

Pease PFC Testing Program: Final Report

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NH Department of Health & Human Services

June 16, 2016

Pease Testing Summary (1)

- PFOS, PFOA, and PFHxS were found in statistically higher levels in the Pease community compared to the general U.S. population
- The absolute difference in mean levels is small:
 - PFOS: 2.3 ppb difference
 - PFOA: 1.0 ppb difference
 - PFHxS: 2.8 ppb difference
- There were not large differences in levels between children and adolescents/adults at Pease

Pease Testing Summary (2)

- Levels of PFOS and PFOA are similar, if not lower, than levels found in the general U.S. population 10 years ago
- Levels of PFOS, PFOA, and PFHxS are lower than other environmentally exposed communities and occupationally exposed workers
- Other PFCs found in very low amounts

Pease Testing Summary (3)

- Age, sex, and time spent on Pease were most consistently associated with serum PFC levels
- Besides contaminated drinking water, likely many other unaccounted for factors contributing to serum PFC levels not evaluated in our brief questionnaire
- Based on known sources of exposure, hand-to-mouth behavior is likely contributing to childhood exposure and could explain the higher levels seen in the 3-5 year old age group

Purpose of Tonight's Meeting

- Review the final results of the Pease PFC serum testing
- Provide a context to aide interpretation of individual test results
- Address additional questions and concerns

Current Areas of Work

Aquifer
Restoration

Lead: **U.S. Air Force**

EPA (Administrative Order)

NHDES (Waste Management Division)

Public
Health
Evaluation

Lead: **NHDES** (“Health Consultation” report)

Lead: **ATSDR** (Community Assistance Panel)

Human
Exposure
Assessment

Lead: **NH DHHS** (PFC Serum Testing)

ATSDR (Technical Assistance)

ATSDR: Agency for Toxic Substances Disease Registry
EPA: U.S. Environmental Protection Agency
NHDES: New Hampshire Department of Environmental Services
NH DHHS: New Hampshire Department of Health & Human Services

Why did NH DHHS Conduct PFC Blood Testing?

- Assess individual exposure to PFCs at the community's request
- Not a health study and no medical information assessing health outcomes from PFC exposure was collected
- PFC blood test does not tell a person where the PFCs came from, and is not able to tell someone whether there might be a health impact

Brief Timeline

- May 12 2014: Haven well was shut down after finding PFOA and PFOS levels above the EPA's Provisional Health Advisory level.
- April—October 2015: NH DHHS conducted blood sampling for PFC serum testing to assess exposure levels
- Preliminary community meetings:
 - June 2015: first 98 adult test results
 - Sept 2015: first 108 pediatric results

Brief Timeline

- Last individual PFC test results were mailed out in April 2016
- May 2016: ATSDR formed the Community Assistance Panel (CAP) to help inform and plan for public health evaluation
- June 16, 2016: Final PFC blood testing report released and community meeting held to discuss results

PFC Levels in Water April 2014

PFC Name	Abbreviation	PFC Levels in µg/L (ppb)		
		Haven Well	Harrison Well	Smith Well
perfluorooctane sulfonic acid	PFOS	2.50	0.05	0.02
perfluorooctanoic acid	PFOA	0.35	0.009	0.004
perfluorohexane sulfonic acid	PFHxS	0.83	0.04	0.01
perfluorononanoic acid	PFNA	0.02	ND	ND
perfluorodecanoic acid	PFDeA	0.005	ND	0.004
perfluoroundecanoic acid	PFUA	ND	ND	0.02
Perfluorododecanoic acid	PFDoA	ND	ND	0.01
Perfluoropentanoic acid	PFPtA	0.27	0.008	0.004
Perfluorobutane sulfonic acid	PFBuS	0.05	0.002	0.0009
Perfluorohexanoic acid	PFHxA	0.33	0.009	0.004
Perfluoroheptanoic acid	PFHpA	0.12	0.005	0.003

Note: 1 µg/L = 1 ng/mL = 1 ppb = 1000 ppt

❖ 2009 PFOS PHA: 0.2 µg/L

❖ 2009 PFOA PHA: 0.4 µg/L

A full report on Pease drinking water testing can be found at:
<http://www.cityofportsmouth.com/publicworks/phwn.html>

ND = Not Detected

PHA = Provisional Health Advisory level (from 2009)

Serum PFC Testing Laboratory Panel

PFC Name	PFC Abbreviation	CDC	AXYS	CA State
Perfluorooctane sulfonic acid	PFOS	X	X	X
Perfluorooctanoic acid	PFOA	X	X	X
Perfluorohexane sulfonic acid	PFHxS	X	X	X
Perfluorononanoic acid	PFNA	X	X	X
Perfluorodecanoic acid	PFDeA	X	X	X
Perfluoroundecanoic acid	PFUA	X	X	X
Perfluorooctane sulfonamide	PFOSA	X	X	X
2-(N-methyl-perfluorooctane sulfonamido) acetic acid	Me-PFOSA-AcOH	X		X
2-(N-ethyl-perfluorooctane sulfonamido) acetic acid	Et-PFOSA-AcOH	X		X
Perfluorobutane sulfonic acid	PFBS			X
Perfluorododecanoic acid	PFDoA			X
Perfluoroheptanoic acid	PFHpA			X

CDC = Centers for Disease Control and Prevention laboratory

AXYS = AXYS Analytical Services laboratory

CA State = California State biomonitoring laboratory

How to Interpret PFC Serum Test Results

- Serum PFC test results can be compared to other study populations including:
 - General U.S. adolescent/adult without a known exposure tested as part of the CDC's National Health and Nutrition Examination Survey (NHANES)
 - Environmentally exposed communities
 - Occupationally exposed workers
- There is not a serum PFC level at which a health problem is known or expected to occur.

Primary Data Collected and Analyzed

- Serum PFC concentrations (reported in $\mu\text{g}/\text{L}$, or ppb)
- Demographic information: age, sex
- Exposure information:
 - Time spent on Pease (cumulative years of exposure to contaminated water)
 - Time since last on Pease (lag time for exposure to contaminated water)
 - Average daily water consumption (amount of daily exposure to contaminated water)
 - Firefighting occupation (other source of exposure)

Three Different Analyses

- Summary test statistics (geometric mean, Min/Max, 95th percentile, distribution graphs)
- Assess for individual relationships between demographic (age and sex) or exposure (water consumption, time on Pease, etc) characteristics and serum PFC levels
- Multivariate (multivariable) analysis (factoring in all demographic and exposure variables) simultaneously into a “linear regression model”.

Terminology

- Median: The middle number in a group of results
- Geometric Mean: A type of average used for non-normally distributed results
- Range: minimum and maximum value
- 95th Percentile: Out of 100 people, 95 would be expected to be at or below the 95th percentile level; 5 would normally be expected to be above this level
- 95% Confidence Intervals: Indicates the range where there is a 95% chance (or confidence) that the actual (“true”) result is

SUMMARY TEST STATISTICS

Summary of All Results (N=1578)

PFC Tested	PEASE TRADEPORT				NHANES, 2011-2012		
	Detection Frequency %	Geometric Mean (µg/L)	Max (µg/L)	% Above NHANES 95 th Percentile	Geometric Mean (µg/L)	Max (µg/L)	95 th Percentile
PFOS	99.8	8.59 *	95.6	9.1	6.31	235.0	21.7
PFOA	99.2	3.09 *	32	16.5	2.08	43.0	5.7
PFHxS	94.2	4.12 *	116	39.8	1.28	47.8	5.4
PFNA	85.2	0.73 ¥	5.2	2.2	0.88	80.8	2.5
PFDeA	42.1	0.22	5.6	1.6	0.20	17.8	0.7
PFUA	30.0	0.19	1.6	1.2	NC	7.0	0.6
PFOSA	2.0	0.13	0.4	N/A	NC	0.6	<0.1
Me-PFOSA-AcOH	36.1	0.09	1.58	2.1	NC	4.3	0.7
Et-PFOSA-AcOH	2.6	0.06	0.51	1.0	NC	0.7	0.1
PFBS	18.7	0.04	0.24	N/A	NC	0.8	<0.1
PFDoA	4.7	0.08	0.31	2.8	NC	1.4	0.1
PFHpA	0.9	0.07	0.39	NS	NC	1.6	0.2

N/A=not applicable, NT=not tested, NS= not shown to protect confidentiality, NC=Not Calculated.

* Geometric mean is significantly higher than NHANES comparison data,

¥ Geometric mean is significantly lower than NHANES comparison data.

Summary of Results for Ages 12 and Older (N=1212)

PFC Tested	PEASE TRADEPORT			NHANES, 2011-2012		
	Geometric Mean (µg/L)	Max (µg/L)	% Above NHANES 95 th Percentile	Geometric Mean (µg/L)	Max (µg/L)	95 th Percentile
PFOS	8.74 *	95.6	10.2	6.31	235.0	21.7
PFOA	2.99 *	32.0	15.7	2.08	43.0	5.7
PFHxS	4.21 *	116.0	39.4	1.28	47.8	5.4
PFNA	0.68 ¥	4.9	1.1	0.88	80.8	2.5
PFDeA	0.22	5.6	1.9	0.20	17.8	0.7
PFUA	0.19	1.6	1.6	NC	7.0	0.6
PFOSA	0.12	0.35	N/A	NC	0.6	<0.1
Me-PFOSA-AcOH	0.09	1.58	1.3	NC	4.3	0.7
Et-PFOSA-AcOH	0.06	0.4	1.0	NC	0.7	0.1
PFBS	NC	NS	N/A	NC	0.8	<0.1
PFDoA	NC	NS	NS	NC	1.4	0.1
PFHpA	NC	NS	NS	NC	1.6	0.2

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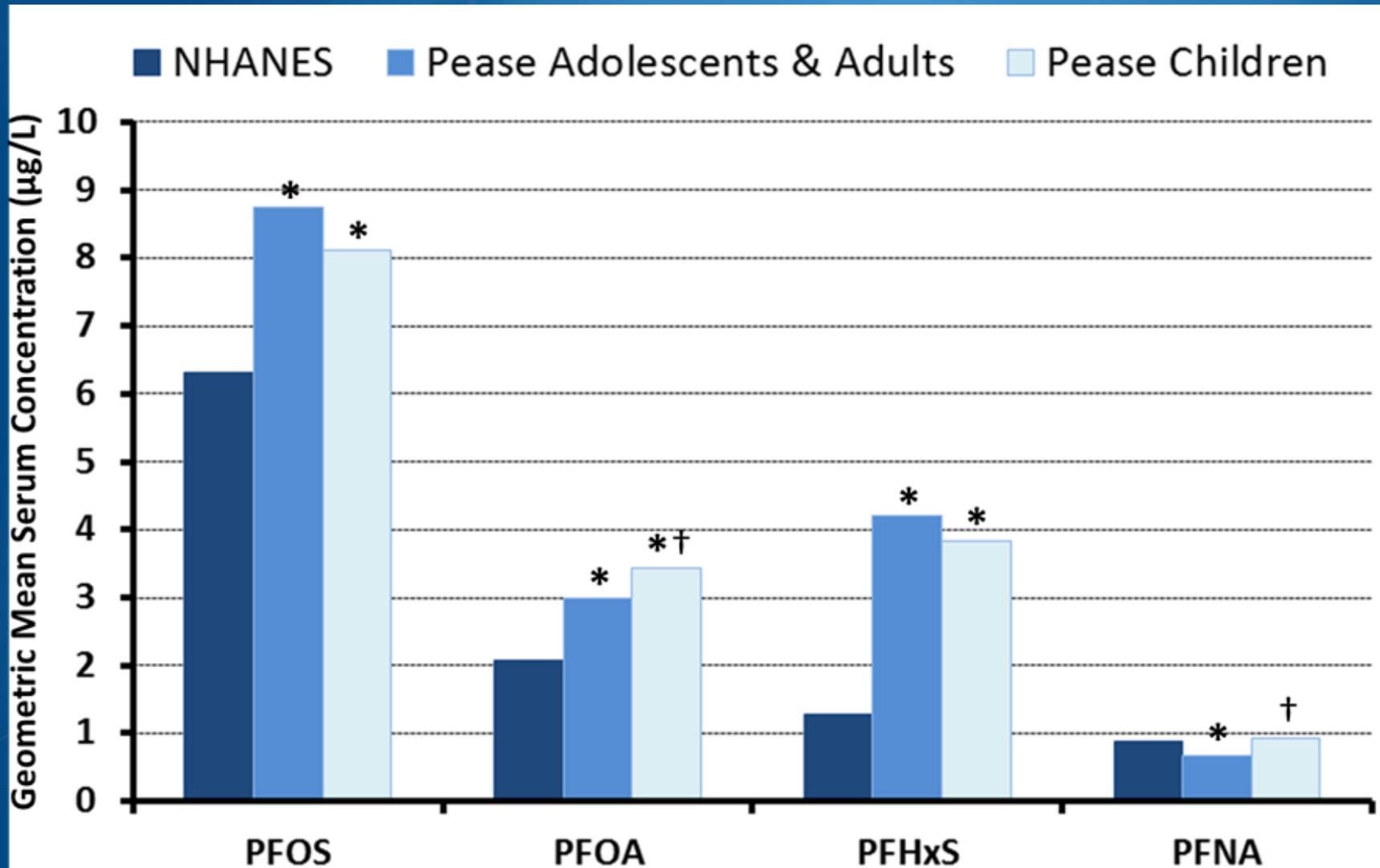
Summary of Results for Ages 11 and Younger (N=366)

PFC Tested	PEASE TRADEPORT			NHANES, 2011-2012		
	Geometric Mean (µg/L)	Max (µg/L)	% Above NHANES 95 th Percentile	Geometric Mean (µg/L)	Max (µg/L)	95 th Percentile
PFOS	8.11 *	30.8	5.2	6.31	235.0	21.7
PFOA	3.43 *	12.0	19.4	2.08	43.0	5.7
PFHxS	3.83 *	31.7	41.3	1.28	47.8	5.4
PFNA	0.92	5.2	6.0	0.88	80.8	2.5
PFDeA	0.23	0.7	0.6	0.20	17.8	0.7
PFUA	0.18	0.5	0.0	NC	7.0	0.6
PFOSA	0.17	0.4	N/A	NC	0.6	<0.1
Me-PFOSA-AcOH	0.10	1.3	5.5	NC	4.3	0.7
Et-PFOSA-AcOH	0.07	0.5	1.2	NC	0.7	0.1
PFBS	NC	NS	N/A	NC	0.8	<0.1
PFDoA	NC	NS	NS	NC	1.4	0.1
PFHpA	NC	NS	NS	NC	1.6	0.2

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Comparison of Geometric Means

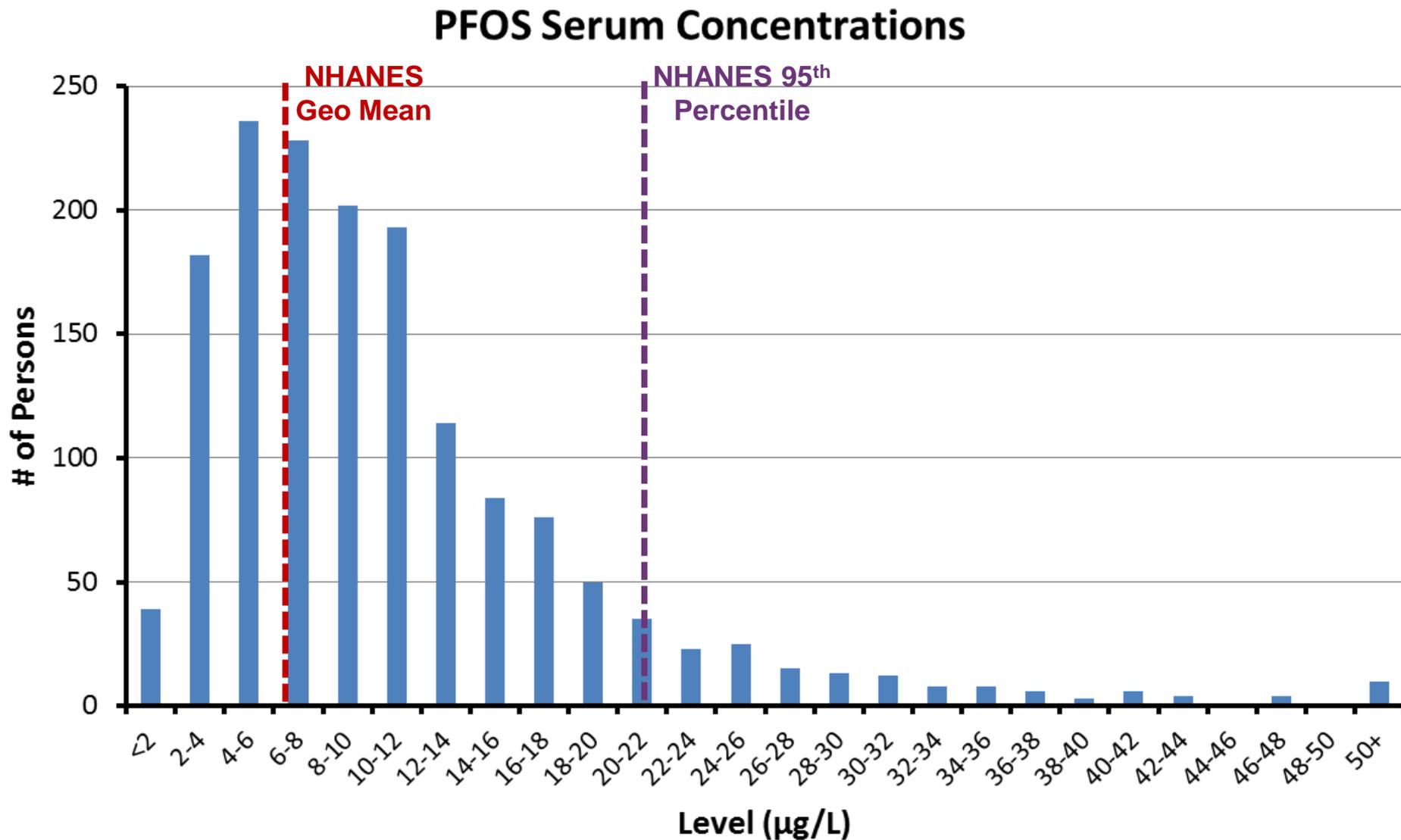


NHANES=National Health and Nutrition Examination Survey, 2011-2012 data

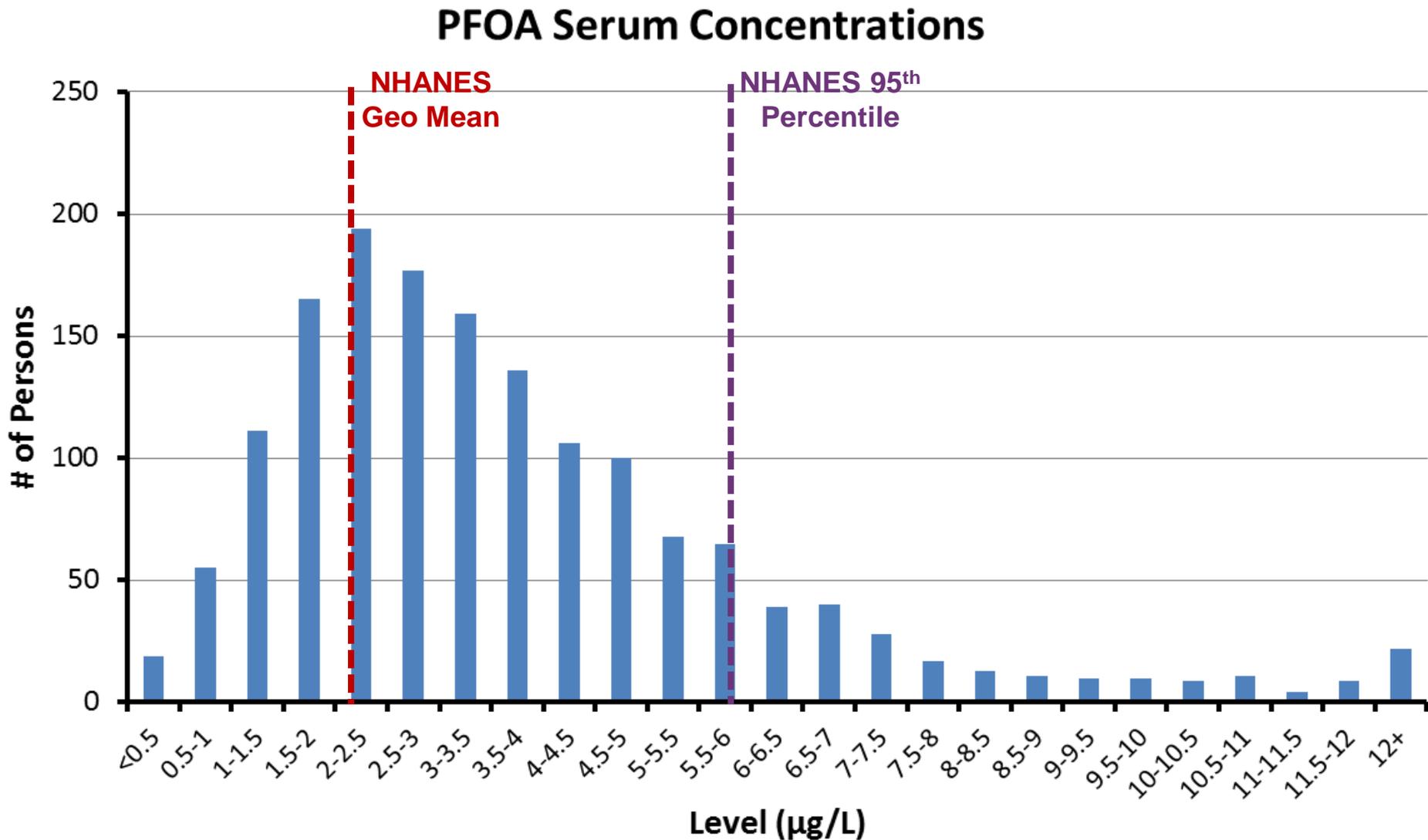
* Indicates a statistically significant difference compared to NHANES

