

# DTSC Laboratory Update

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**Myrto Petreas, PhD, MPH**  
**Environmental Chemistry Laboratory (ECL)**

**Report to Scientific Guidance Panel**  
**Sacramento, CA**  
**November 6, 2014**

# Status

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- Staffing
- Progress with sample analysis
- Progress with identifying “Unknowns”
- Other DTSC activities that benefit the Program

# Staffing

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## **State Funding:**

- Miaomiao Wang, Ph.D.
- Yunzhu (Judy) Wang, M.S.

## **CDC Cooperative Agreement:**

- Erika Houtz, Ph.D.
- Sabrina Crispo-Smith, Ph.D.
- Shirley Cao, M.S.

# Short-term State Funding

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Two Limited-Term positions (2-yrs)

Arthur Holden, MS



Martin Snider, MS





# Status of sample analyses

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Continuing analyses for:

- PFCs, PBDEs, PCBs, OCPs for CA Teachers Study (CTS)
- PBDEs, PCBs, OCPs for Expanded BEST

# Progress with Expanded BEST

(as of November 1, 2014)

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|                                      | <b>n=337</b> | <b>n=218</b>        |
|--------------------------------------|--------------|---------------------|
|                                      | <b>PFC</b>   | <b>PBDE/PCB/OCP</b> |
| <b>Aliquoted</b>                     | <b>337</b>   | <b>218</b>          |
| <b>Extraction completed</b>          | <b>337</b>   | <b>162</b>          |
| <b>Instrument analysis completed</b> | <b>337</b>   |                     |
| <b>Data review completed</b>         | <b>337</b>   |                     |
| <b>Data released to Program</b>      | <b>337</b>   |                     |

# Progress with the CA Teachers Study (CTS)

(as of November 1, 2014)

|   | n=2,439 received |              |              |
|---|------------------|--------------|--------------|
|   | PFC              | PBDE         | PCB/OCP      |
| <b>Aliquoted</b>  | <b>2,025</b>     | <b>2,025</b> | <b>2,025</b> |
| <b>Extraction completed</b>                             | <b>1,337</b>     | <b>1,492</b> | <b>1,492</b> |
| <b>Instrument analysis completed</b>                    | <b>1,337</b>     | <b>1,492</b> | <b>264</b>   |
| <b>Data review completed</b>                            | <b>1,337</b>     | <b>1,283</b> | <b>176</b>   |
| <b>Data released to PI,<br/>to be posted on website</b> | <b>1,337</b>     | <b>1,283</b> | <b>176</b>   |

# Age and Race Distribution for 1,337 CTS Participants

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| Race         | n            | %           |
|--------------|--------------|-------------|
| White        | 992          | 74.2%       |
| Black        | 113          | 8.5%        |
| Hispanic     | 108          | 8.1%        |
| Asian/PI     | 98           | 7.3%        |
| Other        | 26           | 1.9%        |
| <b>Total</b> | <b>1,337</b> | <b>100%</b> |

| Age at Blood Draw (Years) | n            | %           |
|---------------------------|--------------|-------------|
| 40-49                     | 85           | 6.5%        |
| 50-59                     | 217          | 16%         |
| 60-69                     | 517          | 39%         |
| 70-79                     | 392          | 29%         |
| 80-89                     | 121          | 9.1%        |
| 90-99                     | 5            | 0.4%        |
| <b>Total</b>              | <b>1,337</b> | <b>100%</b> |



