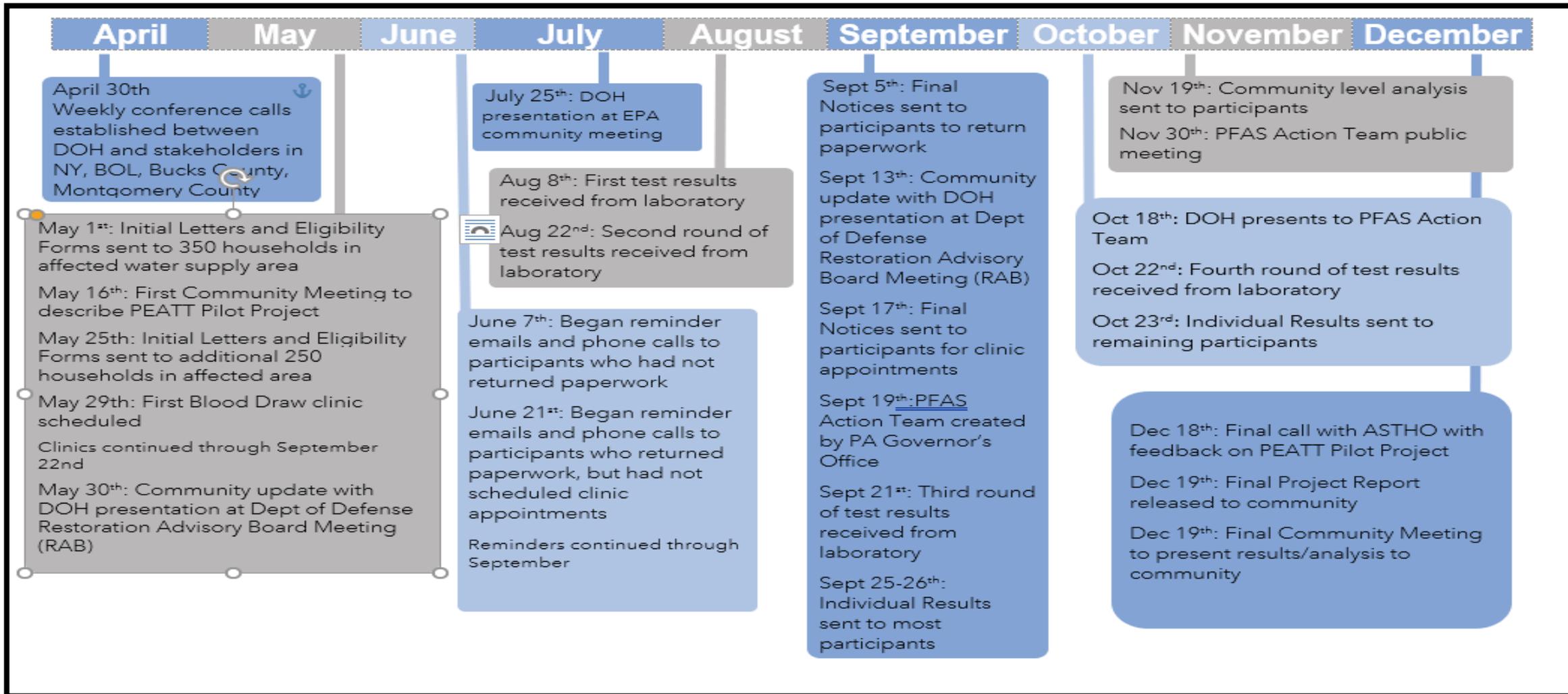
- The Naval Air Warfare Center Warminster and the Horsham Air Guard Station (formerly Naval Air Station Joint Reserve Base Willow Grove)
  - Military and firefighter training
  - Aqueous Film Forming Foam (AFFF) used on bases
  - PFAS in the foam
  - Exact composition of AFFF is proprietary
- PFAS levels in community drinking water
  - 1,440 ppt - about 21 times higher than the Lifetime Health advisory Level (70 ppt) found in a municipal well in Warminster Municipal Authority (WMA) area



# Participant Selection

- 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 Project Timeline



# PEATT Project Demographics - Comparison

	Study Participants (%)	Community (%)	U.S. (%)
<b>Age</b>			
Under 12 years	5.1	14.9	15.8
12 to 19 years	8.1	10.9	11.2
20+ years	86.8	74.2	73.0
<b>Sex</b>			
Male	44.3	48.8	49.2
Female	55.7	51.2	50.8
<b>Race/Ethnicity</b>			
Hispanic or Latino	0	5.1	16.3
White	94.5	85.6	63.7
Black	0	3.0	12.2
Asian	0.4	4.8	4.7
Other	5.1	1.5	3.0
<b>Education Level (18+ years old)</b>			
Lower than College	20.6	34.7	40.5
Some College or more	74.2	65.3	59.5
Other	5.3	0.0	0.0