† Indicates a statistically significant difference comparing Pease children to Pease adolescents & adults

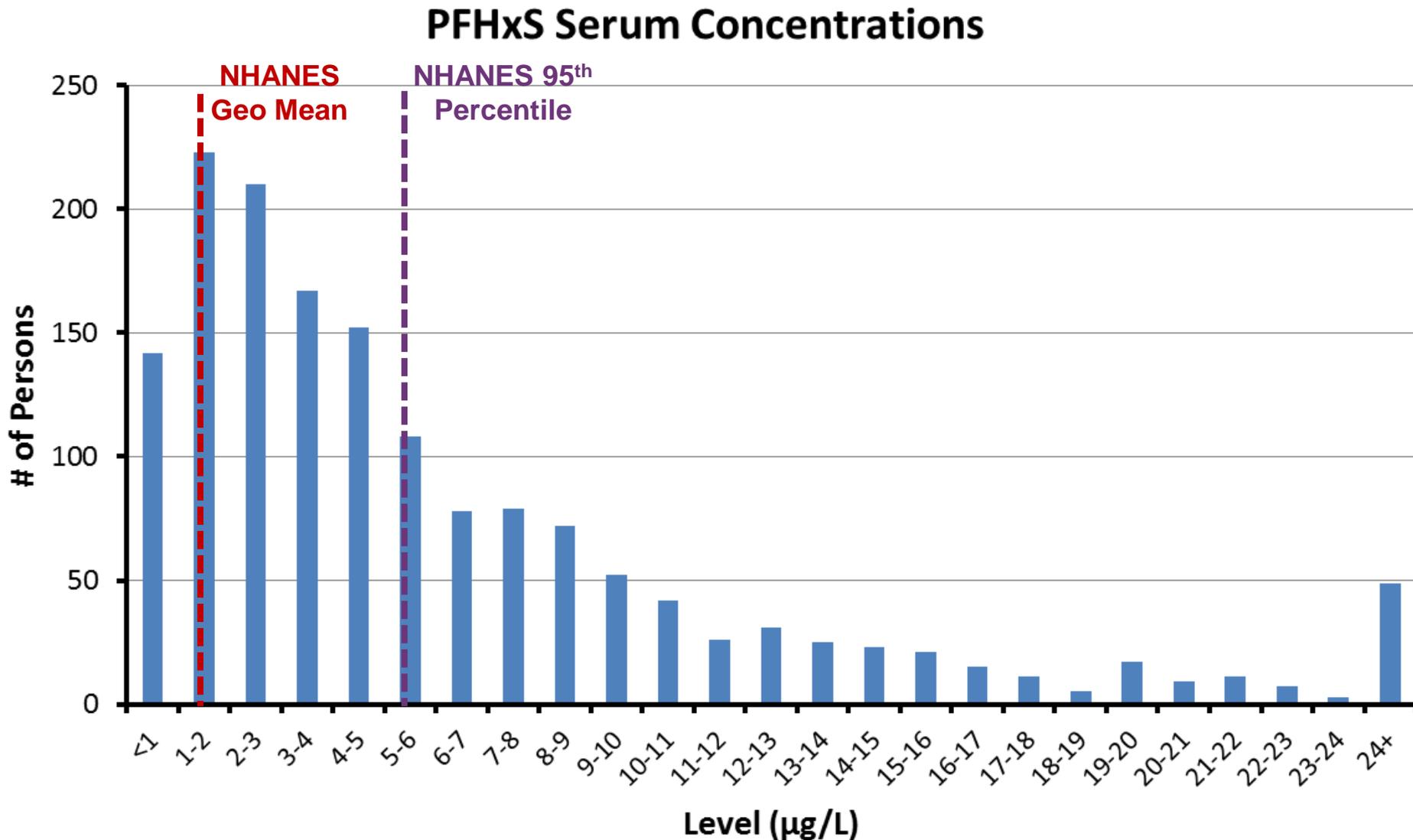
PFOS Distribution of Results



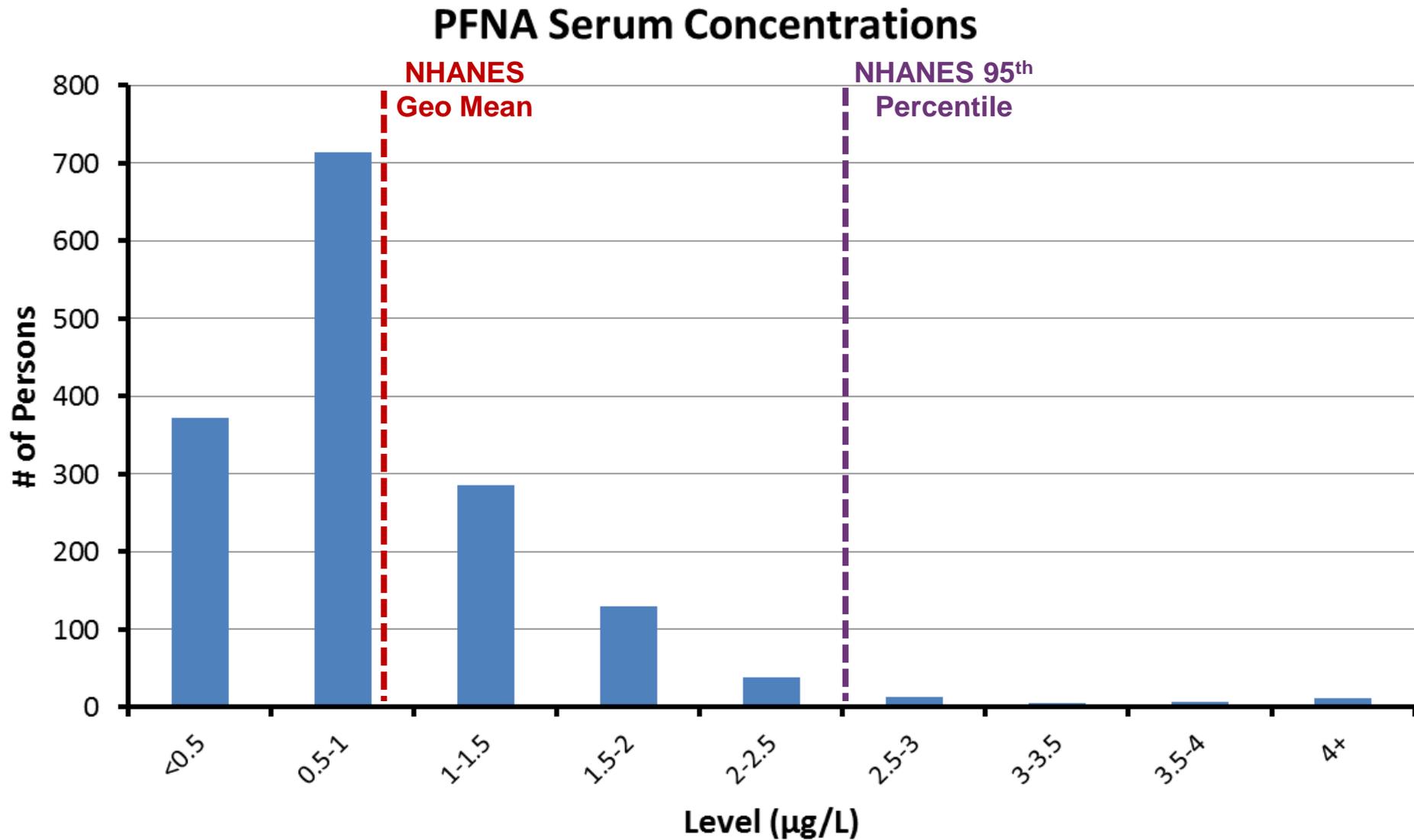
PFOA Distribution of Results



PFHxS Distribution of Results

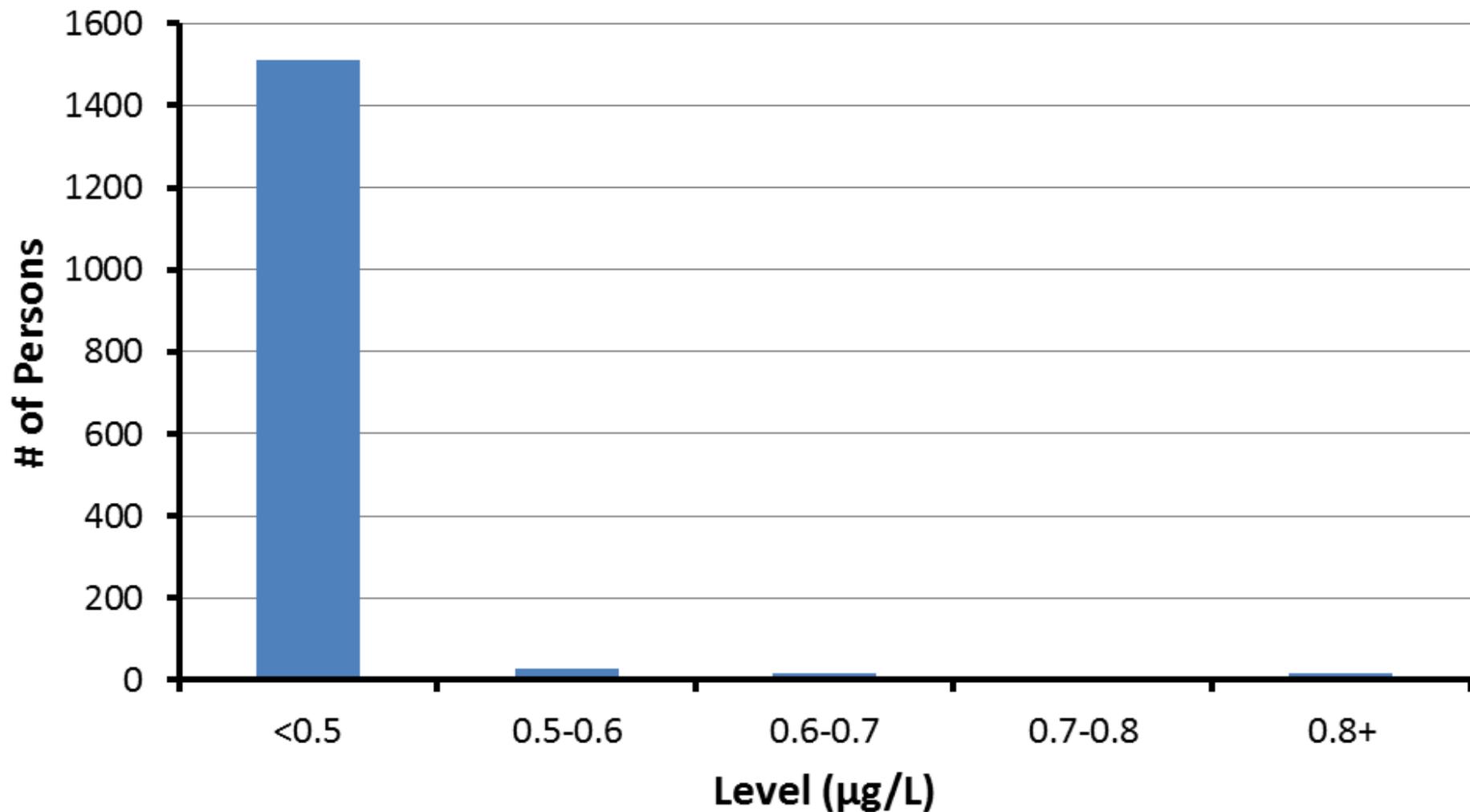


PFNA Distribution of Results



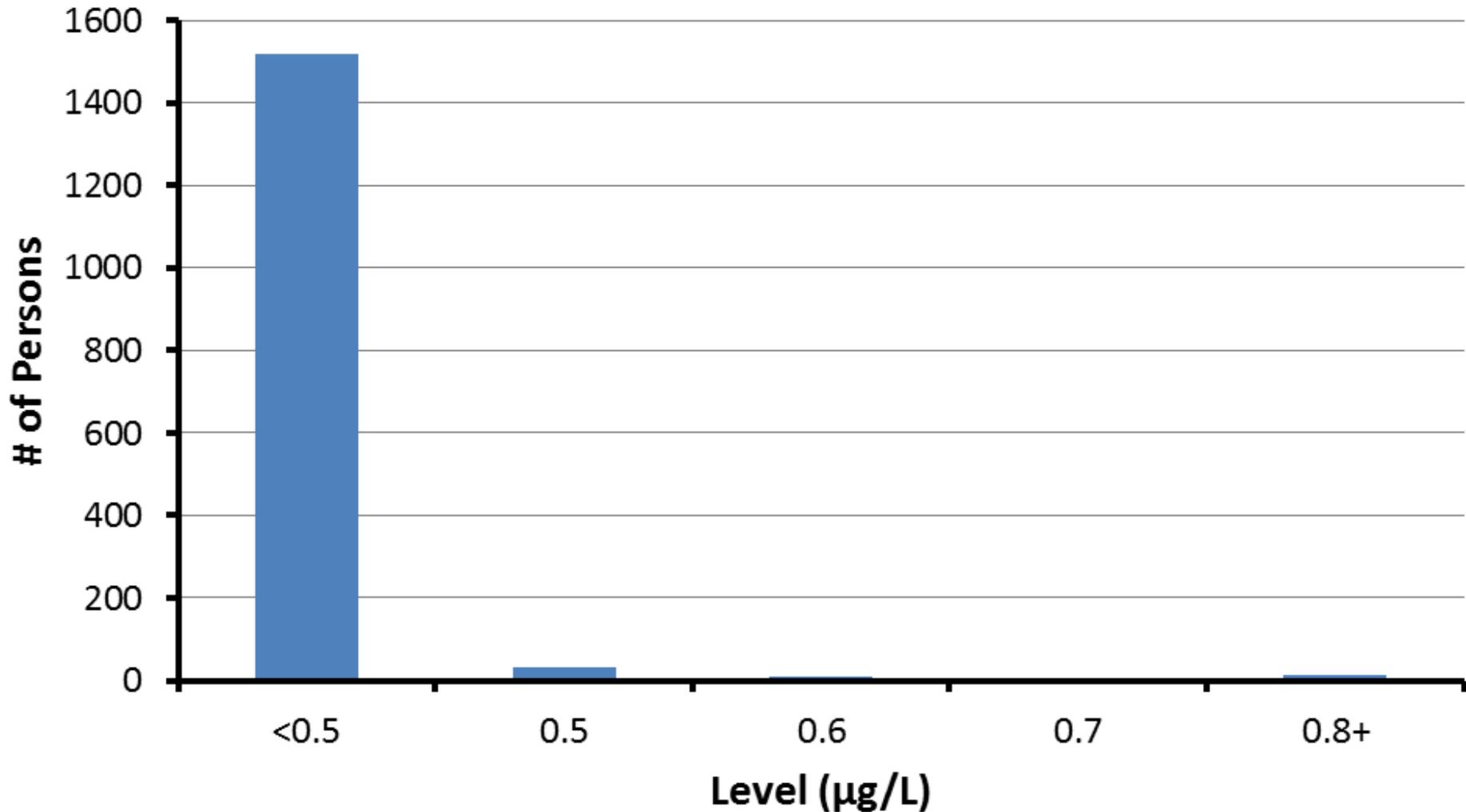
PFDeA Distribution of Results

PFDeA Serum Concentrations



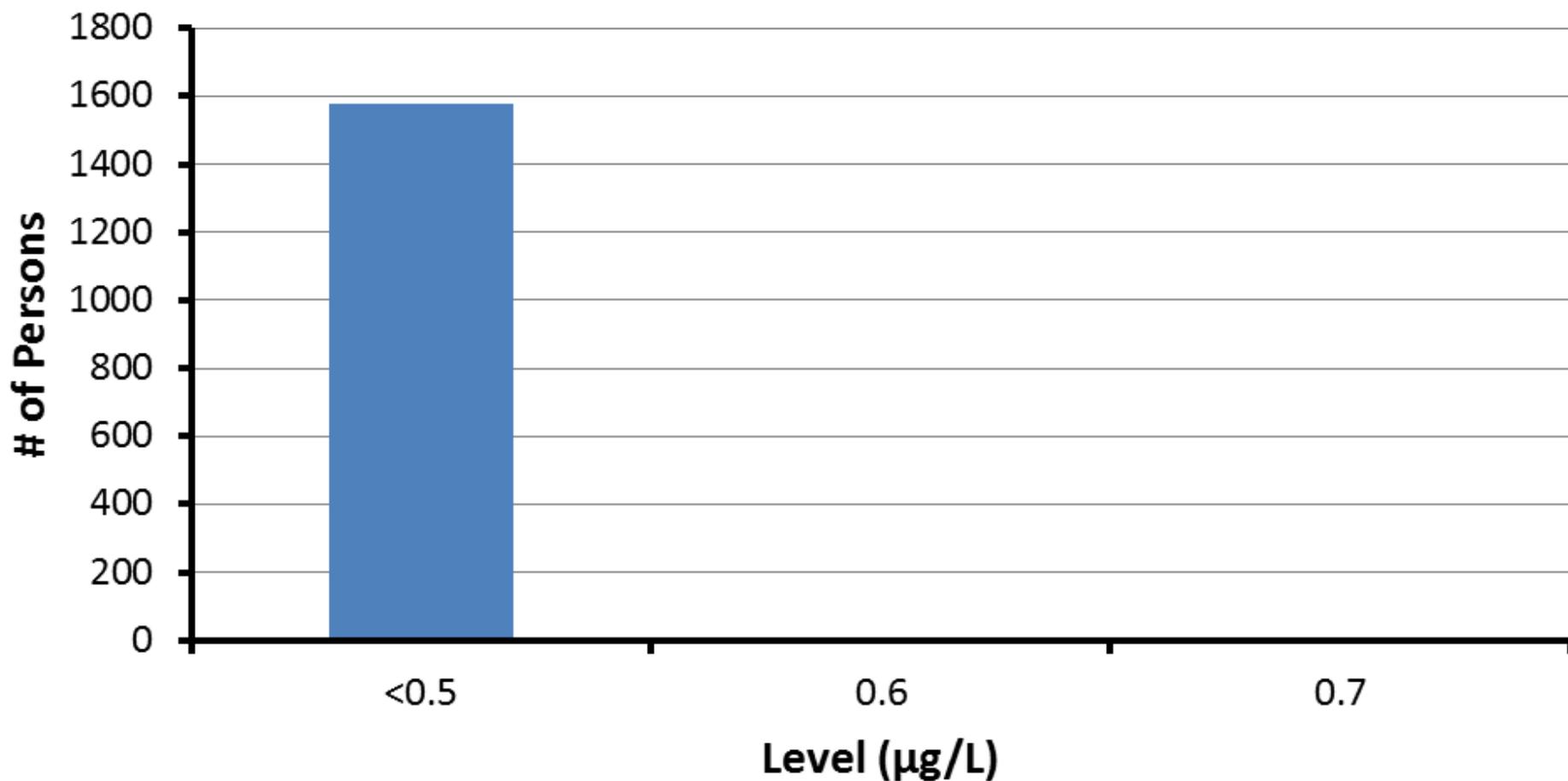
PFUA Distribution of Results

PFUA Serum Concentrations



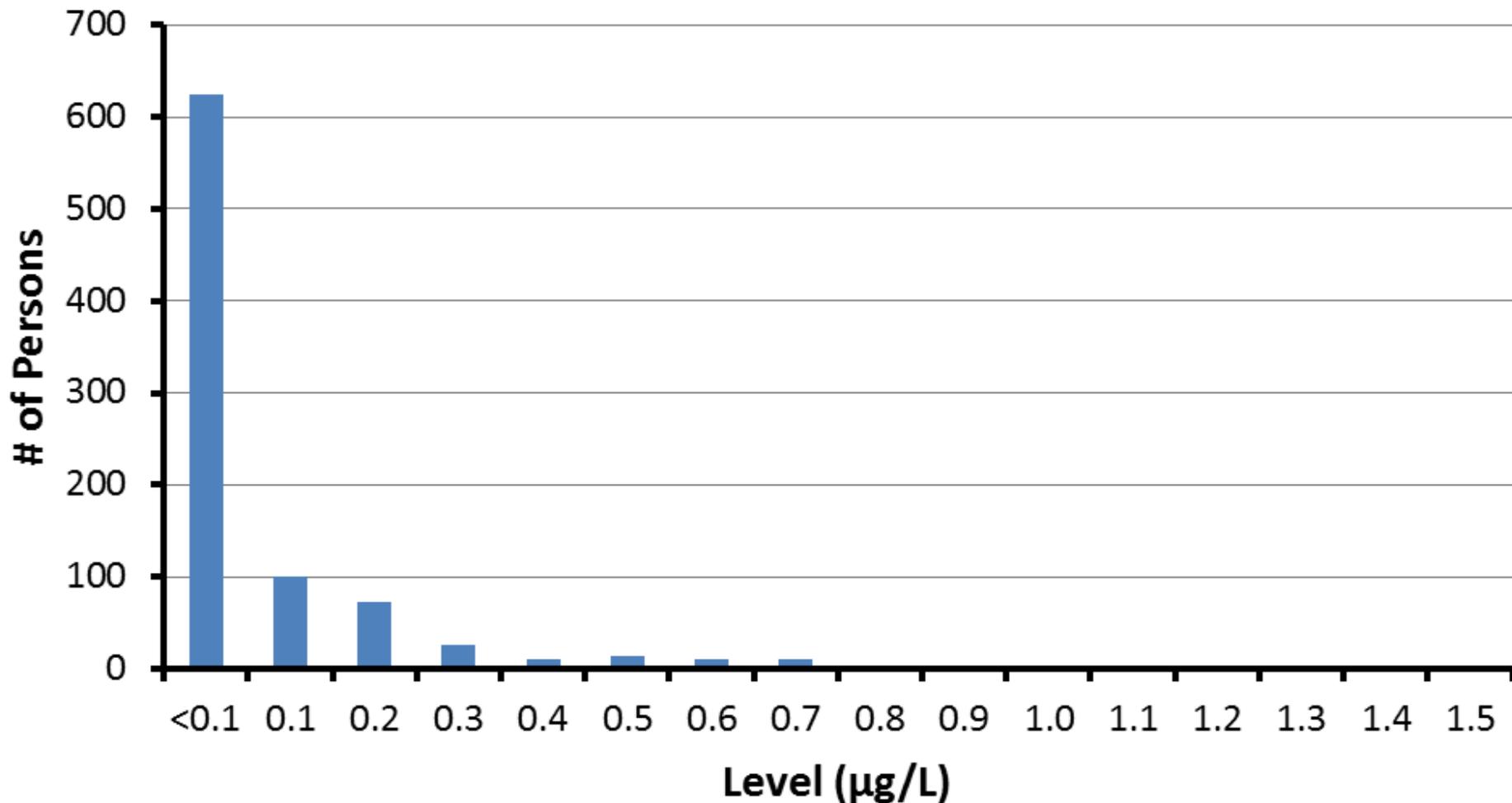
PFOSA Distribution of Results

PFOSA Serum Concentrations



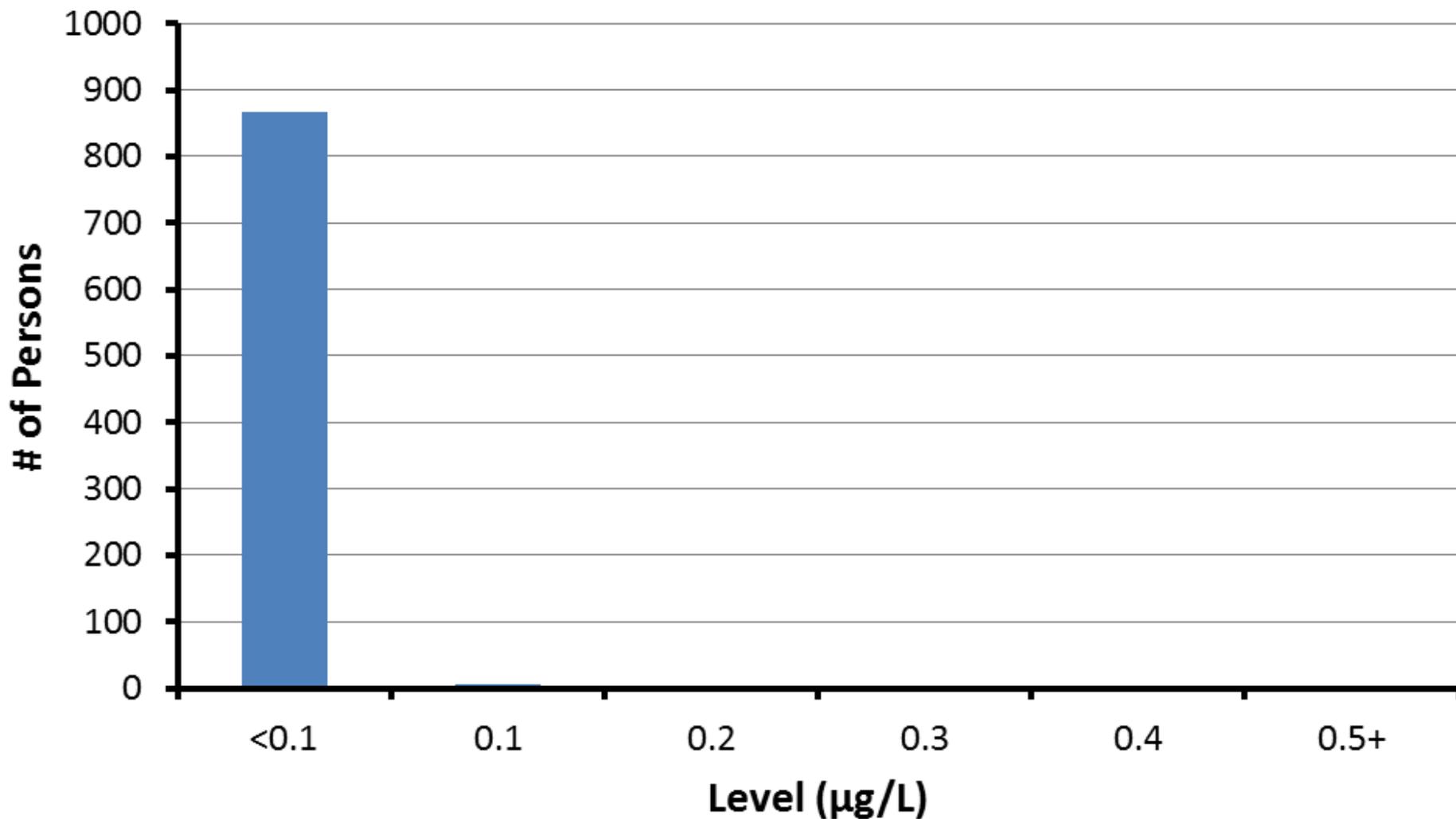
Me-PFOSA-AcOH Distribution of Results

Me-PFOSA-AcOH Serum Concentrations



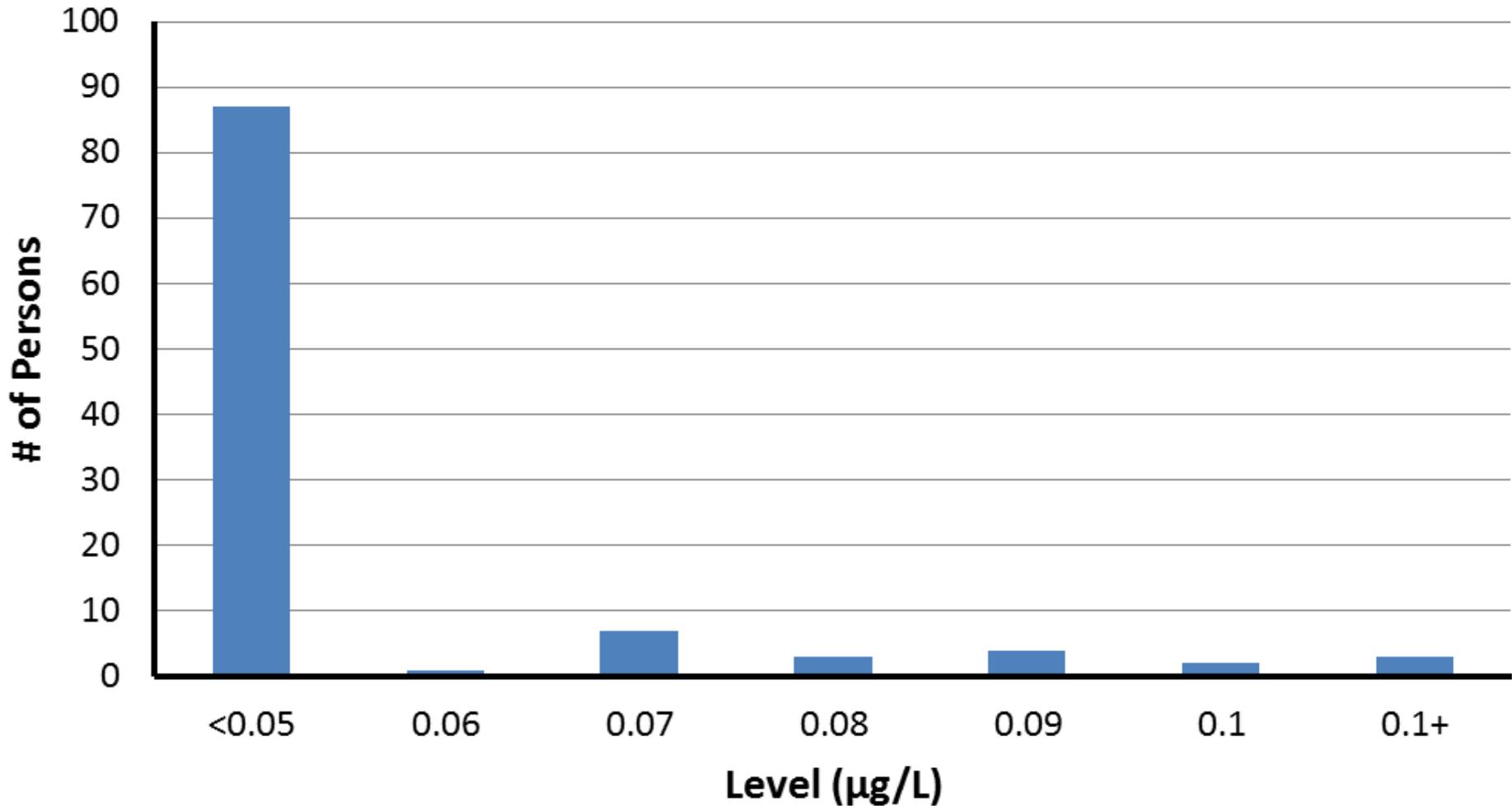
Et-PFOSA-AcOH Distribution of Results

Et-PFOSA-AcOH Serum Concentrations



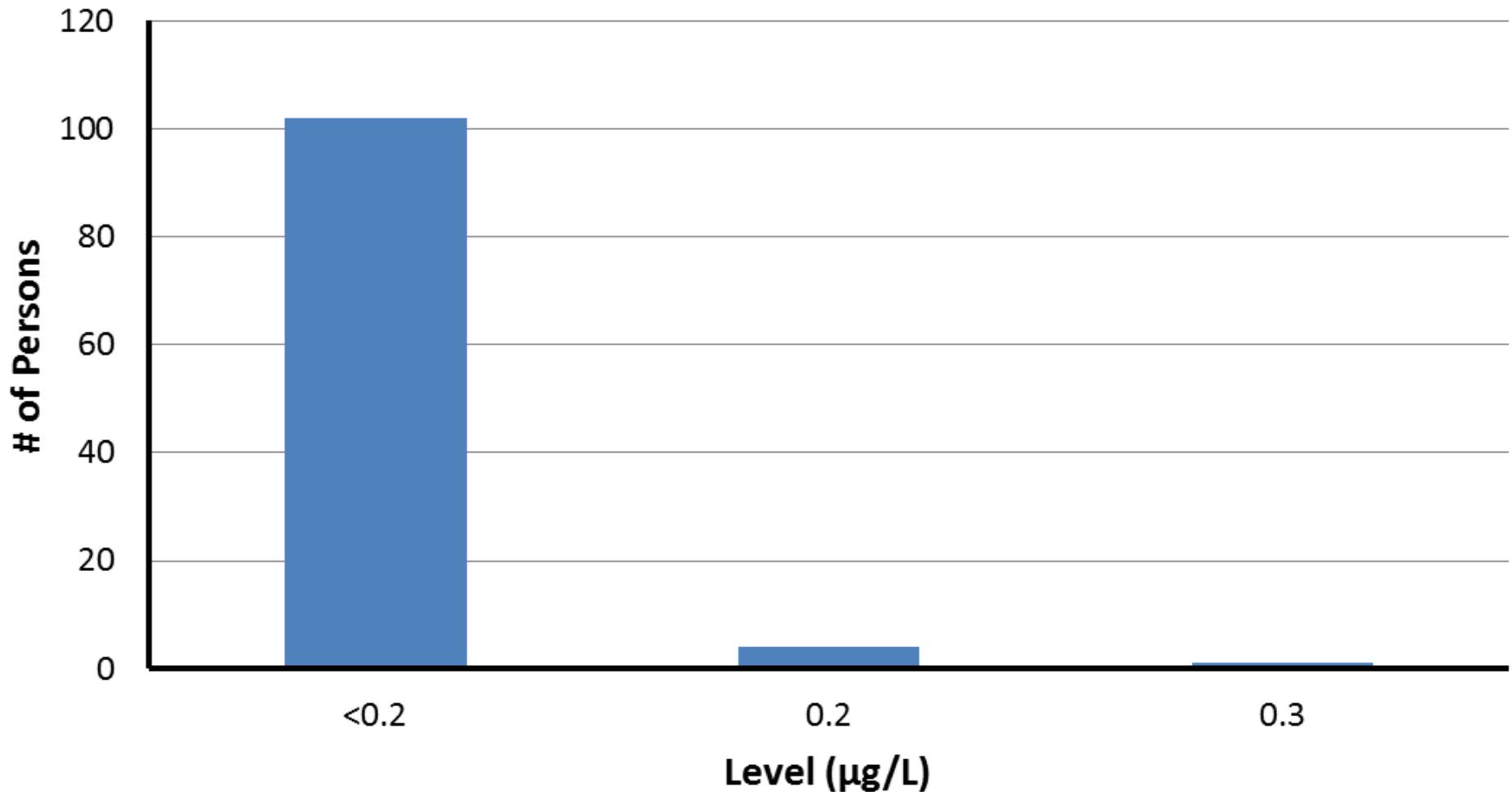
PFBS Distribution of Results

PFBS Serum Concentrations



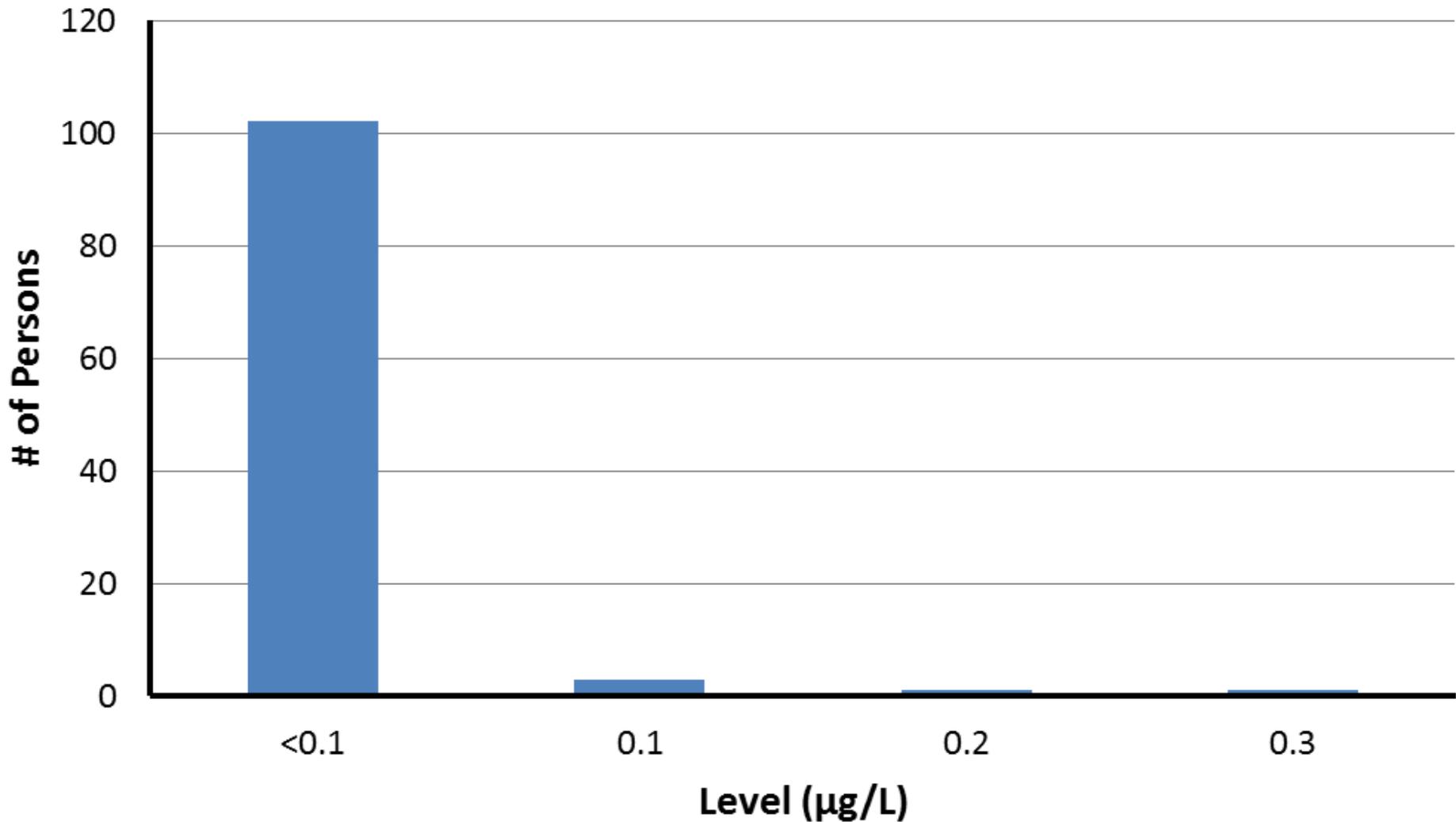
PFDoA Distribution of Results

PFDoA Serum Concentrations



PFHpA Distribution of Results

PFHpA Serum Concentrations



Adult Comparison Studies

Study Population	Years Blood Tested	# Participants	Reference
3M workers(PFOS and PFOA)	2000	263	Olsen GW, et al. Epidemiologic assessment of worker serum perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) concentrations and medical surveillance examinations. J Occup Environ Med. 2003;45(3):260-270.