# PFCs (ng/mL) in Serum of 1,337 CTS Participants, 2011-14 (results as of 11/1/2014)

| Perfluorochemicals<br>(PFCs) | Geometric Mean<br>(95% Confidence Interval) | Selected Percentiles |                  |                  |                  |
|------------------------------|---|----------------------|------------------|------------------|------------------|
|                              |   | 25 <sup>th</sup>     | 50 <sup>th</sup> | 75 <sup>th</sup> | 95 <sup>th</sup> |
| PFHpA                        | <b>0.06</b> (0.05– 0.06)                    | 0.03                 | 0.06             | 0.11             | 0.27             |
| PFOA                         | <b>2.45</b> (2.37 – 2.53)                   | 1.67                 | 2.49             | 3.57             | 6.07             |
| PFNA                         | <b>0.94</b> (0.92 – 0.97)                   | 0.68                 | 0.96             | 1.34             | 2.22             |
| PFDeA                        | <b>0.22</b> (0.21 – 0.23)                   | 0.15                 | 0.23             | 0.35             | 0.66             |
| PFUA                         | <b>0.13</b> (0.12 – 0.13)                   | 0.08                 | 0.14             | 0.23             | 0.42             |
| PFDoA                        | *   | <LOD                 | <LOD             | <LOD             | 0.08             |
| PFBuS                        | *   | <LOD                 | <LOD             | <LOD             | 0.07             |
| PFHxS                        | <b>1.62</b> (1.55 – 1.69)                   | 1.05                 | 1.57             | 2.50             | 6.17             |
| PFOS                         | <b>6.74</b> (6.48 – 7.01)                   | 4.48                 | 7.17             | 10.80            | 18.90            |
| PFOSA                        | <b>0.04</b> (0.04 – 0.05)                   | 0.02                 | 0.04             | 0.09             | 0.28             |
| Et-PFOSA-AcOH                | <b>0.03</b> (0.03 – 0.03)                   | 0.02                 | 0.03             | 0.06             | 0.20             |
| Me-PFOSA-AcOH                | <b>0.22</b> (0.21 – 0.23)                   | 0.11                 | 0.21             | 0.44             | 1.37             |

\* Geometric mean was not calculated for chemicals that were found in less than 65% of the study group.  
< **LOD** means below limit of detection.

# PFCs (ng/mL) in 1,337 CTS Participants, 2011-14 compared to NHANES, 2009-10

| Perfluorochemicals<br>(PFCs) | Geometric Mean<br>(95% Confidence Interval) | NHANES 11-12 (n=489)<br><i>Women 40 years and above</i> |
|------------------------------|---|---|
| PFHpA                        | 0.06 (0.05– 0.06)                           | *   |
| <b>PFOA</b>                  | <b>2.45 (2.37 – 2.53)</b>                   | <b>2.02 (1.86 – 2.33)</b>                               |
| PFNA                         | 0.94 (0.92 – 0.97)                          | 0.90 (0.82 – 0.99)                                      |
| PFDeA                        | 0.22 (0.21 – 0.23)                          | 0.21 (0.19 – 0.24)                                      |
| PFUA                         | 0.13 (0.12 – 0.13)                          | 0.15 (0.13 – 0.18)                                      |
| PFDoA                        | *   | *   |
| PFBuS                        | *   | *   |
| <b>PFHxS</b>                 | <b>1.62 (1.55 – 1.69)</b>                   | <b>1.10 (0.94 – 1.27)</b>                               |
| PFOS                         | 6.74 (6.48 – 7.01)                          | 6.11 (5.57 – 6.70)                                      |
| PFOSA                        | 0.04 (0.04 – 0.05)                          | *   |
| Et-PFOSA-AcOH                | 0.03 (0.03 – 0.03)                          | *   |
| Me-PFOSA-AcOH                | 0.22 (0.21 – 0.23)                          | *   |

\* Geometric mean was not calculated for chemicals that were found in less than 65% of the study group.

# Identifying “Unknowns”

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- **Instrument**
  - **Agilent iFunnel QTOF 6550**
  - **Installation/testing in June-September**
- **Training**
  - **Agilent; UCDavis; SDSU**
- **Cross-lab TOF group to co-ordinate work**
- **Building libraries**

# Libraries for “Unknowns”

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- **Chemicals in Commerce: Pharmaceuticals, Impurities, Transformation By-products:** Howard & Muir, *ES&T*; 2010; 2011; 2013
- **Chemicals in consumer products compiled by USEPA**  
Goldsmith et al. *Food & Chemical Toxicology* 65 (2014) 269–27  
Modified by Dr. Tom Young, UCD
- **Pesticides (Agilent)**
- **All chemicals in our current methods**



