

DTSC Laboratory Update



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

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

Status

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

Staffing

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

Two Limited-Term positions (2-yrs)

Arthur Holden, MS



Martin Snider, MS



Status of sample analyses

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)

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

Progress with the CA Teachers Study (CTS)

(as of November 1, 2014)

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

Age and Race Distribution for 1,337 CTS Participants

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

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%
Total	1,337	100%

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

Perfluorochemicals (PFCs)	Geometric Mean (95% Confidence Interval)	Selected Percentiles			
		25 th	50 th	75 th	95 th
PFHpA	0.06 (0.05– 0.06)	0.03	0.06	0.11	0.27
PFOA	2.45 (2.37 – 2.53)	1.67	2.49	3.57	6.07
PFNA	0.94 (0.92 – 0.97)	0.68	0.96	1.34	2.22
PFDeA	0.22 (0.21 – 0.23)	0.15	0.23	0.35	0.66
PFUA	0.13 (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	1.62 (1.55 – 1.69)	1.05	1.57	2.50	6.17
PFOS	6.74 (6.48 – 7.01)	4.48	7.17	10.80	18.90
PFOSA	0.04 (0.04 – 0.05)	0.02	0.04	0.09	0.28
Et-PFOSA-AcOH	0.03 (0.03 – 0.03)	0.02	0.03	0.06	0.20
Me-PFOSA-AcOH	0.22 (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 (PFCs)	Geometric Mean (95% Confidence Interval)	NHANES 11-12 (n=489) <i>Women 40 years and above</i>
PFHpA	0.06 (0.05– 0.06)	*
PFOA	2.45 (2.37 – 2.53)	2.02 (1.86 – 2.33)
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	*	*
PFHxS	1.62 (1.55 – 1.69)	1.10 (0.94 – 1.27)
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”

- **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”