3M workers (PFHxS)*	2004	26	Olsen GW, et al. Half-life of serum elimination of perfluorooctanesulfonate,perfluorohexanesulfonate, and perfluorooctanoate in retired fluorochemical production workers. Environ Health Perspect. 2007;115(9):1298-1305.
Dupont workers*	2004	1025	Sakr CJ, et al. Cross-sectional study of lipids and liver enzymes related to a serum biomarker of exposure (ammonium perfluorooctanoate or APFO) as part of a general health survey in a cohort of occupationally exposed workers. J Occup Environ Med. Oct 2007;49(10):1086-1096.
Ohio River Valley	2005-2006	69,030	Frisbee et al. The C8 Health Project: Design, methods, and participants. Env Health Persp 2009;117(12):1873-82.
Decatur, Alabama	2009	153	ATSDR. Exposure Investigation Report: PFC serum sampling in the vicinity of Decatur, AL Morgan, Lawrence, and Limestone Counties. Apr 2013. Accessed at: http://www.atsdr.cdc.gov/HAC/pha/Decatur/Perfluorochemical_Serum%20Sa
East Metro Minnesota pilot	2008-2009	196	Minnesota Dept of Health. East Metro PFC biomonitoring pilot project. Jul 2009. Accessed at: http://www.health.state.mn.us/divs/hpcd/tracking/biomonitoring/projects/pfcfinalrpt2009.pdf
Red Cross donors	2006	600	Olsen GW, et al. Decline in PFOS and other PFCs in American Red Cross adult blood donors, 2000-2006. Environ Sci Technol. 2008;42:4989-4995.
NHANES	2005-2006 2011-2012	2120 1904	CDC. Fourth National report on human exposure to environmental chemicals. Feb 2015. Accessed at: http://www.cdc.gov/exposurereport/

* Reports on arithmetic mean serum concentration (instead of geometric mean). Arithmetic mean is usually higher than the geometric mean. All other studies report geometric mean serum concentration.