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# DTSC Activities

# Newer nomenclature for PFCs

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We have been measuring the 12 PFCs included in NHANES

- Perfluorocarboxylic acids (PFCAs, e.g., PFOA)
- Perfluorosulfonic acids (PFSAs, e.g., PFOS)

Additional fluorinated compounds of emerging concern

Newer nomenclature

**Perfluoroalkyl & Polyfluoroalkyl Substances (PFASs)**

# PFASs:

## Perfluoroalkyl & Polyfluoroalkyl Substances

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**Perfluorinated**, i.e., fully fluorinated, C4 to C12

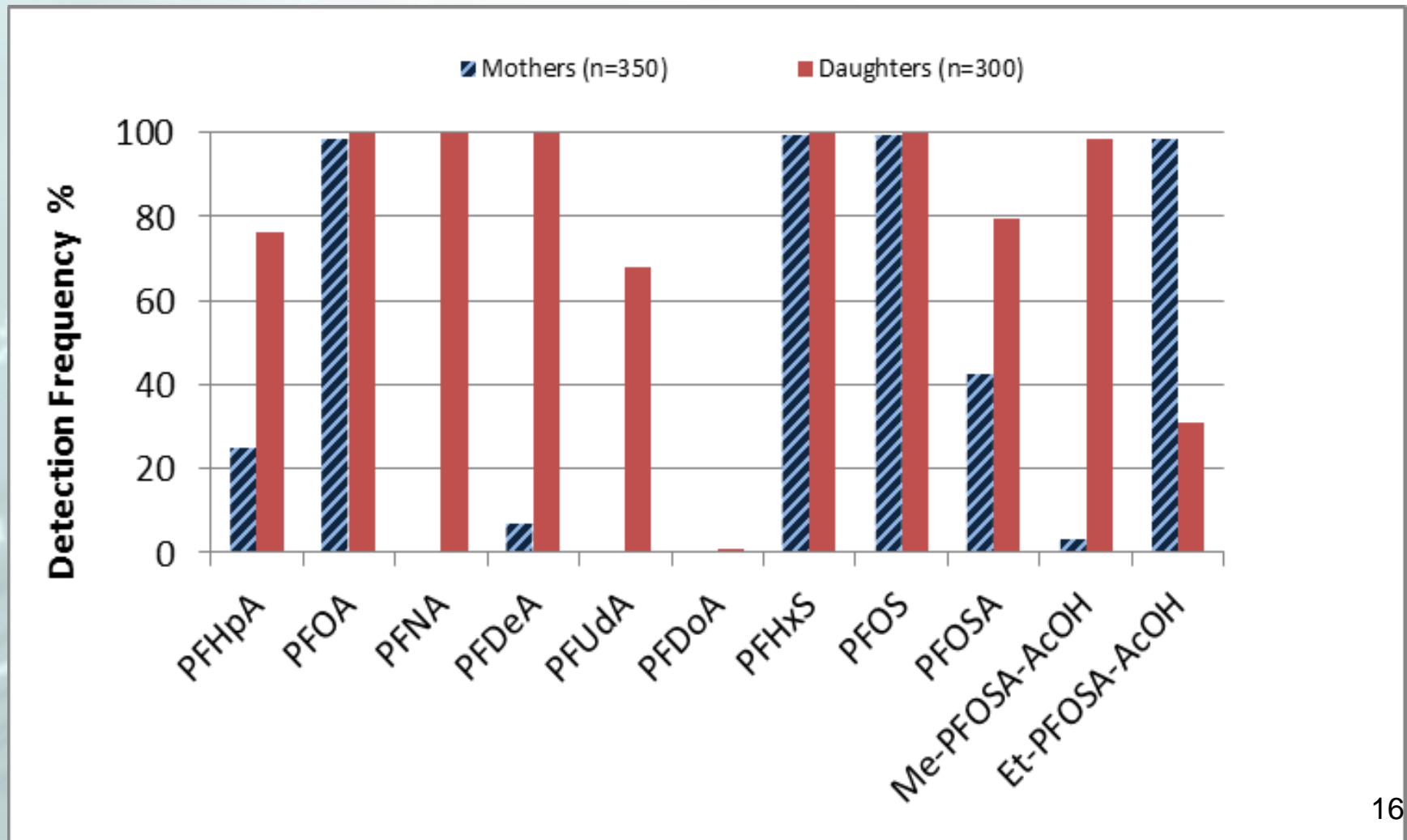
- All PFCs we have been monitoring

**Polyfluoroalkyl** molecules contain one or more C-H bonds

**Precursors:** polyfluoroalkyl compounds that may transform to perfluoroalkyl molecules through biotic or abiotic processes

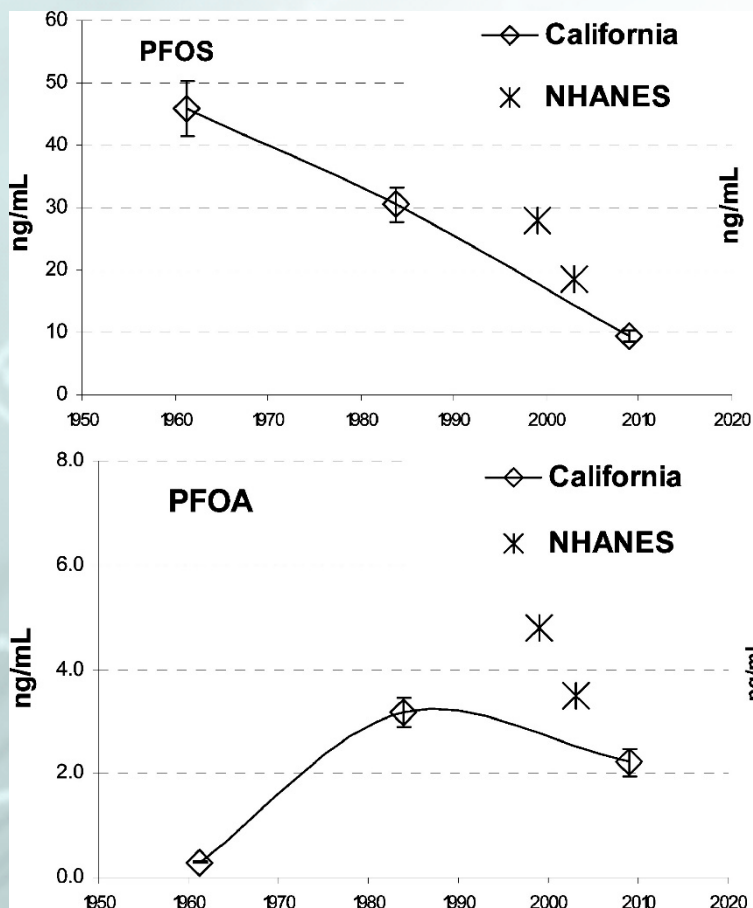
**Polyfluoroalkyl phosphates (PAPs)** –phosphate esters with one or more perfluorinated groups