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

# Results Overall

- Tested for 11 PFAS compounds (all **perfluorinated**)
  - ▣ 4 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% of participants

Note: PFOS, PFOA and PFHxS are main components found in Aqueous Film Forming Foams (AFFF)

PFHxS has longer half-life in the body

PFNA is a biodegradation product during polyvinyl fluoride production/application

PFNA blood levels are rising in the general population as PFOA, PFOS, and PFHxS levels decline

Das et al., (2015)

# Results Overall

- Of the remaining 7 compounds-
  - ▣ PFDeA was found in 14 participants
  - ▣ MeFOSAA was found in 9 participants
  - ▣ PFUA in 8 participants
  - ▣ PFHpA in 1 participant

# ➤ Results Overall—4 main compounds

- Average serum PFAS levels (level of PFAS in the blood) were higher compared to NHANES's averages
  - 94% had higher levels of PFHxS
  - 81% had higher levels of PFOS
  - 75% had higher levels of PFOA
  - 59% had higher levels of PFNA
- Results are consistent with other studies on PFAS exposure through drinking water

PFAS Compound	Community Results				NHANES Results (2013-2014)	
	Average	95% Confidence Interval	Median	Range	Average	95% Confidence Interval
PFOA	<b>3.13</b>	2.81-3.50	3.06	0.55-24.8	<b>1.94</b>	1.76-2.14
PFOS	<b>10.24</b>	8.86-11.83	9.86	1.02-105.00	<b>4.99</b>	4.50-5.52
PFHxS	<b>6.64</b>	5.51-7.99	6.61	0.54-116.00	<b>1.35</b>	1.20-1.52
PFNA	<b>0.74</b>	0.67-0.80	0.76	0.50-2.56	<b>0.68</b>	0.61-0.74

- Results shown in ug/L. Range excludes <LOD

# ➤ Results Overall – Univariate Analyses

- In general, PFAS levels increased with:
  - ▣ Age
  - ▣ Male gender
  - ▣ Residence time
  - ▣ BMI
  - ▣ Private well use
  - ▣ Quantity of tap water consumed
  - ▣ Water service area's proximity to military base

# Serum PFAS Levels by Public Water System (PWS) Area- Current Address

**Serum PFAS levels among participants in different PWS areas (includes all drinking water sources)**

PFAS Compound	HWSA (n=69)		WMA (n=98)		WTWSD (n=41)		WTWSD/NWWA (n=27)	
	Average	95% C.I.	Average	95% C.I.	Average	95% C.I.	Average	95% C.I.
PFOA	<b>3.69</b>	2.99-4.56	<b>3.17</b>	2.71-3.71	<b>3.35</b>	2.62-4.29	<b>1.78</b>	1.44-2.20
PFOS	<b>12.38</b>	9.47-16.19	<b>10.06</b>	8.06-12.57	<b>11.47</b>	8.69-15.15	<b>5.65</b>	4.17-7.67
PFHxS	<b>8.81</b>	6.28-12.37	<b>6.98</b>	5.32-9.16	<b>6.56</b>	4.61-9.33	<b>2.72</b>	1.72-4.30
PFNA	<b>0.79</b>	0.68-0.92	<b>0.72</b>	0.62-0.84	<b>0.78</b>	0.66-0.94	<b>0.59</b>	0.51-0.67

- Results shown in ug/L
- Significant difference in levels of all four PFAS ( $P \leq 0.05$  for all) among PWS areas

# Serum PFAS Levels-Public Water Users- Current Address

PFAS Compound	HWSA (n=61)		WMA (n=83)		WTWSD (n=31)		WTWSD/NWWA (n=18)	
	Average	95% C.I.	Average	95% C.I.	Average	95% C.I.	Average	95% C.I.
PFOA	<b>3.65</b>	2.89-4.60	<b>3.24</b>	2.73-3.84	<b>3.63</b>	2.76-4.78	<b>1.63</b>	1.25-2.11
PFOS	<b>12.17</b>	9.03-16.39	<b>10.06</b>	7.89-12.83	<b>12.39</b>	9.08-16.91	<b>4.53</b>	3.51-5.85
PFHxS	<b>8.90</b>	6.11-12.96	<b>7.19</b>	5.31-9.73	<b>7.69</b>	5.41-10.92	<b>2.42</b>	1.55-3.79
PFNA	<b>0.76</b>	0.65-0.89	<b>0.72</b>	0.60-0.85	<b>0.81</b>	0.66-0.99	<b>0.56</b>	0.51-0.61