Note: Compares Geometric Mean, unless otherwise noted*

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Study Population	Years Blood Tested	# Participants	Reference
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3M workers (PFHxS)*	2004	26	Olsen GW, et al. Perfluorooctanoate (PFOA) and perfluorooctanesulfonate (PFOS) in retired workers. J Occup Environ Med. 2007;115(12):1155-1161.
Dupont workers*	2004	1025	Sakr CJ, et al. Ammonium perfluorooctanoate (APFO) as a serum biomarker of exposure (ammonium perfluorooctanoate or APFO) as part of a general health survey in a cohort of occupationally exposed workers. J Occup Environ Med. Oct 2007;49(10):1086-1096.
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Decatur, Alabama	2009	153	ATSDR. Environmental Health Survey of Decatur, Alabama. Report at: http://www.atsdr.cdc.gov/HOT/decatur.html
East Metro Minnesota pilot	2008-2009	196	Minnesota Department of Health. 2009. A community-based pilot study of perfluorinated compounds in Minnesota. http://www.health.state.mn.us/divs/hpcd/tracking/biomonitoring/projects/pfocfinalrpt2009.pdf
Red Cross donors	2006	600	Centers for Disease Control and Prevention. 2006. National Health and Medical Examination Survey. http://www.cdc.gov/nchs/nhanes/
NHANES	2005-2006 2011-2012	2120 1904	Centers for Disease Control and Prevention. 2005-2006 and 2011-2012. National Health and Medical Examination Survey. http://www.cdc.gov/nchs/nhanes/

Occupationally Exposed

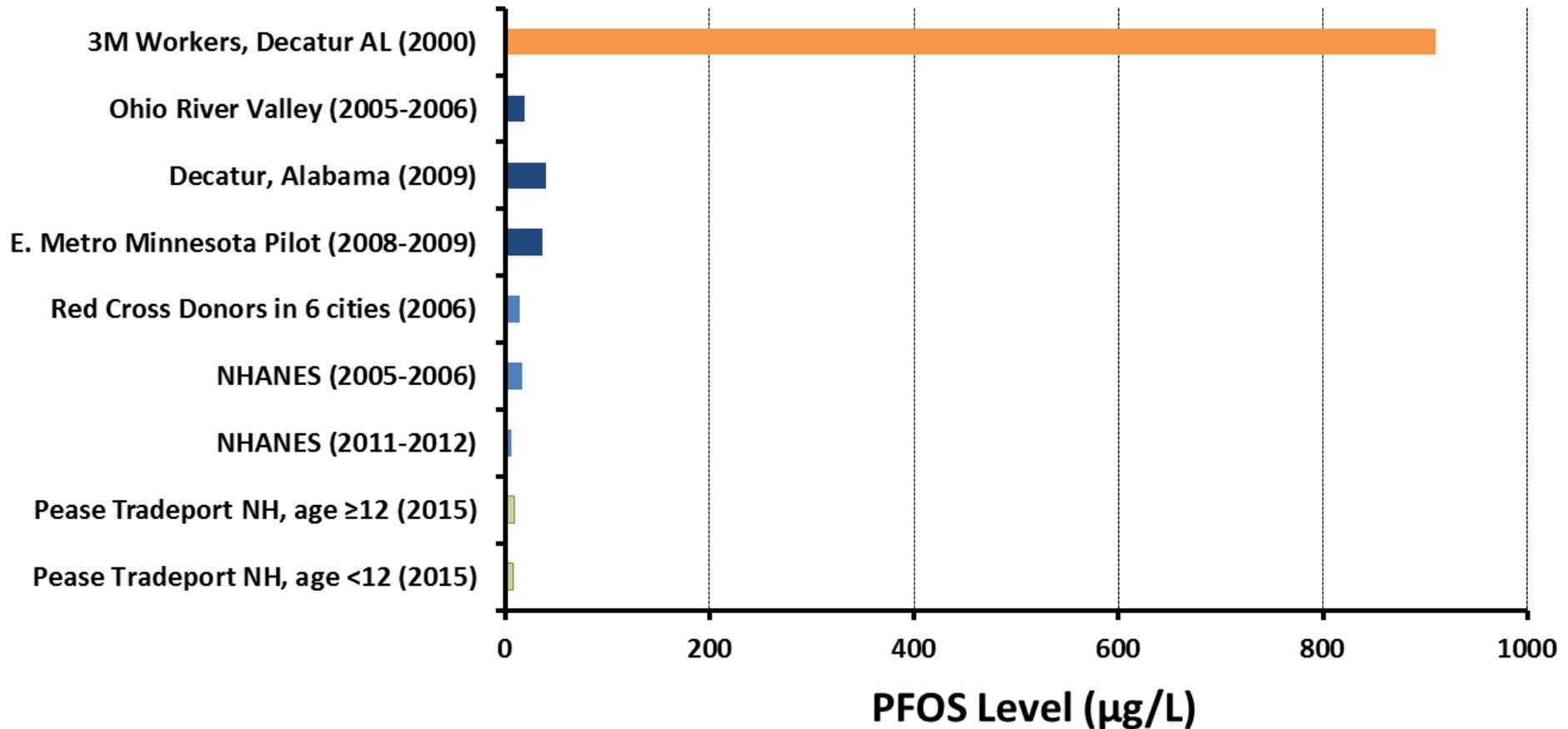
Environmentally Exposed

General Population

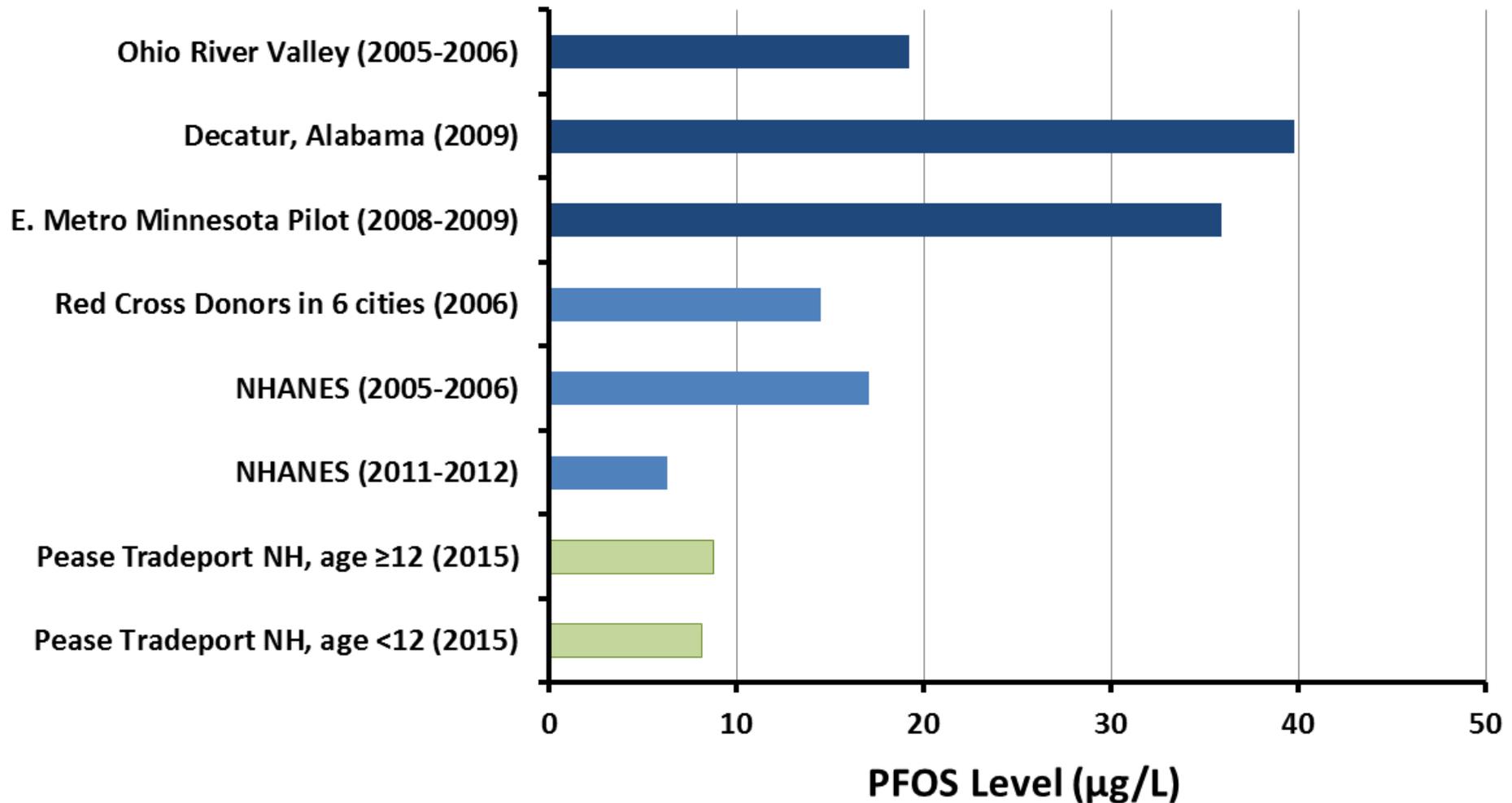
* Reports on arithmetic mean serum concentration (instead of geometric mean). Arithmetic mean is usually higher than the geometric mean. All other studies report geometric mean serum concentration.

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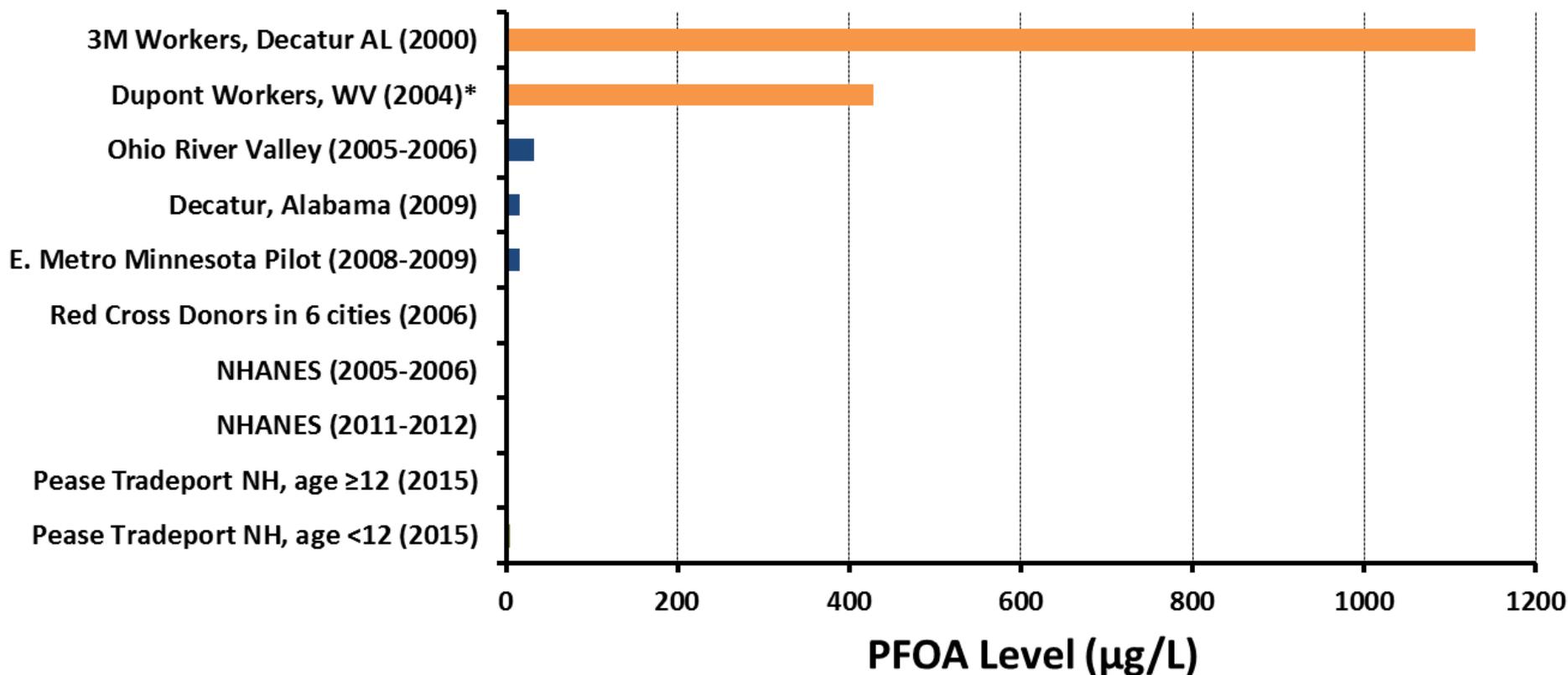
PFOS Adult Population Comparison (Includes Occupationally Exposed)



PFOS Adult Population Comparison (Excludes Occupationally Exposed)

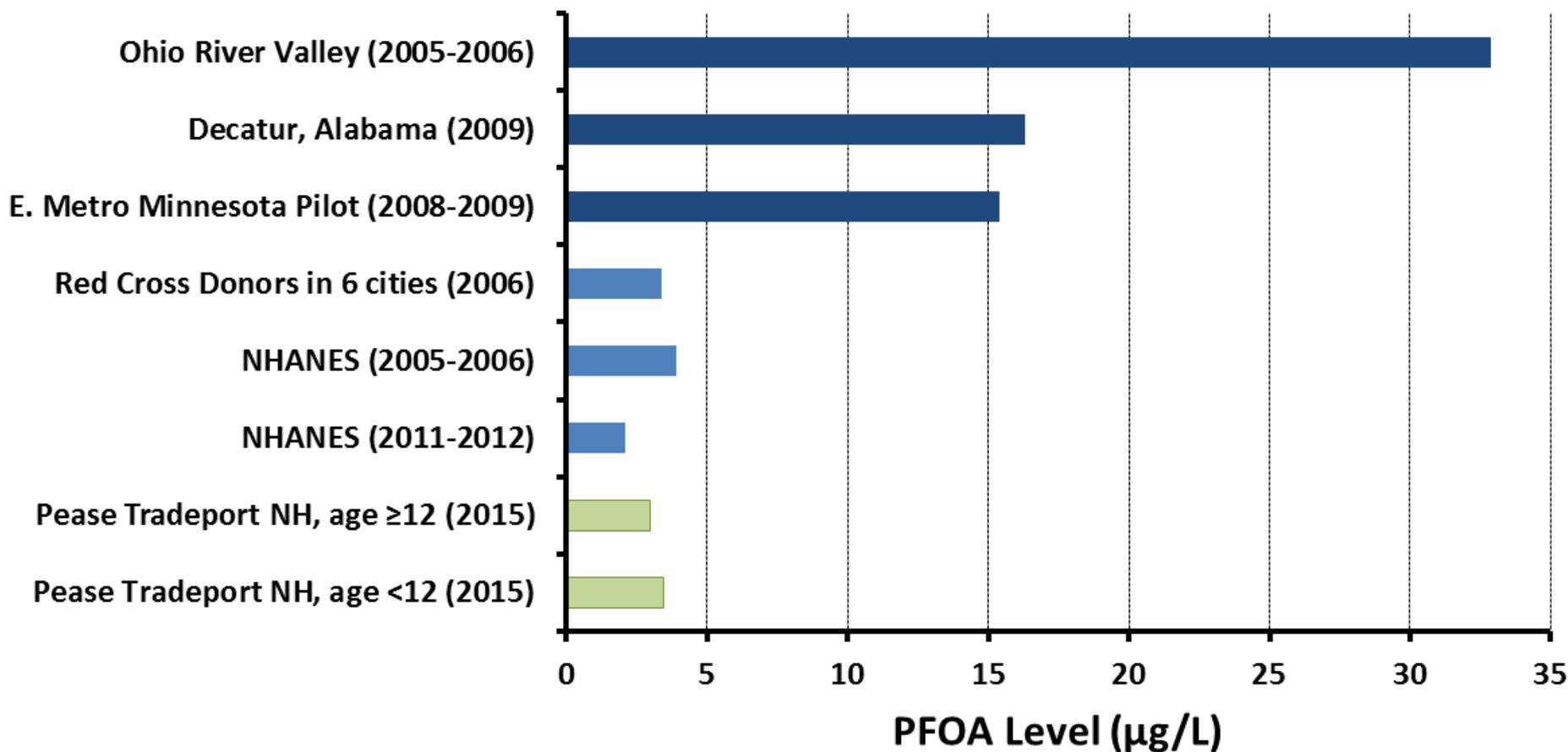


PFOA Adult Population Comparison (Includes Occupationally Exposed)

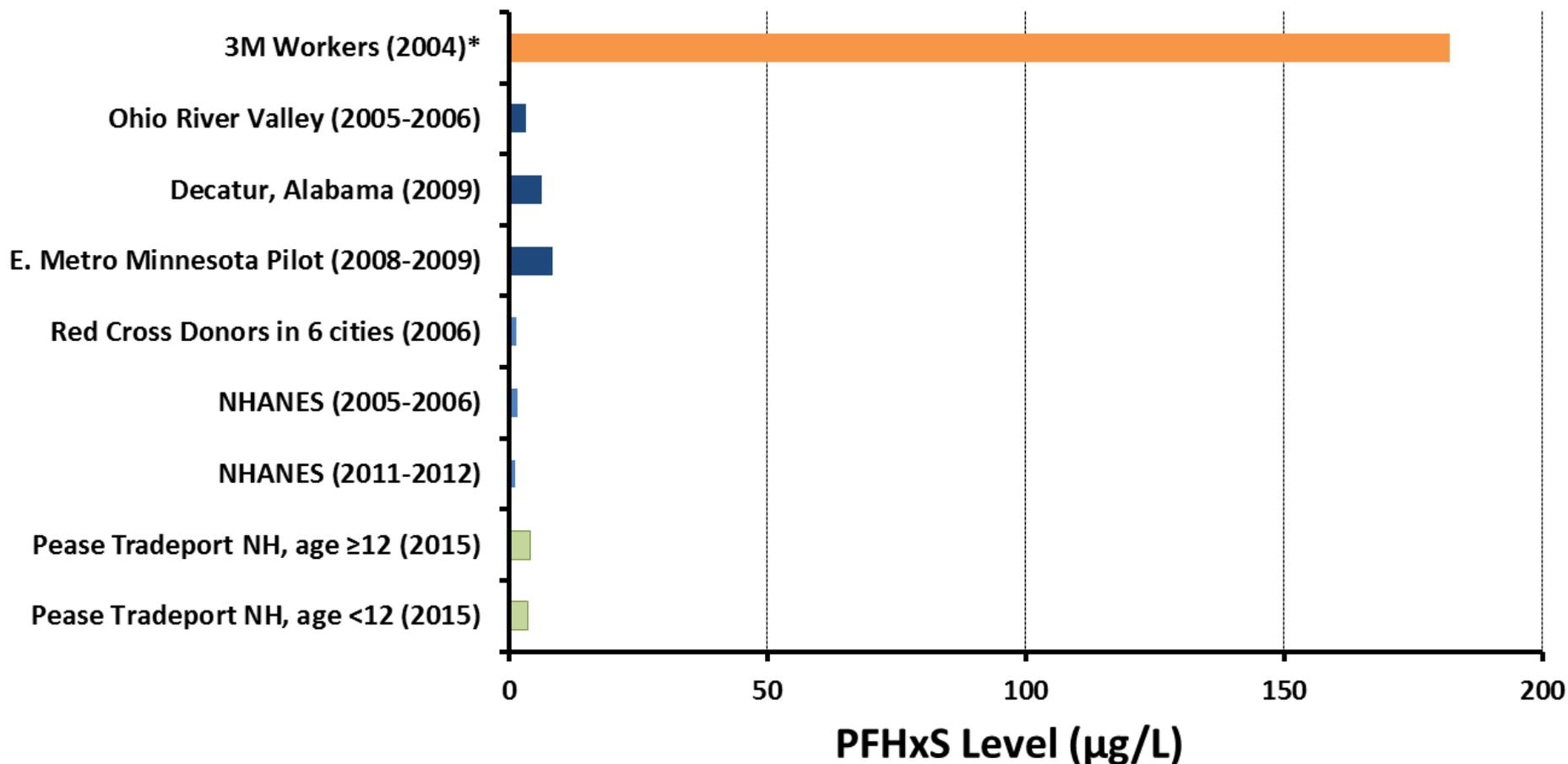


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PFOA Adult Population Comparison (Excludes Occupationally Exposed)