# Detection Frequency of PFCs in 3G Study Mothers' (1960s) and Daughters' (2012) Serum

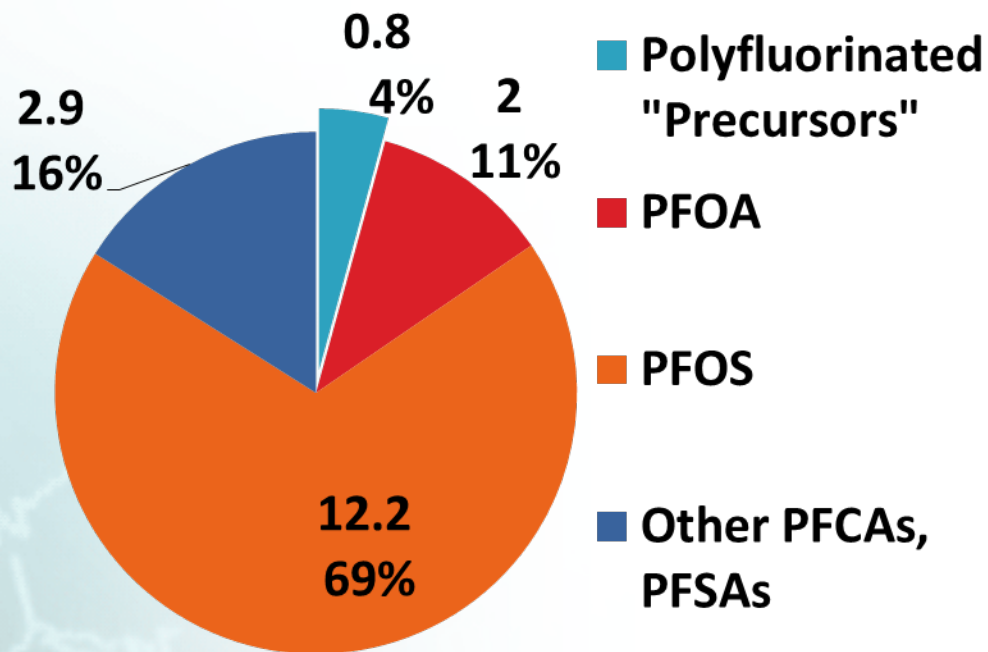




# Trends of PFASs in Serum



Wang et al., *ES&T*, 2011



PFASs (ng/mL) in US  
Lee and Mabury, *ES&T*, 2011

# PFASs

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More information and discussion for possible additions to the Designated List at a future SGP meeting

# Pregnant Women from SF General Hospital

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- PBDEs and OH-BDEs in serum of women undergoing 2<sup>nd</sup> trimester pregnancy termination; placenta and fetal liver
- Recruitment underway (2014: n=50 each; 2015: n=130 each)
- **1<sup>st</sup> phase sample collection (2014) done and analysis begun**
- Comparable demographics with previous studies (2008-09 and 2011-12):
  - Determine temporal trends
  - Distribution of chemicals among mother, placenta and fetal liver
- Funded by NIEHS, Tracey Woodruff, Ph.D., PI

**Aggregate results will be shared with Biomonitoring CA**

# Measuring Contaminants in Dust

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**Support DTSC's Safer Consumer Products**

**Link between chemicals in products and body burdens**

**Complement biomonitoring measurements**

**May predict exposures:**

POPs in California women's serum and residential dust  
(Whitehead et al., *Environ Res*, *In Press*)





# Methods for Dust Analysis

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## Completed:

- PBDEs, Firemaster and other BFRs
- PAHs, PCBs, OCPs
- Brominated and Chlorinated Dioxins/Furans
- Phosphorus Flame Retardants, including TDCPP, TCEP

## Near future:

- PFAS and Precursors
- Phenolics (BPA, Triclosan, etc.)
- Unknowns



| <b>Phosphorus Flame Retardants (OPFRs)<br/>in Dust<br/>(GC-MSMS)</b> | <b>Metabolites in<br/>Urine<br/>(LC-MSMS)</b> |
|--|---|
| Tri-ethyl phosphate (TEP)  |   |
| Tri-n-butyl phosphate (TnBP)   |   |
| Tris(2-chloroethyl) phosphate (TCEP)                                 | BCEP  |
| Tris(1-chloro-2-propyl) phosphate (TCiPP)                            | BCiPP   |
| Tris(1,3-dichloro-2-propyl) phosphate (TDCPP)                        | BDCPP   |
| Triphenyl phosphate (TPhP)   | DPhP  |
| Tris(2-butoxyethyl) phosphate (TBEP)                                 |   |
| Tris(2-ethylhexyl) phosphate (TEHP)                                  |   |
| Tri-o-tolyl-phosphate (ToTP)   |   |
| Tri-m-tolyl-phosphate (TmTP)   |   |
| Tri-p-tolyl-phosphate (TpTP)   |   |
| Tris(2,3-dibromopropyl) phosphate (TDBPP)                            |   |
| Tri-propyl phosphate (TPP)   |   |

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**QUESTIONS?**