- Results shown in ug/L
- Significant difference ( $P \leq 0.05$ ) in levels of all four PFAS compounds
- Consumers in HWSA had higher mean serum levels for all 4 PFAS compounds except PFNA and PFOS

# Serum PFAS Levels- Private Well Users – Current Address

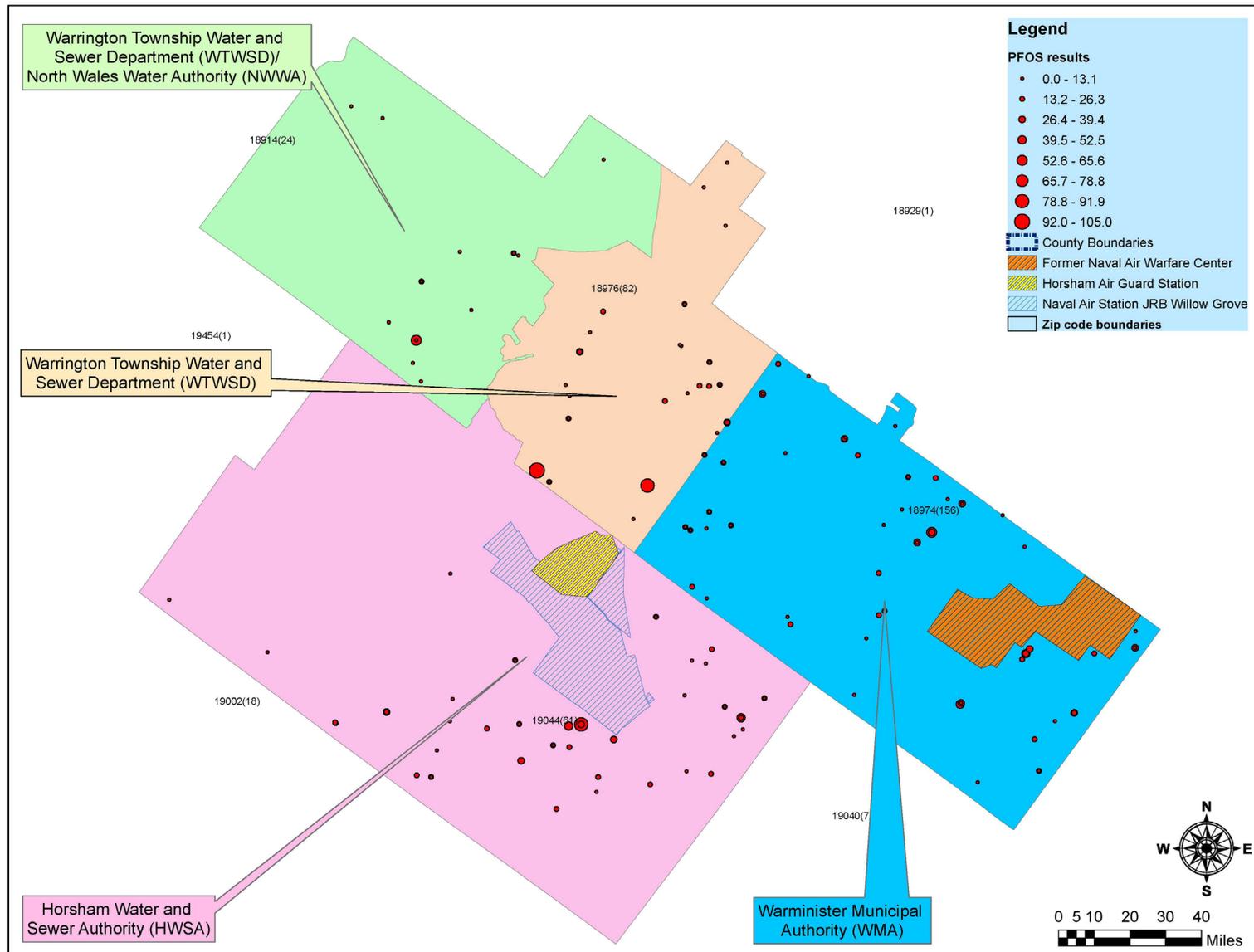
PFAS Compound	HWSA (n=1)		WMA (n=10)		WTWSD (n=3)		WTWSD/NWWA (n=6)	
	Average	95% C.I.	Average	95% C.I.	Average	95% C.I.	Average	95% C.I.
PFOA	<b>7.78</b>	7.78-7.78	<b>3.23</b>	2.30-4.55	<b>4.87</b>	2.43-9.79	<b>2.33</b>	1.27-4.28
PFOS	<b>23.60</b>	23.60-23.60	<b>12.59</b>	8.36-18.97	<b>15.94</b>	7.19-35.33	<b>7.55</b>	5.86-9.74
PFHxS	<b>25.90</b>	25.90-25.90	<b>8.05</b>	4.48-14.47	<b>11.75</b>	8.99-15.35	<b>2.29</b>	0.99-5.28
PFNA	<b>1.44</b>	1.44-1.44	<b>0.76</b>	0.58-0.99	<b>0.96</b>	0.68-1.35	<b>0.69</b>	0.37-1.31