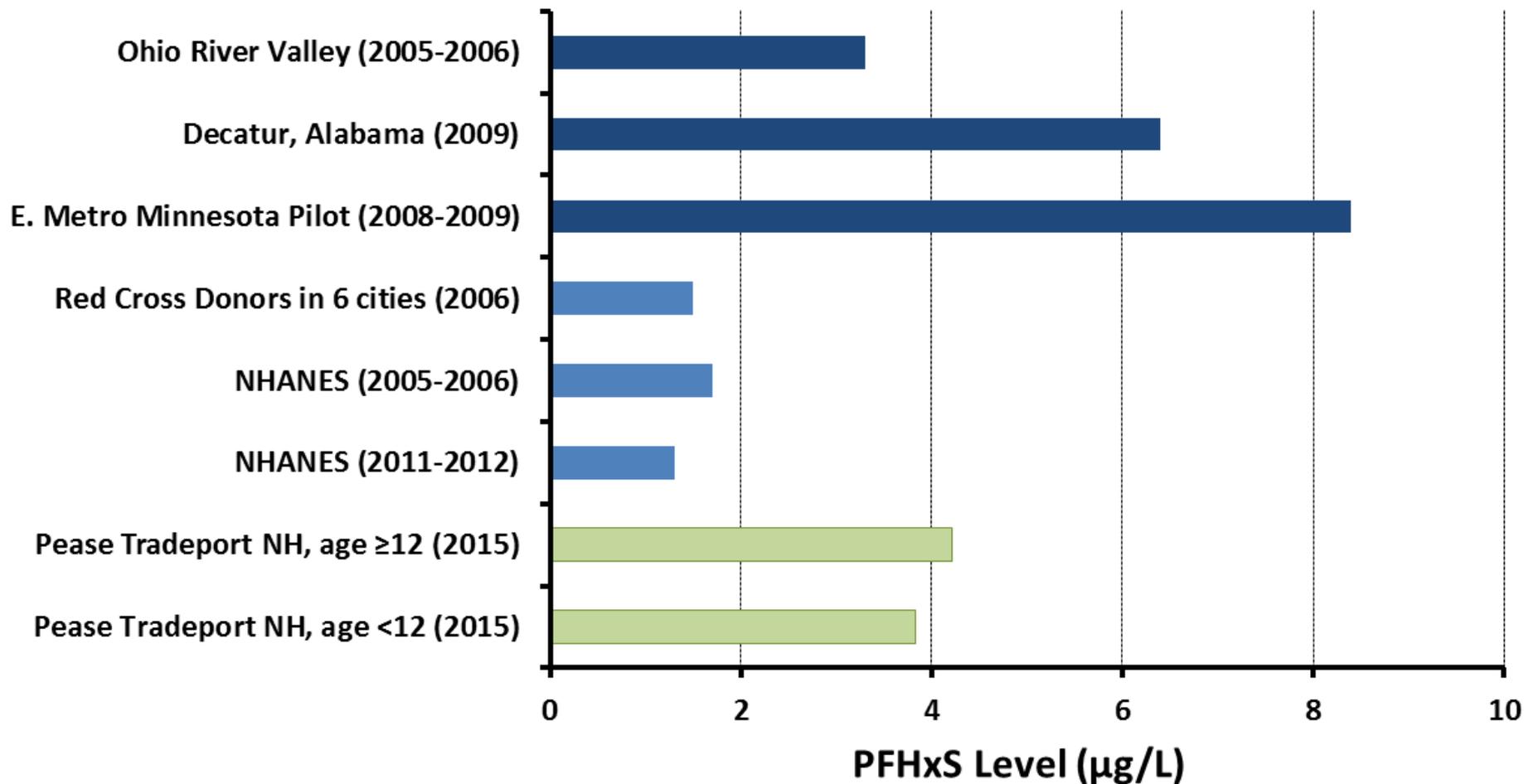


PFHxS Adult Population Comparison (Includes Occupationally Exposed)

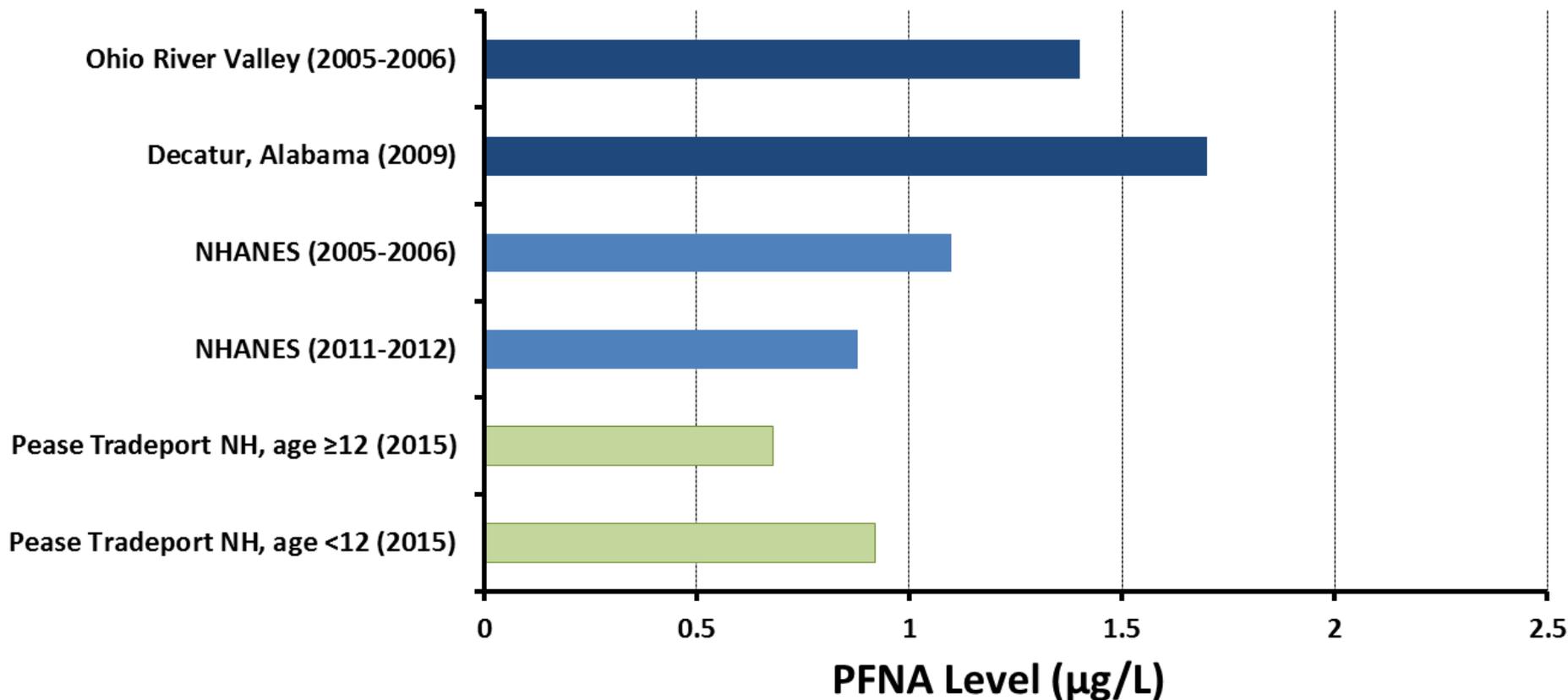


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PFHxS Adult Population Comparison (Excludes Occupationally Exposed)



PFNA Adult Population Comparison (Excludes Occupationally Exposed)



Pediatric Comparison Studies

Location	Years Blood Tested	# Participants	Age Range (years)	Reference
Ohio River Valley (PFOA water contamination)	2005-2006	?	<12	Frisbee et al. The C8 Health Project: Design, methods, and participants. <i>Env Health Persp</i> 2009;117(12):1873-82.
23 States + D.C.	1994-1995	598	2-12	Olsen et al. Quantitative Evaluation of Perfluorooctanesulfonate (PFOS) and Other Fluorochemicals in the Serum of Children. <i>J Child Health</i> 2004;2(1):53-76.
Greater Cincinnati	2005-2007	353	6-8	Pinney SM, et al. Serum Biomarkers of Polyfluoroalkyl Compound Exposure in Young Girls in Greater Cincinnati and the San Francisco Bay Area, USA. <i>Environ Pollut</i> 2014;184:327-34.
San Francisco Bay	2005-2009	351	6-8	Pinney SM, et al. Serum Biomarkers of Polyfluoroalkyl Compound Exposure in Young Girls in Greater Cincinnati and the San Francisco Bay Area, USA. <i>Environ Pollut</i> 2014;184:327-34.
Northern California	2008-2009	68	2-8	Wu et al. Serum concentrations of perfluorinated compounds (PFC) among selected populations of children and Adults in California. <i>Environ Res</i> 2015; 136:264-73.
Texas*	2009	300	0-12	Schechter et al. Polyfluoroalkyl Compounds in Texas Children from Birth through 12 Years of Age. <i>Environ Health Perspect</i> 2012;120:590-594.

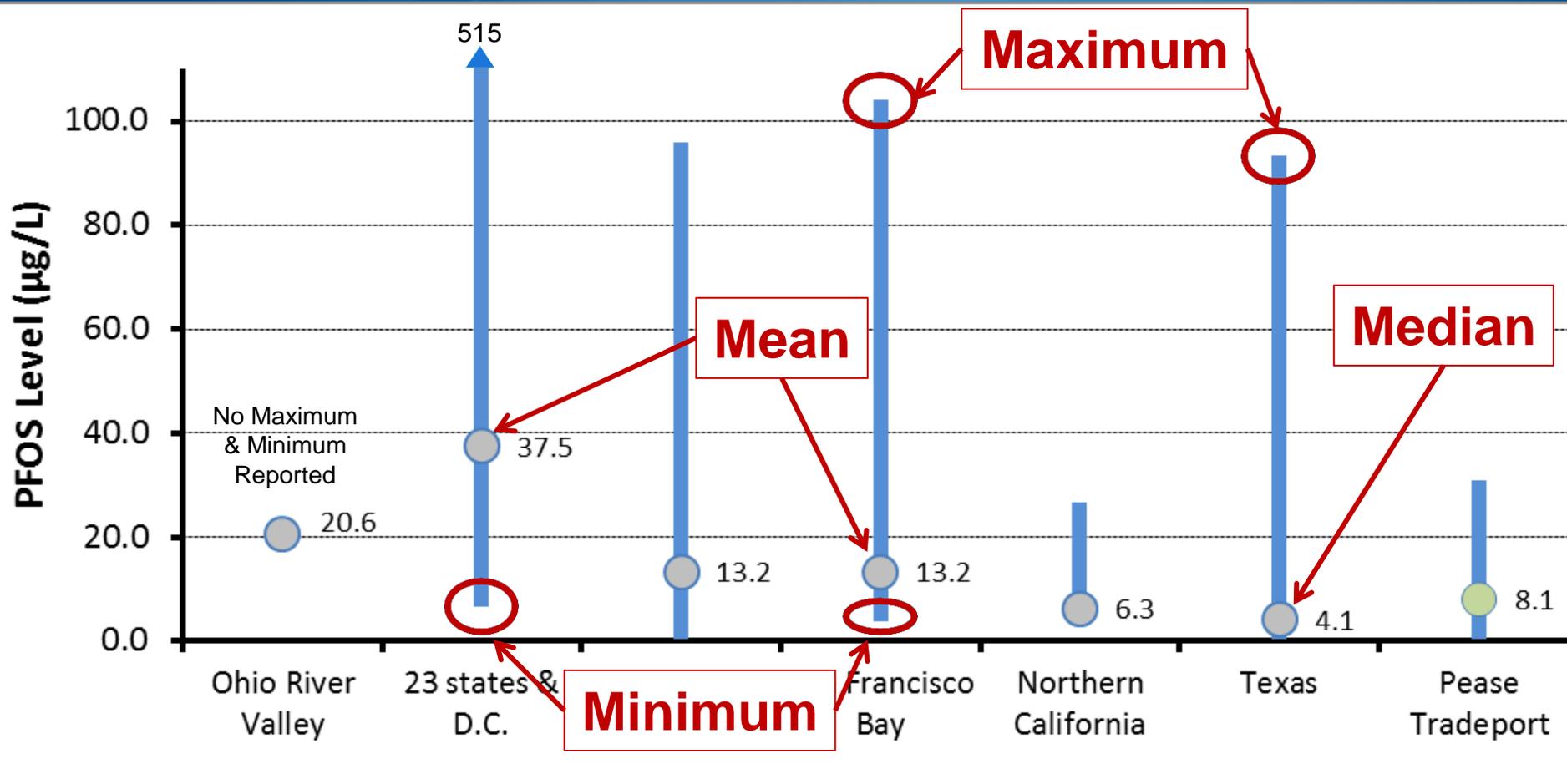
* Reports on median serum concentration. All other studies report geometric mean serum concentrations.

Pediatric Comparison Studies

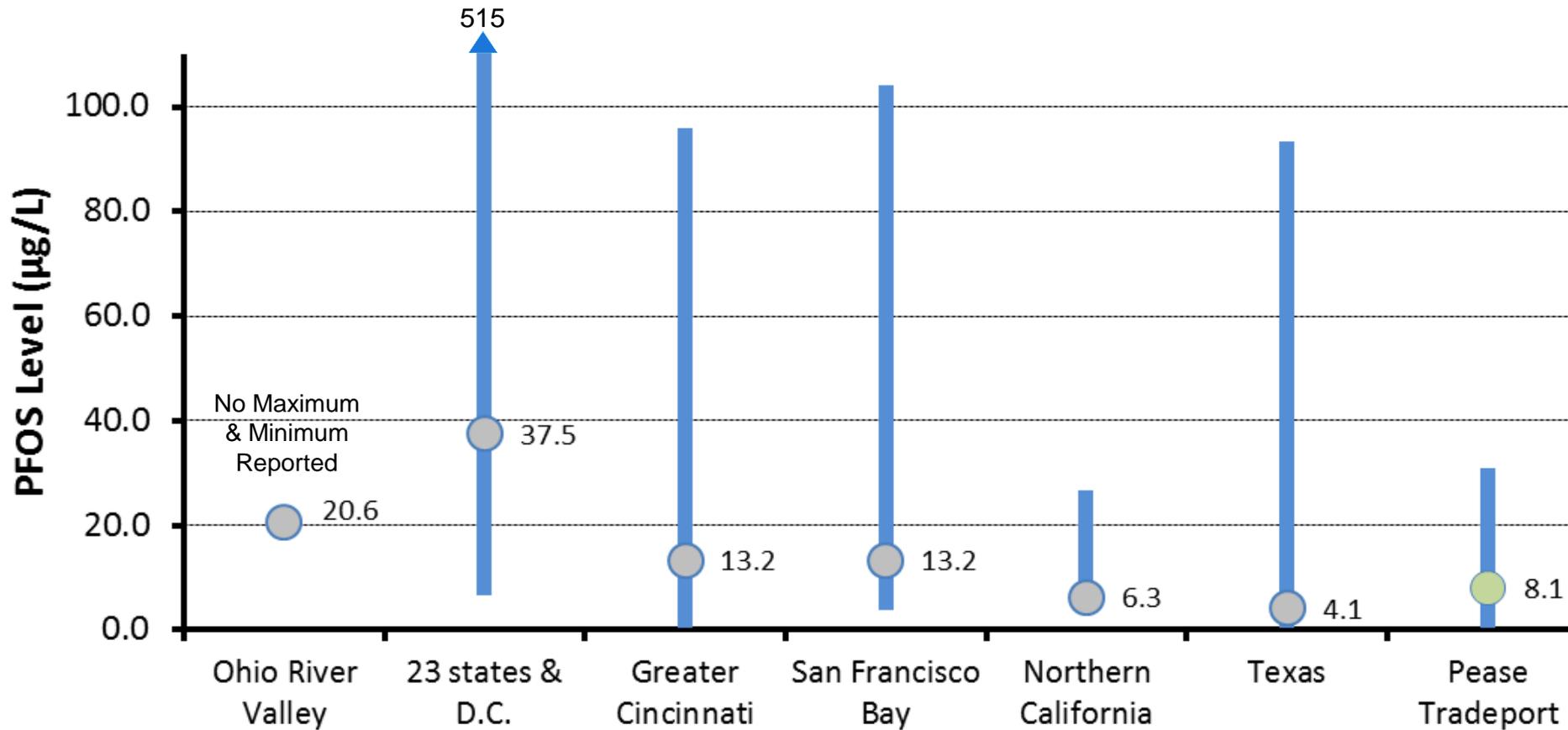
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Greater Cincinnati	2005-2007	353	6-8	Pinney SM, et al. Serum Biomarkers of Polyfluoroalkyl Compound Exposure in Young Girls in Greater Cincinnati and the San Francisco Bay A
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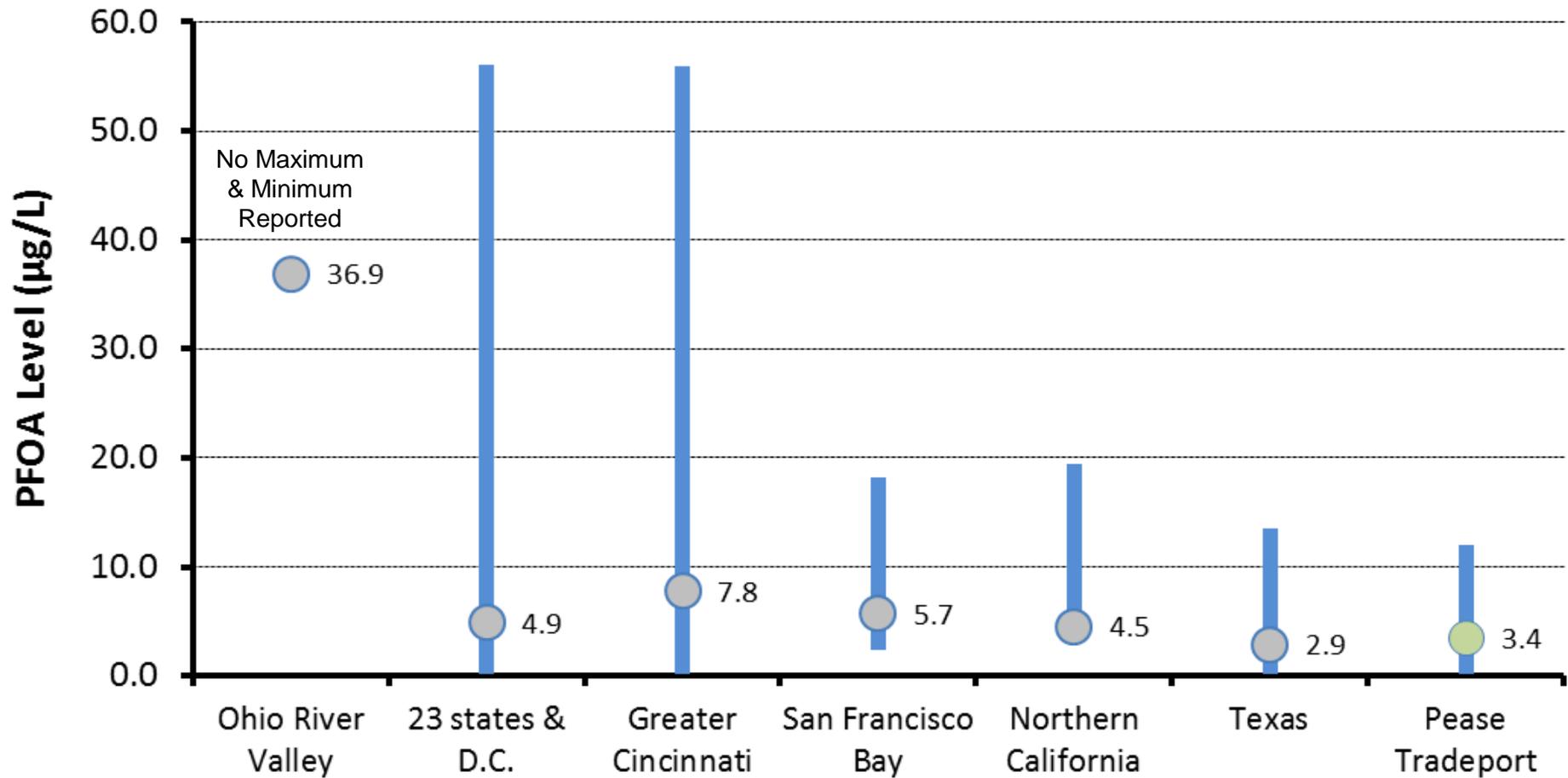
PFOS Pediatric Population Comparison of Central Measure (circle) and Range (blue bars)



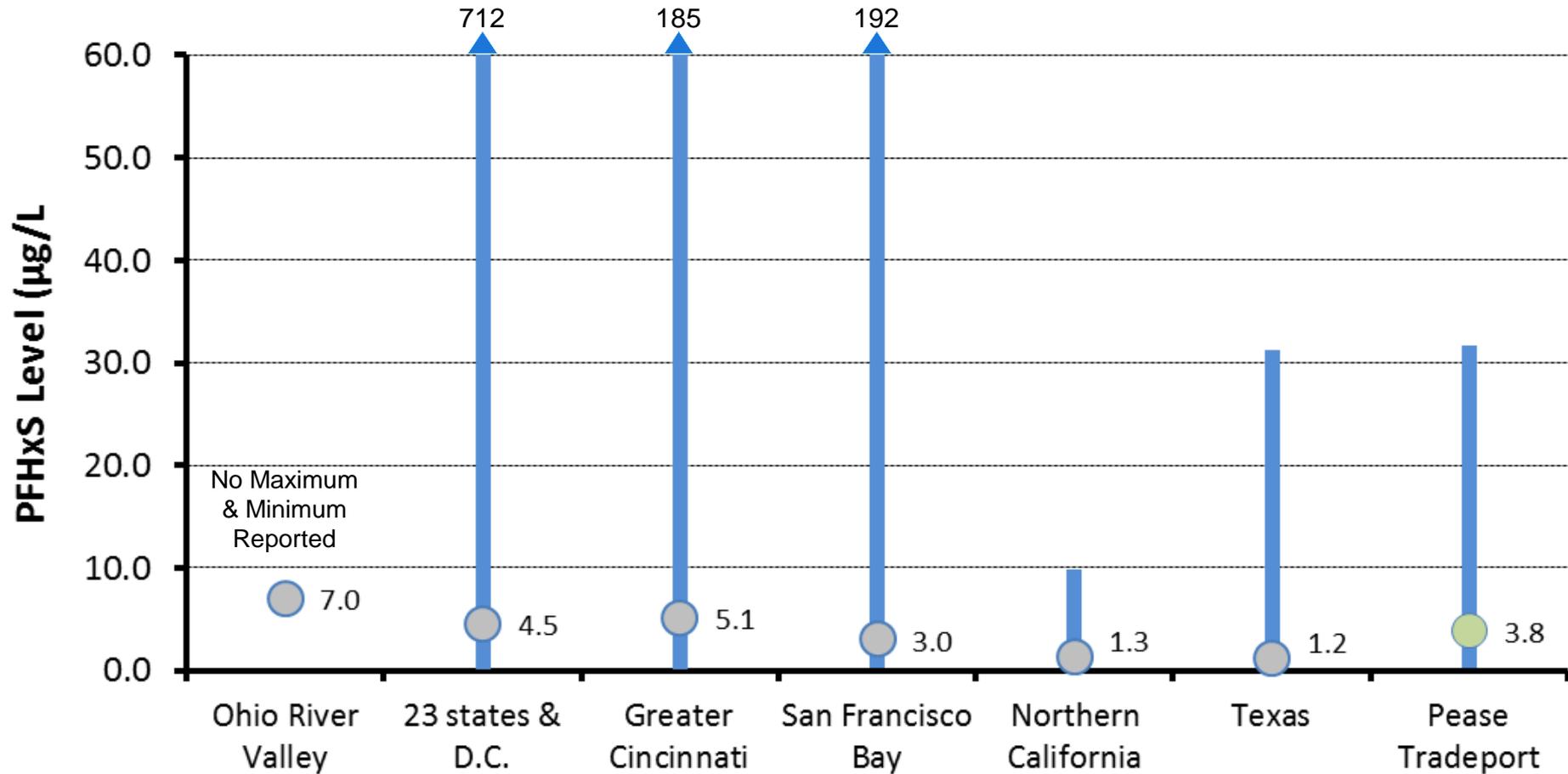
PFOS Pediatric Population Comparison of Central Measure (circle) and Range (blue bars)



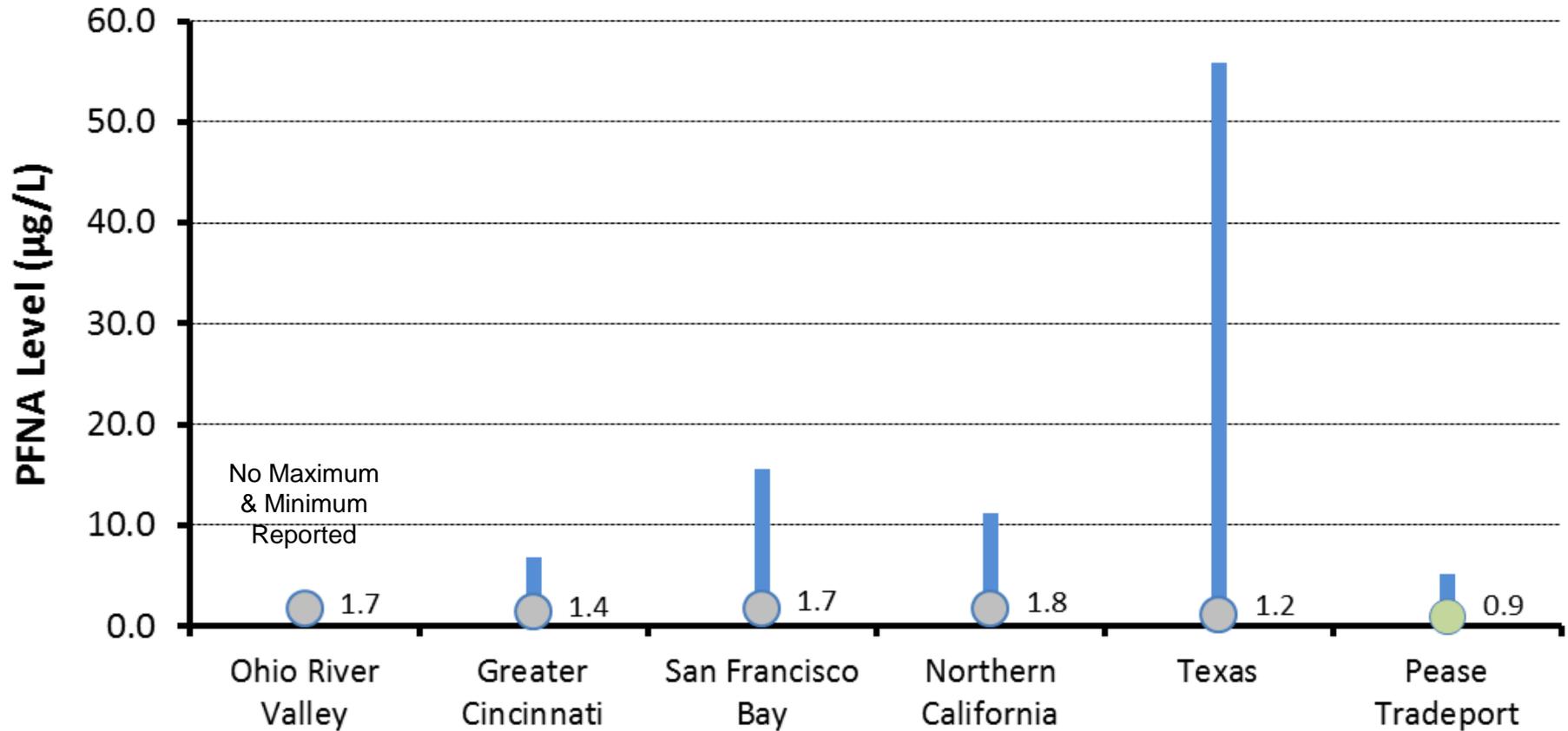
PFOA Pediatric Population Comparison of Central Measure (circle) and Range (blue bars)



PFHxS Pediatric Population Comparison of Central Measure (circle) and Range (blue bars)



PFNA Pediatric Population Comparison of Central Measure (circle) and Range (blue bars)

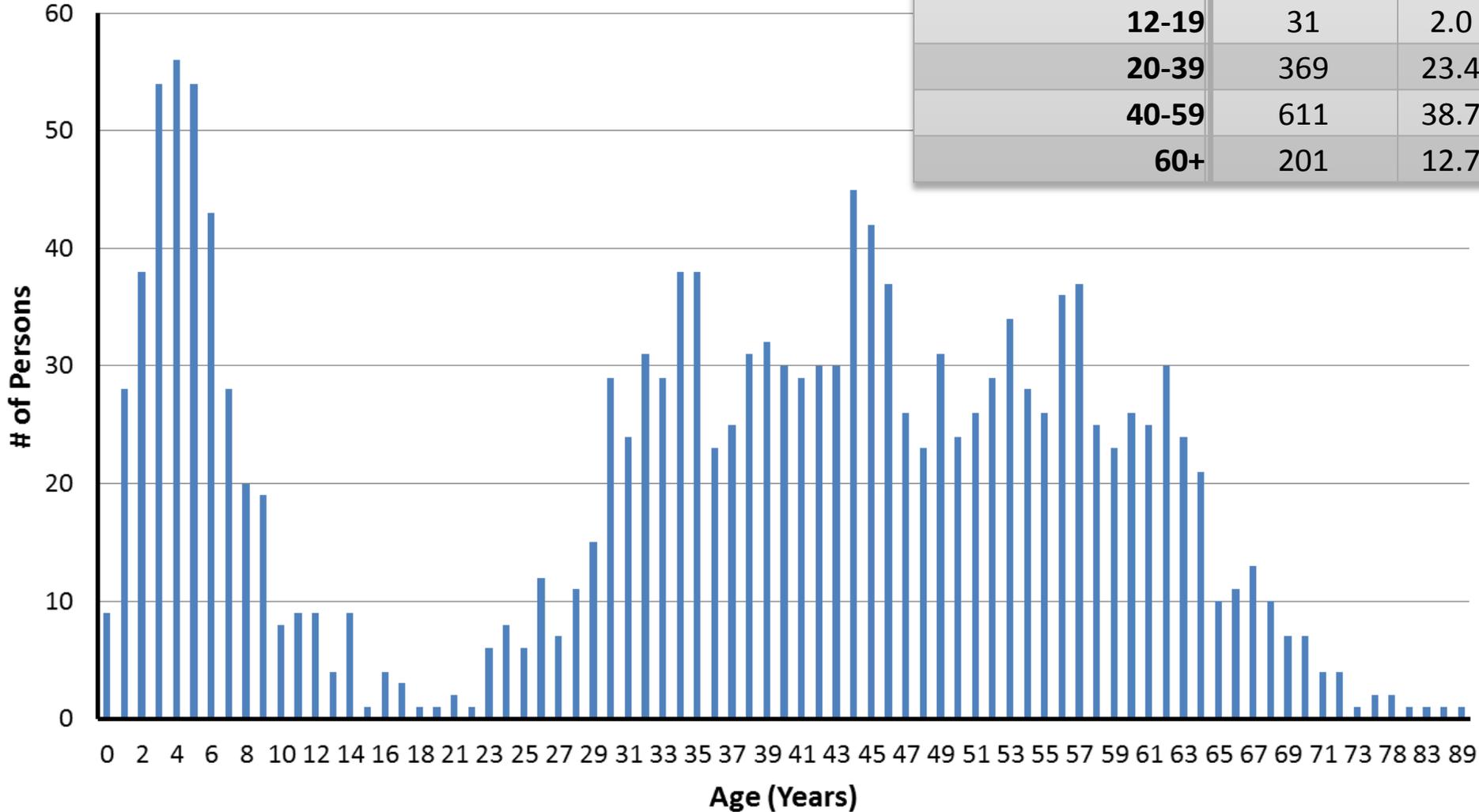


ANALYSIS OF INDIVIDUAL DEMOGRAPHIC AND EXPOSURE CHARACTERISTICS

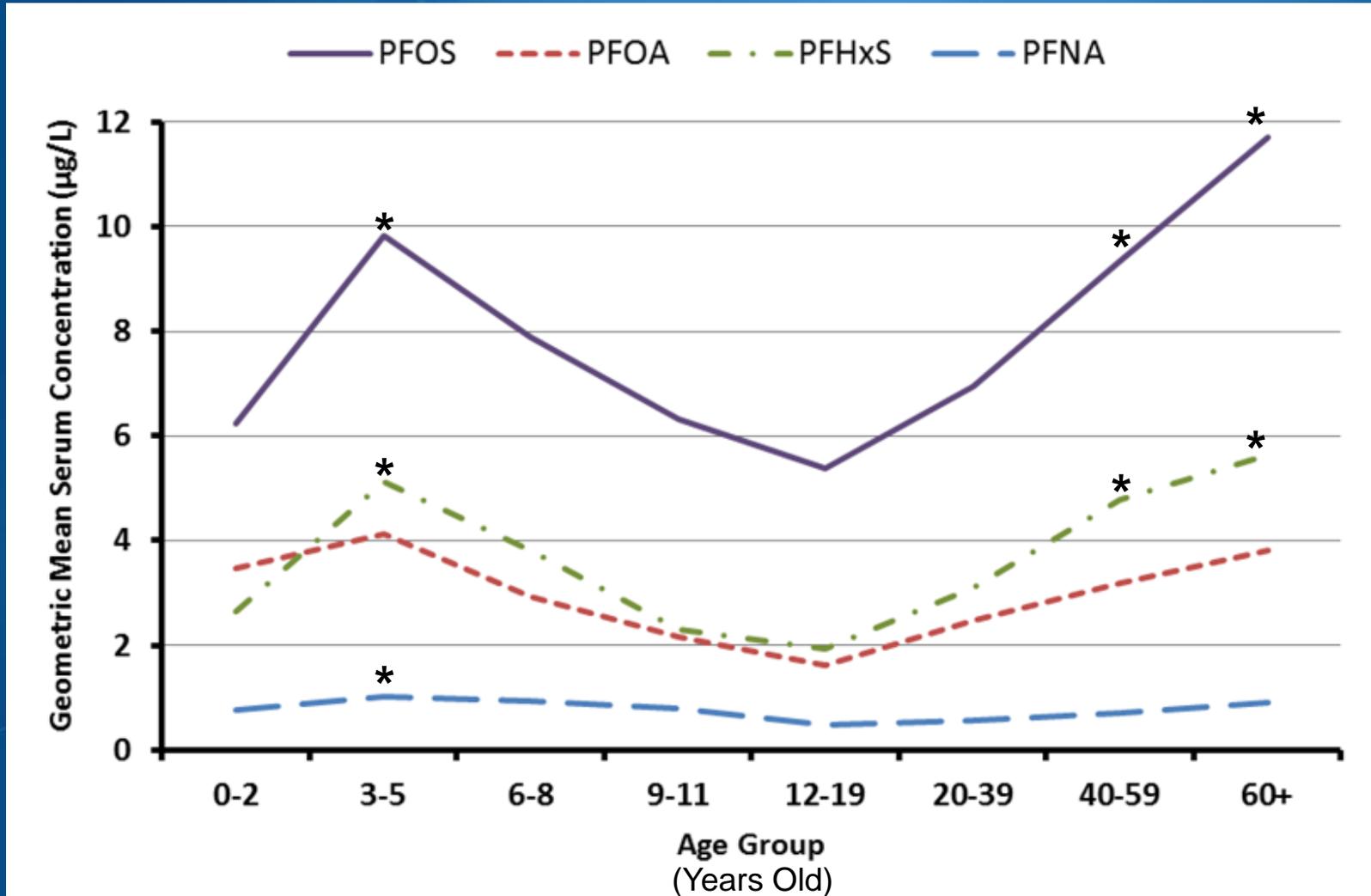
Age Distribution of Testing Population

Characteristics	n	%
Age Group (years)	(median=40)	
0-2	75	4.8
3-5	164	10.4
6-8	91	5.8
9-11	36	2.3
12-19	31	2.0
20-39	369	23.4
40-59	611	38.7
60+	201	12.7

Age Distribution



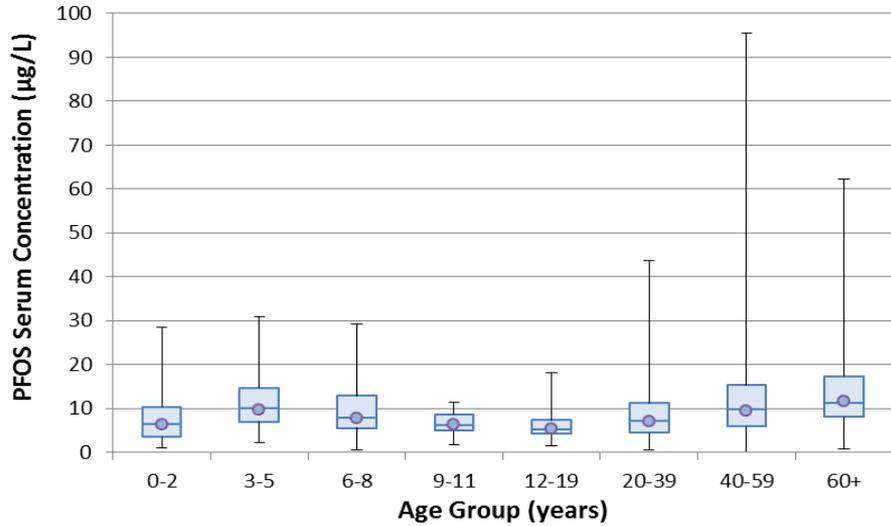
Serum PFC Levels by Age Group



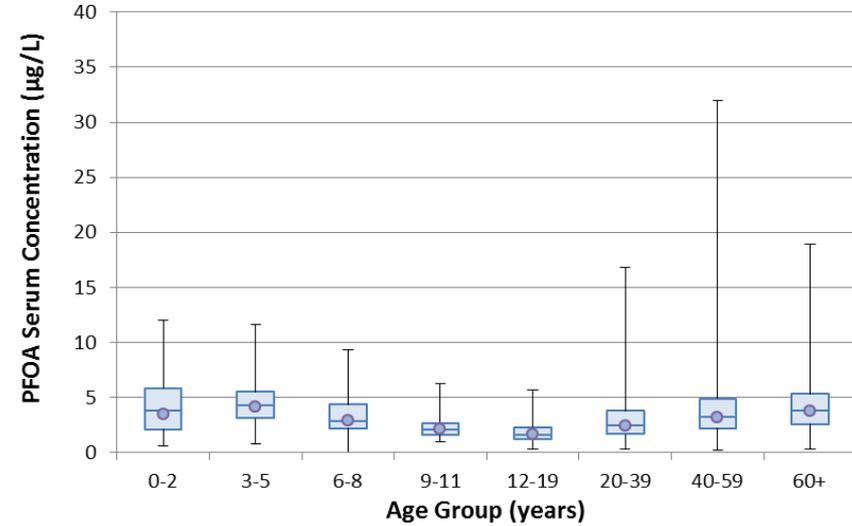
* Indicates a significantly higher mean concentration compared to youngest age group (0-2 years).
Note: the age groups 9-39 for PFOA and 12-39 for PFNA are significantly **lower** compared to youngest age group.