- Results shown in ug/L
- Significant difference in levels of all four PFAS compounds
- HWSA had higher PFAS serum levels

## Serum PFAS Levels- Public vs. Private Wells- Current Address

- Serum PFAS levels were higher for private well water users compared to public water users in all PWS areas (not statistically tested - small sample size)
- Both public water users and private well users in the area of HSWA had higher serum PFAS levels compared to study participants in the PWS area of WTWSD/NWWA

# Serum PFOS levels by PWS area



# ▶ Results—Multivariate analysis

- Multivariate analysis = when we analyze more than two variables (e.g. age, sex, water source, serum PFAS levels, etc.) at the same time.
- It lets us predict the effect a change in one variable will have on the outcome variable while controlling for the effects of other variables.
- Analysis determined that average serum levels for PFOA, PFOS, PFHxS and PFNA were **positively associated** with drinking water source, and total length of residence in the study area.

# ➤ Results—Multivariate analysis

- Multivariate analysis did not account for the location of private well/bottled water users.
  - Public water users were geocoded to the correct PWS area based on their addresses.

# Multivariate analysis

- 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 the base, in the area
- Health information
  - health status, BMI

# ➤ Multivariate analysis - Results

- Overall, serum PFAS (PFOA, PFOS, PFHxS and PFNA) levels were positively aligned with total length of residence in the study area.
- Those who lived in the area more than 10 years generally had higher PFAS serum levels compared to those who lived in the area less than 10 yrs).

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

Bold = statistically significant ( $p \leq 0.05$ )

# Multivariate analysis - Results

- 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):

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

Bold= statistically significant ( $p \leq 0.05$ )  
 WTWSD/NWWA reference group

# Multivariate analysis - Results

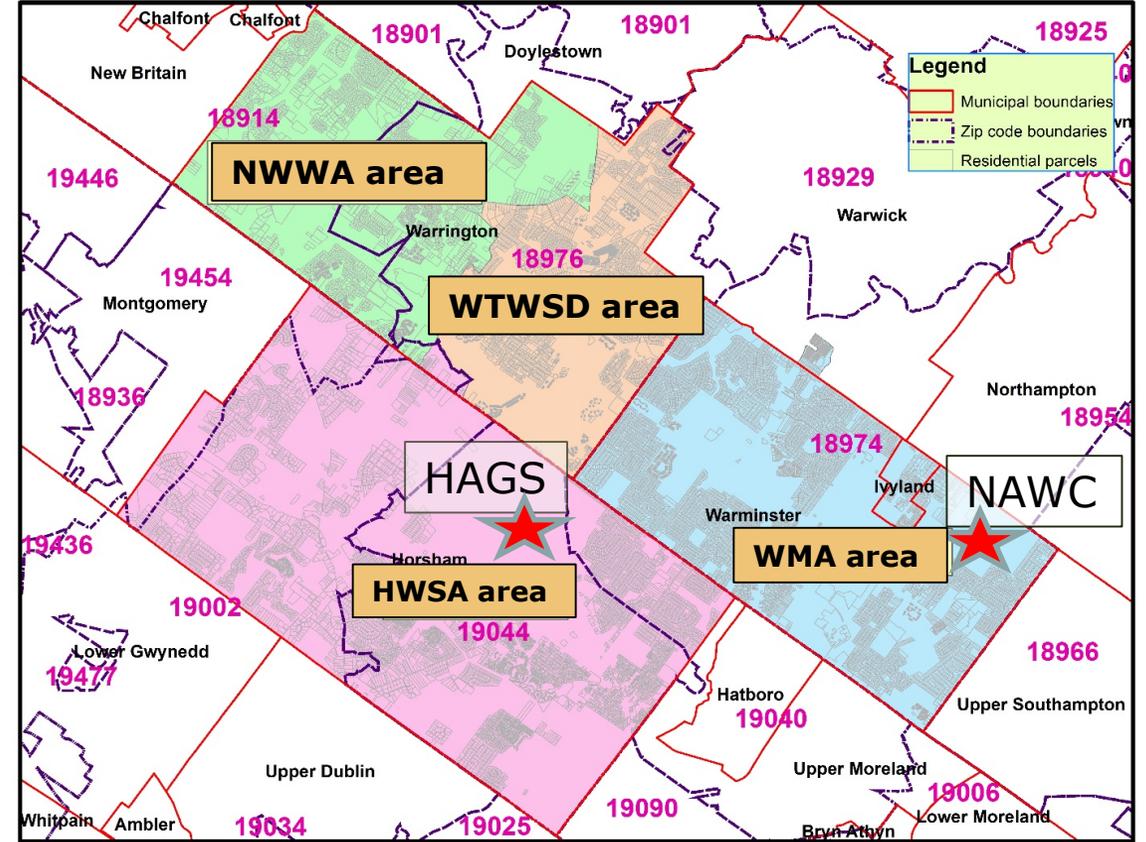
- Higher serum levels associated with proximity to the base
- HWSA consumers compared to WTWSD/NWWA consumers
  - ▣ 157% higher PFOA
  - ▣ 169% higher PFOS
  - ▣ 257% higher PFHxS
  - ▣ 34% higher PFNA

**WMA compared to WTWSD/NWWA**  
 105% higher PFOA  
 89% higher PFOS  
 137% higher PFHxS

**WTWSD compared to WTWSD/NWWA**  
 94% higher PFOA  
 99% higher PFOS  
 114% higher PFHxS

**“Other” category compared to WTWSD/NWWA**  
 78% higher PFOA  
 98% higher PFOS  
 30% higher PFNA

**Private well users compared to WTWSD/NWWA**  
 106% higher PFOA  
 101% higher PFOS  
 39% higher PFNA



# ▶ Multivariate analysis - Results

- Average PFHxS serum levels 32% higher in men than women
- Average PFHxS serum levels 35% higher in employed than never employed in study area (self-reported)
- Average PFOA serum levels of participants consuming 4-7 cups of tap water daily were 29% higher than participants consuming 0-3 cups daily
- Average serum levels of PFOA, PFOS and PFNA increased with participant age

# CDC/ASTHO Report Presentation

- Atlanta, March 18–19, 2019
  - ▣ PA DOH and NY DOH presented PEATT findings
  - ▣ New York saw similar results to ours
  - ▣ New York had many more resources available to them

# ▶ PEATT Expansion—Exposure Assessment

- Expansion project – Kickoff call April 15<sup>th</sup>
- Urine, dust, and water sampling of current participants
  - ▣ Will collect urine from **all** of our initial participants (235)
  - ▣ Will analyze 10% of samples
  - ▣ If geometric mean exceeds 95<sup>th</sup> percentile—**all** samples will be analyzed
- Dust and water sampling on 10% of current participating households

# ▶ PEATT Expansion—Exposure Assessment

- PA DOH will collect and ship urine samples
- CDC will store and analyze urine (no cost)
- PA DOH will contract with outside lab to collect and analyze dust and water
  - Initial announcement and letters to participants – May 2019
  - Sample collection –June-July 2019

# Multi-Site Health Study Opportunity

- CDC/ATSDR taking applications to participate in Multi-Site National Health Study
- Will study health implications of exposure to PFAS-contaminated drinking water
- Six sites will be accepted and given grants
- Goal is to enroll at least 6,000 adults and 2,000 children (in total across all sites)
- Research oriented, competitive grant

# Multi-Site Health Study Opportunity

- Historical reconstruction of water and serum PFAS concentrations using models
- Will study health conditions including high cholesterol, immunity issues, and thyroid function
- Can propose additional research questions for study
  - ▀ DOH is considering cancer-related investigator initiated (University) study
- Application due May 30<sup>th</sup>

# 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
- Pennsylvania Department of Environmental Protection

# PEATT Pilot Project Team

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

# Contact Information

**Should you have any questions or concerns, feel free to contact us at [env.health.concern@pa.gov](mailto: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>**

# ▶ 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
  - ▣ Guidance for households with college-aged children (considered residents?)
  - ▣ Blood donation/transfusion/major surgeries

# ▶ 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
- Additional Guidance
  - ▣ Literature review and continuing education on PFAS studies and the current state of the science regarding this emerging contaminant