Serum PFC Levels by Age Group

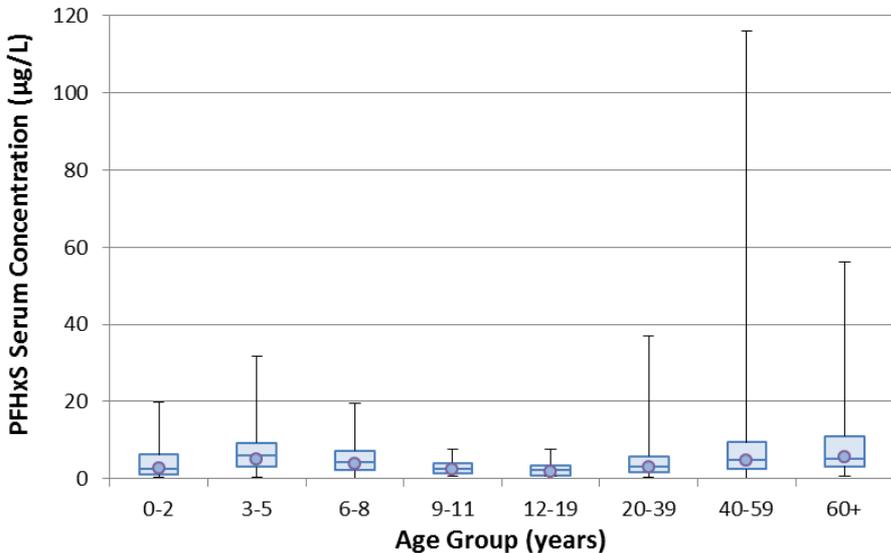
PFOS



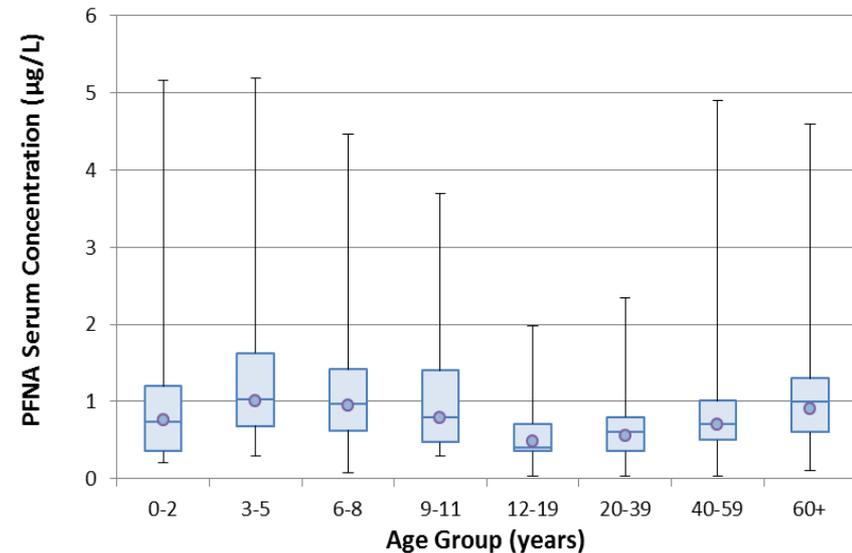
PFOA



PFHxS

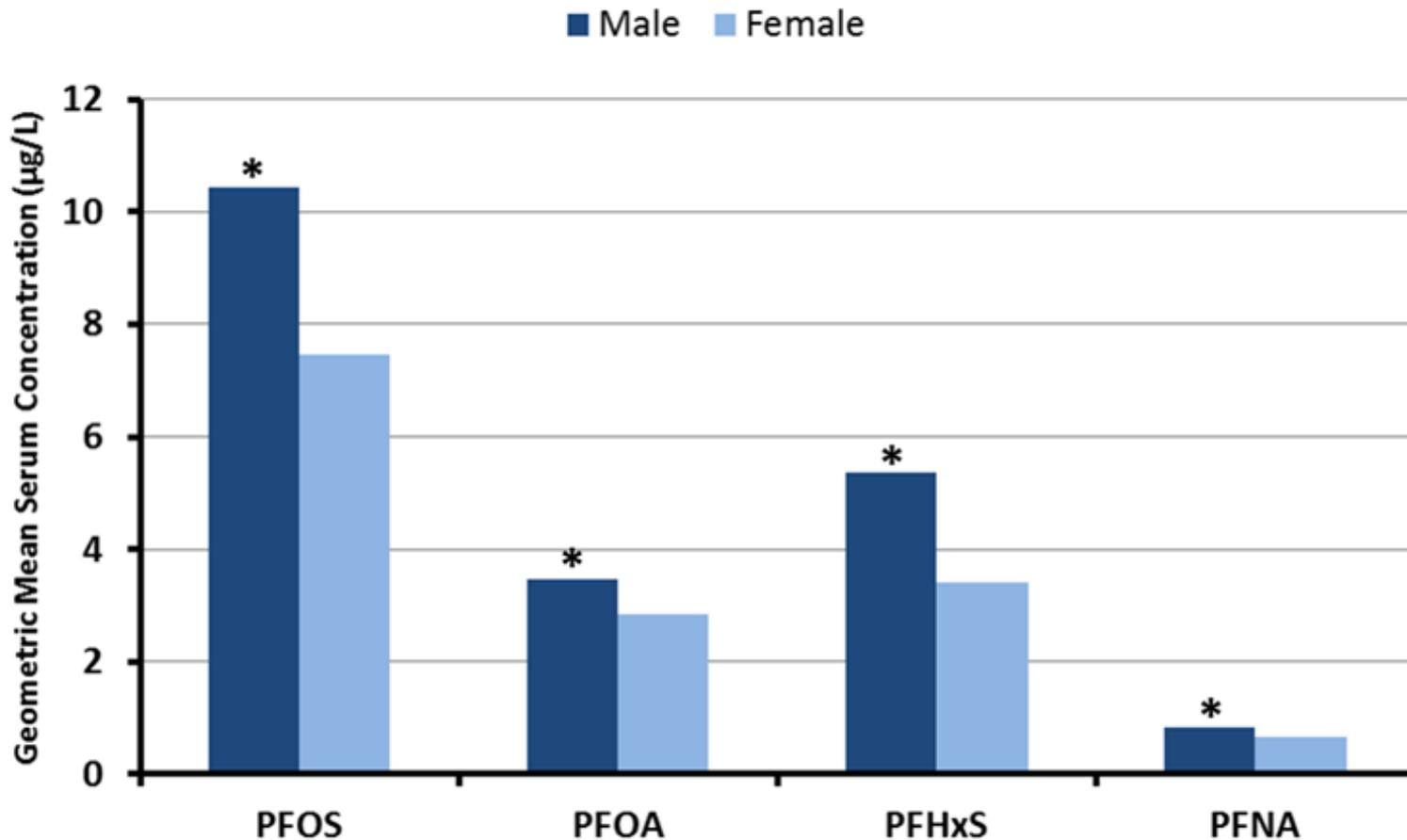


PFNA



Serum PFC Levels by Sex

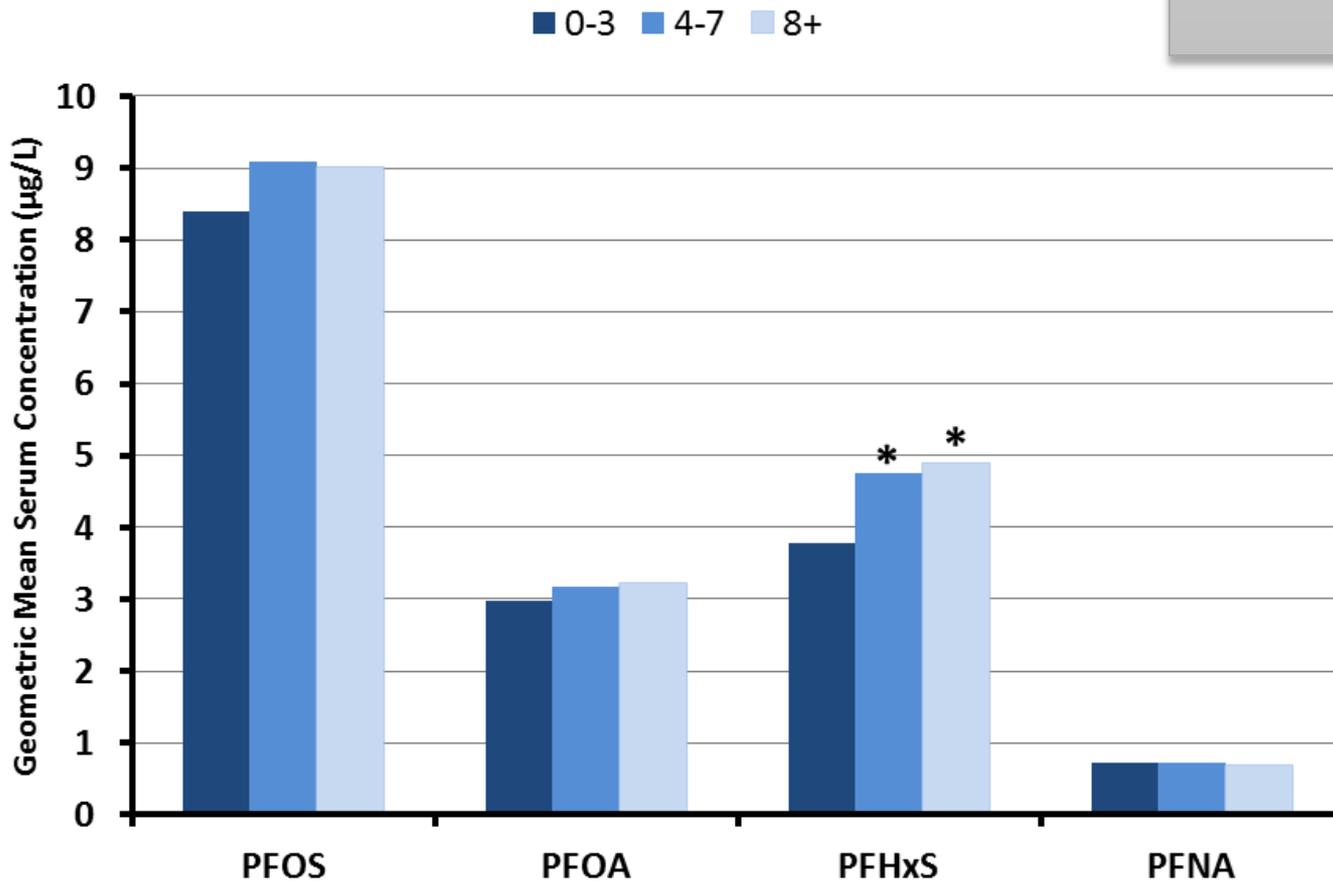
Characteristics	n	%
Sex		
Male	639	40.1
Female	856	54.3
Unknown	83	5.3



* Indicates a significantly higher mean concentration compared to females

Serum PFC Levels by Water Consumption (cups per day)

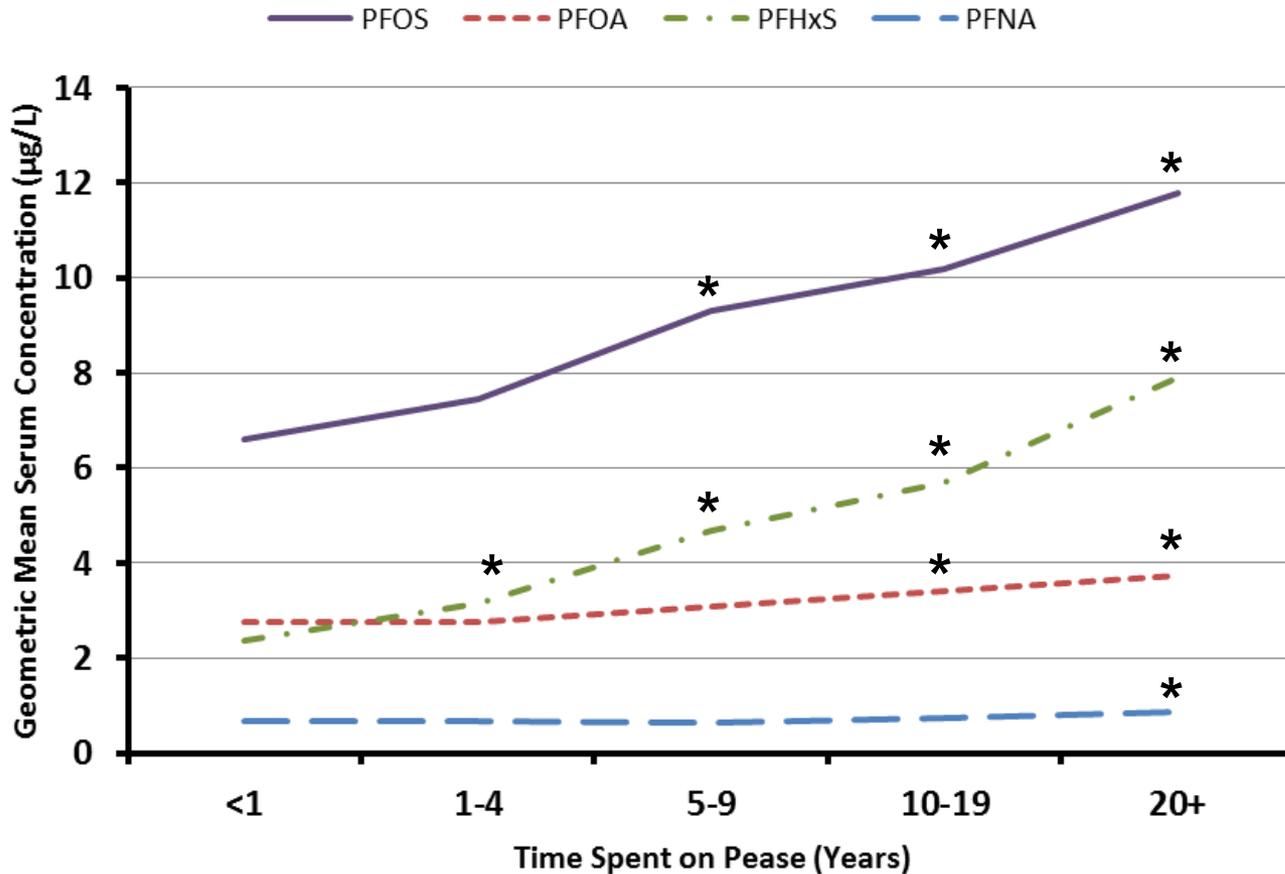
Characteristics	n	%
Water Consumption (cups per day)	(median=4)	
<4	572	36.3
4-7	539	34.2
8+	227	14.4
Unknown	240	15.2



* Indicates a significantly higher mean concentration compared with lowest water consumption group (0-3 cups/day)

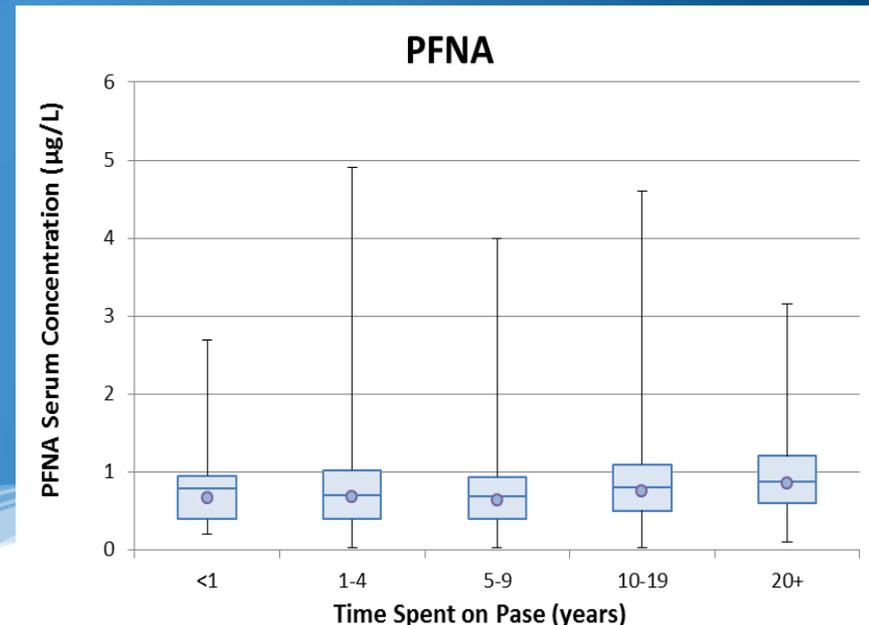
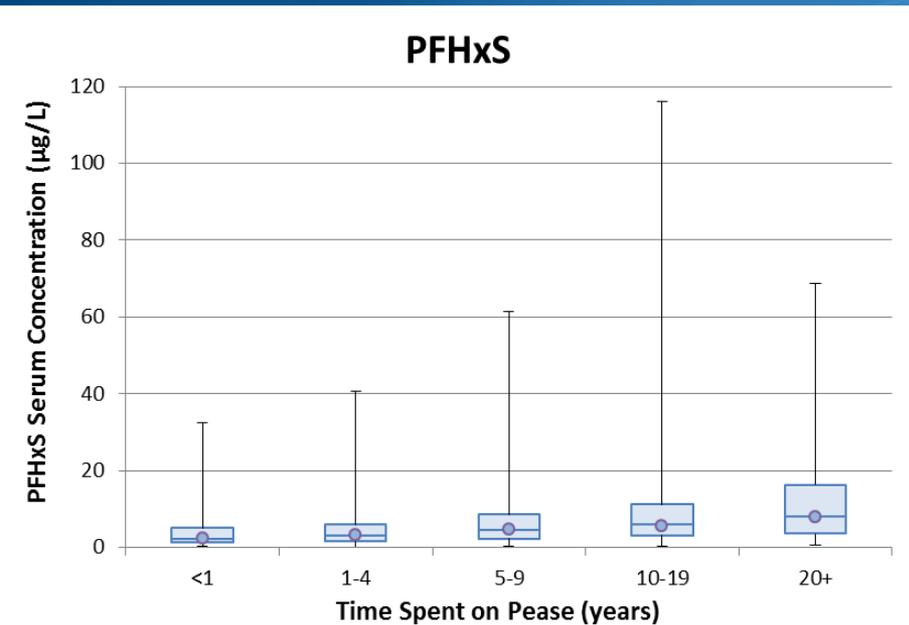
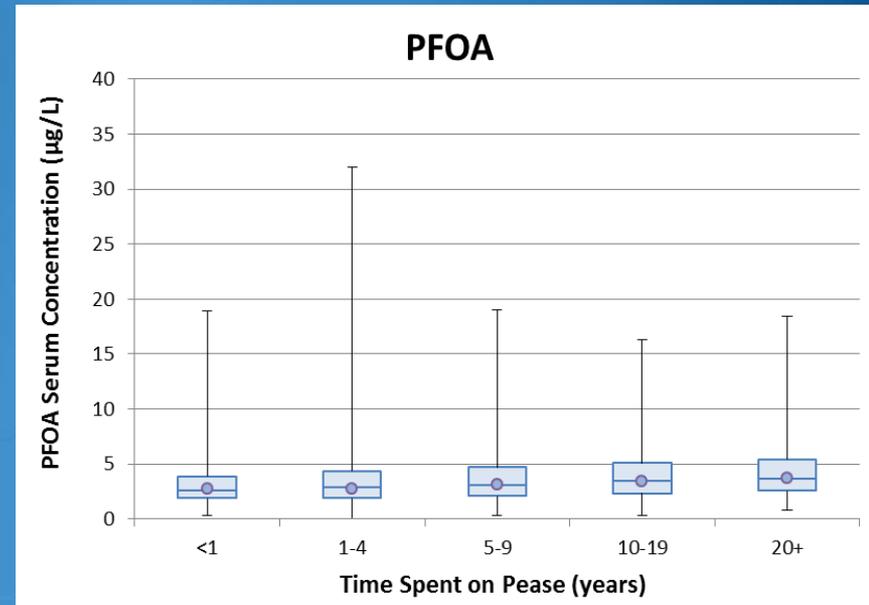
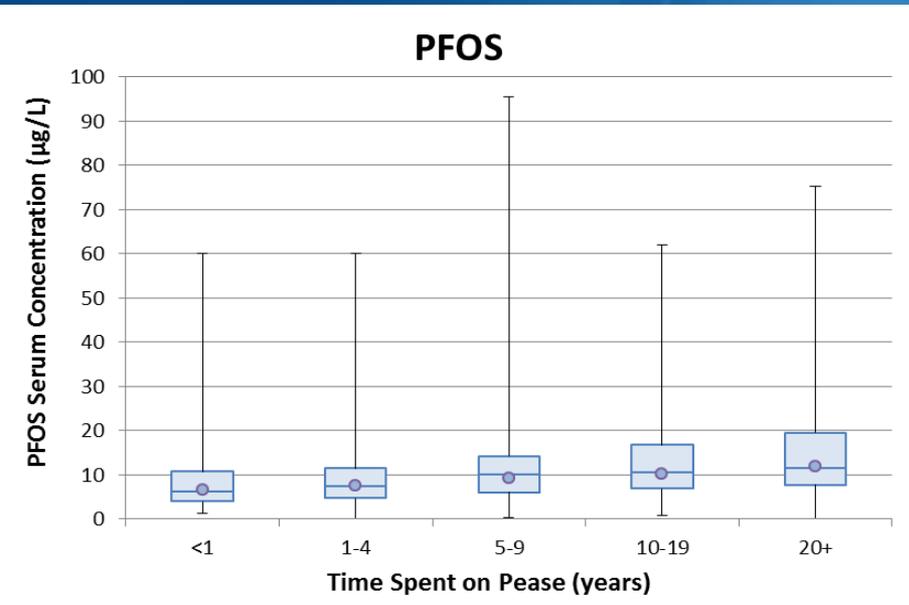
Serum PFC Levels by Cumulative Time Spent on Pease (Years)

Characteristics	n	%
Time Spent on Pease (years)	(median=6.5)	
<1	75	4.8
1-4	429	27.2
5-9	378	24.0
10-19	318	20.2
20+	88	5.6
Unknown	290	18.4



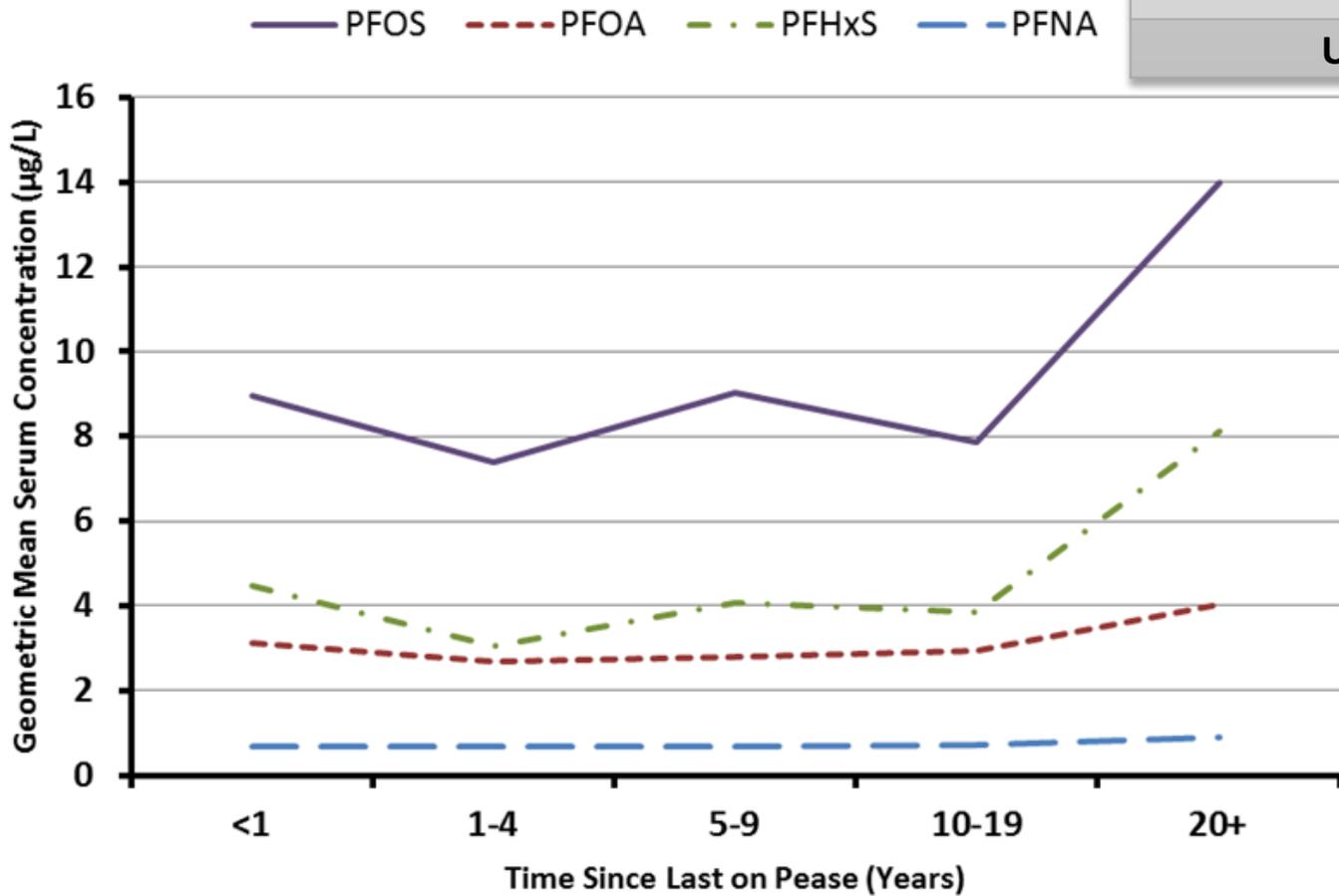
* Indicates a significantly higher mean concentration compared with group with lowest number of years spent on Pease (<1 years)

Serum PFC Levels by Time Spent on Pease



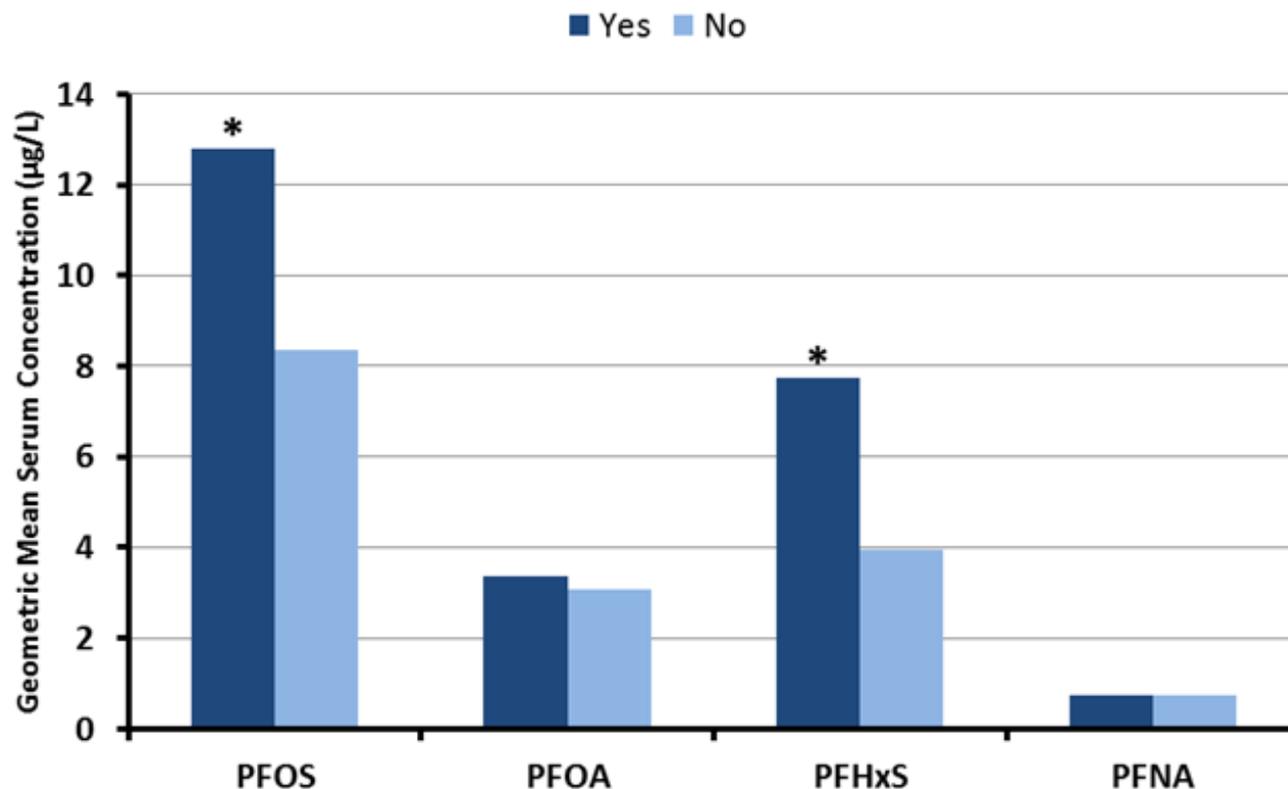
Serum PFC Levels by Time Since Last on Pease (Years)

Characteristics	n	%
Time Since Last on Pease (years)	(median=0.0)	
<1	948	60.1
1-4	144	9.1
5-9	88	5.6
10-19	74	4.7
20+	34	2.2
Unknown	290	18.4



Serum PFC Levels by Self-Identified Firefighter Occupation (“yes”)

Characteristics	n	%
Firefighter (yes)	98	6.2



* Indicates a significantly higher mean concentration in firefighters compared with those who did not report firefighting work

MULTIVARIATE (MULTIPLE VARIABLE) ANALYSIS USING LINEAR REGRESSION MODELING

Multivariate Linear Regression: Significant Predictors of Serum PFC Levels

- PFOS:
 - Age
 - Sex (male)
 - Time spent on Pease
- PFOA: (stratified by age due to “interaction”)
 - Sex (significant for age groups 20-39 and 40-59)
 - Time spent on Pease (significant for age groups 20-39 and 40-59)

Multivariate Linear Regression: Significant Predictors of Serum PFC Levels

- PFHxS: (stratified by age due to “interaction”)
 - **Sex** (significant for age groups 20-39 and 40-59)
 - **Time spent on Pease** (significant for age groups 20-39, 40-59, and 60+)
 - **Water consumption** (significant for age groups 0-19, 20-39, and 40-59)
 - **Time since last on Pease** (significant for age groups 0-19, 20-39)
- PFNA:
 - **Sex** (male)

Summary of Multivariate Analysis

- Age, sex, and Time Spent on Pease seem to be most consistently associated with serum PFC levels
- Data quality is a limitation
- Multiple other exposures and factors related to PFC level that are unaccounted for in our analysis

Summary of Multivariate Analysis

- Association between male sex and PFC levels is well described in the scientific literature (not unique to Pease)
- Association with age (especially in children), may indicate age-related behaviors that predispose children to PFC exposure (i.e. hand-to-mouth behavior)

Commercial and Industrial Products That Use PFCs

Commercial Products	Industrial Uses
<p>Cookware (Teflon®, Nonstick)</p> <p>Fast Food Containers</p> <p>Candy Wrappers</p> <p>Microwave Popcorn Bags</p> <p>Personal Care Products (Shampoo, Dental Floss)</p> <p>Cosmetics (Nail Polish, Eye Makeup)</p> <p>Paints and Varnishes</p> <p>Stain Resistant Carpet</p> <p>Stain Resistant Chemicals (Scotchgard®)</p> <p>Water Resistant Apparel (Gore-Tex®)</p> <p>Cleaning Products</p> <p>Electronics</p> <p>Ski Wax</p>	<p>Photo Imaging</p> <p>Metal Plating</p> <p>Semiconductor Coatings</p> <p>Aviation Hydraulic Fluids</p> <p>Medical Devices</p> <p>Firefighting Aqueous Film-Forming Foam</p> <p>Insect Baits</p> <p>Printer and Copy Machine Parts</p> <p>Chemically Driven Oil Production</p> <p>Textiles, Upholstery, Apparel and Carpets</p> <p>Paper and Packaging</p> <p>Rubber and Plastics</p>

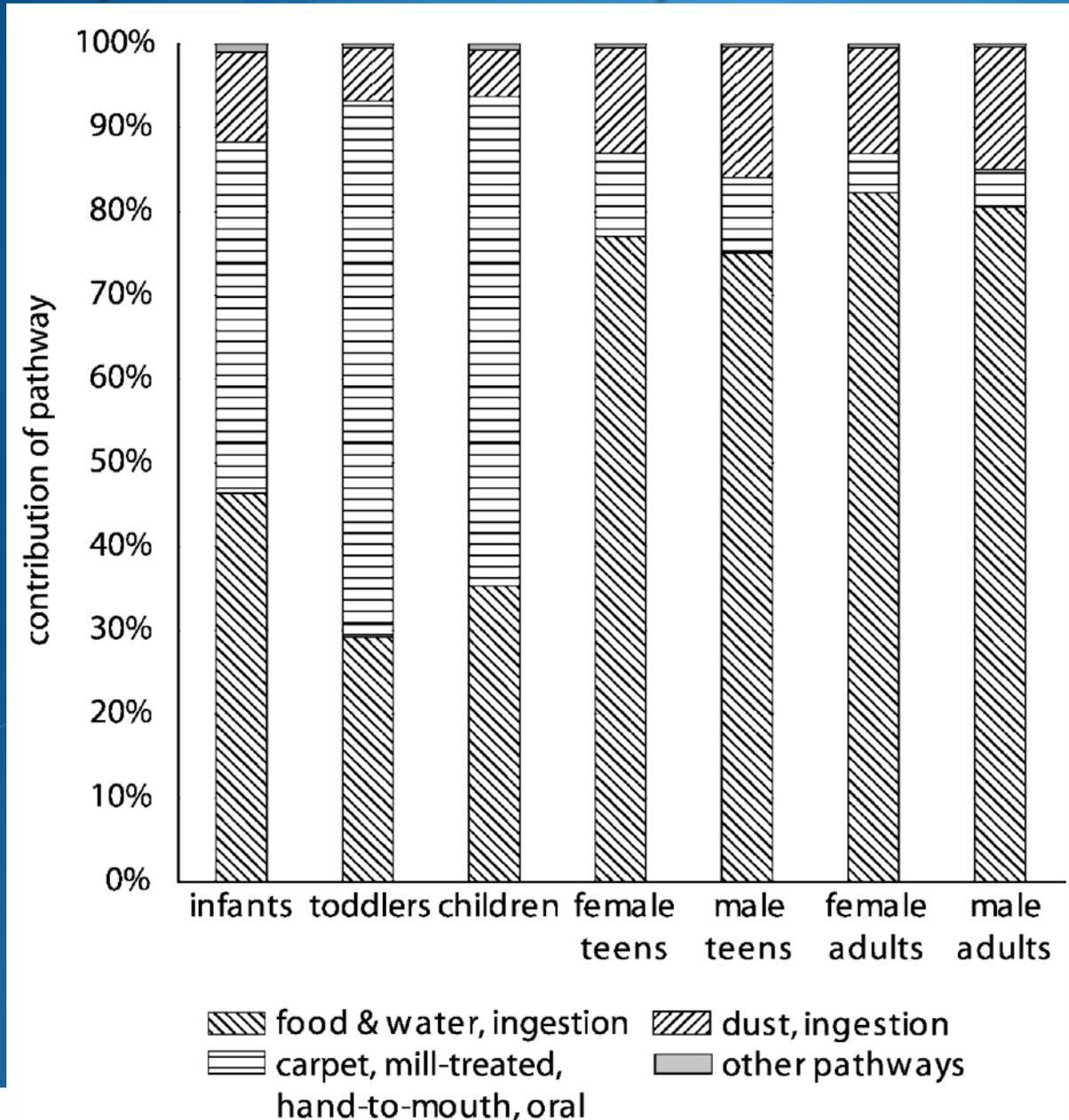
Estimating Consumer Exposure to PFOS and PFOA

Risk Analysis, Vol. 28, No. 2, 2008

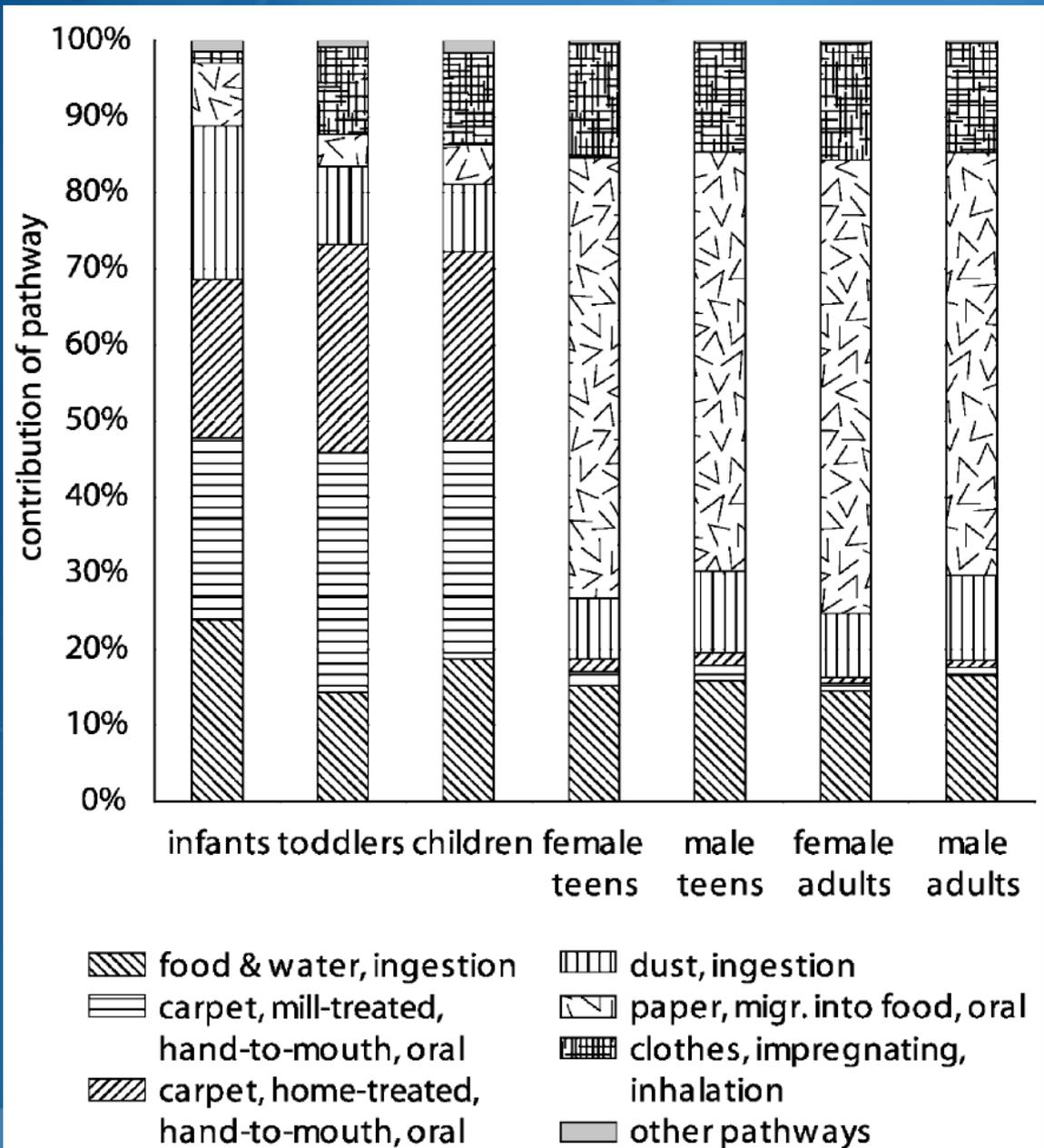
David Trudel,¹ Lea Horowitz,¹ Matthias Wormuth,¹ Martin Scheringer,^{1*} Ian T. Cousins,² and Konrad Hungerbühler¹

- Assess the total daily exposure to PFOS and PFOA via various pathways
- 7 age groups
 - Infants (age 0-1)
 - Toddlers (age 1-4)
 - Children (age 5-11)
 - Teenagers, male & female (age 12-20)
 - Adults, male & female (age >20)

Pathways of PFOS Exposure



Pathways of PFOA Exposure



Article Summary

- Consumption of food is the most important pathway for exposure to PFOA/PFOS (includes migration of PFCs into food from boxes and packaging)
- Ingestion of contaminated dust is a significant source of exposure (carpets, upholstery, clothing)
- In infants, toddlers, and children, hand-to-mouth contact with treated carpets is a significant exposure

Pease Testing Summary (1)

- PFOS, PFOA, and PFHxS were found in statistically higher levels in the Pease community compared to the general U.S. population
- The absolute difference in mean levels is small:
 - PFOS: 2.3 ppb difference
 - PFOA: 1.0 ppb difference
 - PFHxS: 2.8 ppb difference
- There were not large differences in levels between children and adolescents/adults at Pease

Pease Testing Summary (2)

- Levels of PFOS and PFOA are similar, if not lower, than levels found in the general U.S. population 10 years ago
- Levels of PFOS, PFOA, and PFHxS are lower than other environmentally exposed communities and occupationally exposed workers
- Other PFCs found in very low amounts

Pease Testing Summary (3)

- Age, sex, and time spent on Pease were most consistently associated with serum PFC levels
- Besides contaminated drinking water, likely many other unaccounted for factors contributing to serum PFC levels not evaluated in our brief questionnaire
- Based on known sources of exposure, hand-to-mouth behavior is likely contributing to childhood exposure and could explain the higher levels seen in the 3-5 year old age group

ADDITIONAL COMMENTS

How Will the Individual PFC Blood Levels be Used?

- The purpose of the PFC testing was to provide individuals more information about their level of exposure
- ATSDR has formed a Community Assistance Panel (CAP) to help address health concerns
- We have shared serum PFC test results with ATSDR as they plan for further health evaluation
- We will continue to work with ATSDR to support and be involved in their efforts

Who Should I Talk to About Health Concerns?

- Talk to your healthcare provider about any health concerns you have
- Monitoring of your health should be conducted through your healthcare provider
- Healthcare providers are the most appropriate person to decide whether additional steps should be taken to monitor your health
- We are in the process of engaging healthcare providers further to support them

Should I Have my Blood re-tested for PFCs?

- There is no medically approved or appropriate way to remove PFCs faster from your body
- Your body will remove PFCs slowly over time after exposure is stopped
- There is no recommendation to re-test blood for PFCs in the future because of the limited health information obtained from PFC blood testing and the expectation that levels should slowly decline over time

Resources

- Questions or concerns can be directed to the NH DHHS Inquiry Line: **603-271-9461**
- Questions specific to individuals' test results can be directed to the Northern New England Poison Center: **1-800-562-8236**
- Frequently Asked Questions (FAQs) about PFCs can be found on the NH DHHS website:
<http://www.dhhs.nh.gov/dphs/investigation-pease.htm>
- The full final Pease PFC blood testing report can be downloaded on our website:
<http://www.dhhs.nh.gov/dphs/documents/pease-pfc-blood-testing.pdf>

Questions?