- **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**

DTSC Activities

Newer nomenclature for PFCs

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

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

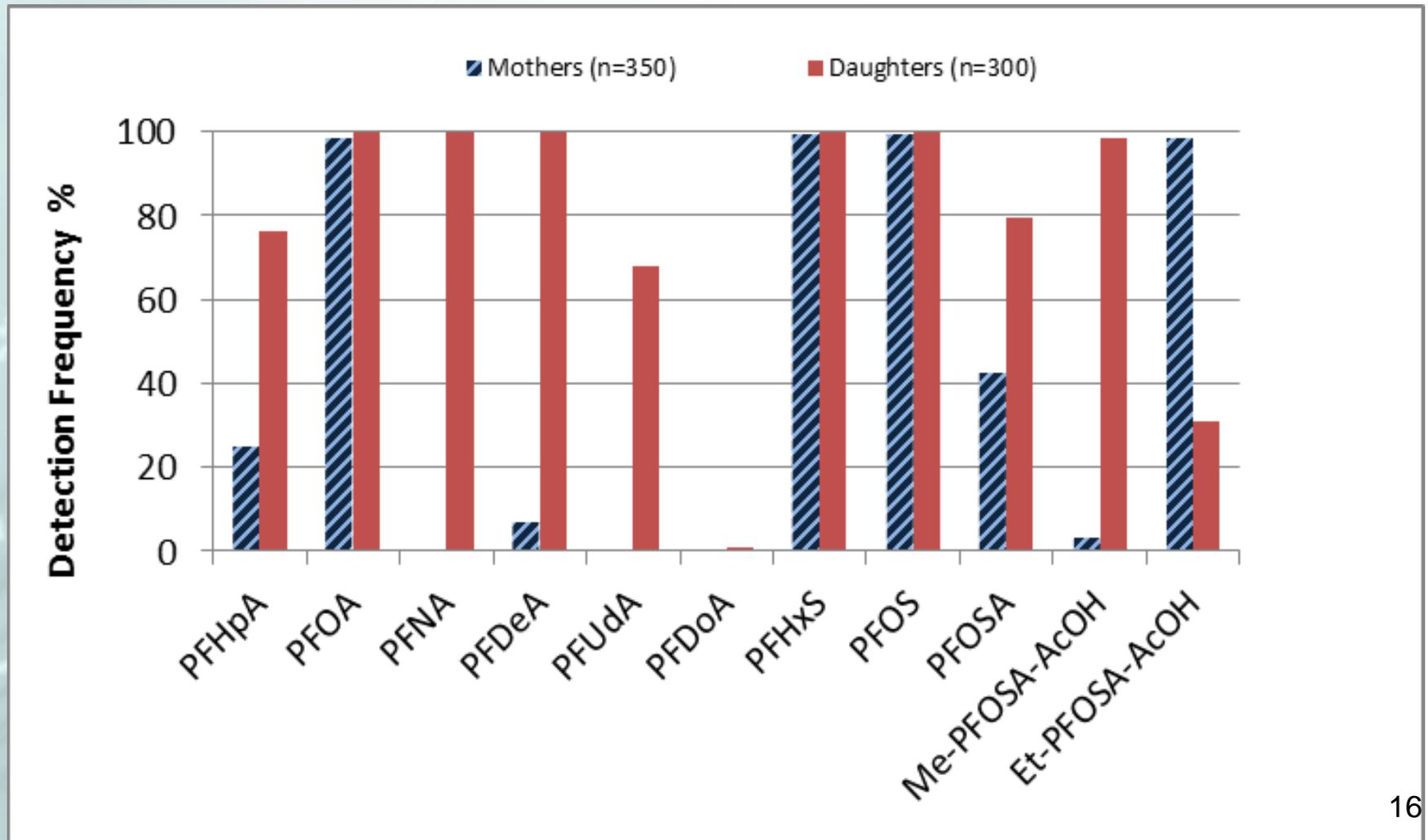
- All PFCs we have been monitoring

Polyfluoroalkyl molecules contain one or more C-H bonds

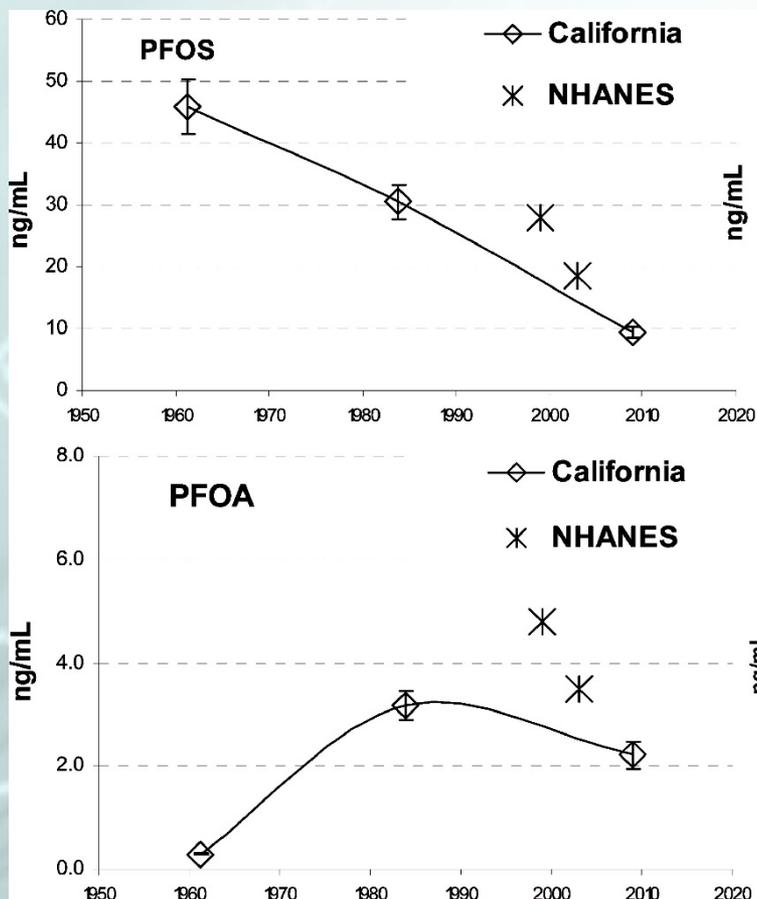
Precursors: polyfluoroalkyl compounds that may transform to perfluoroalkyl molecules through biotic or abiotic processes

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

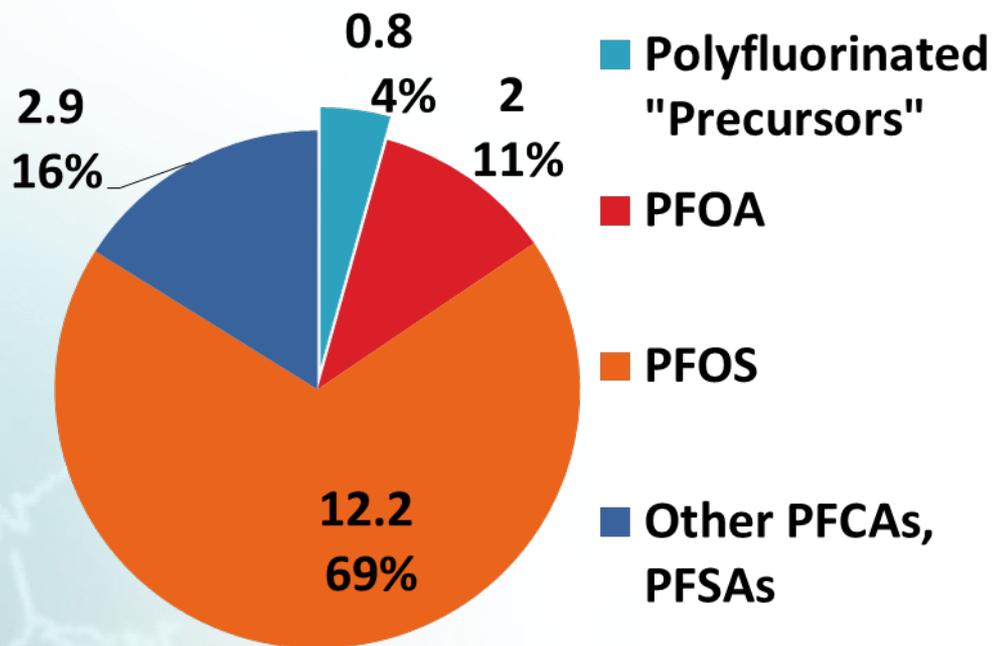
Detection Frequency of PFCs in 3G Study Mothers' (1960s) and Daughters' (2012) Serum



Trends of PFASs in Serum



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



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

PFASs

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

Pregnant Women from SF General Hospital

- PBDEs and OH-BDEs in serum of women undergoing 2nd trimester pregnancy termination; placenta and fetal liver
- Recruitment underway (2014: n=50 each; 2015: n=130 each)
- **1st 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

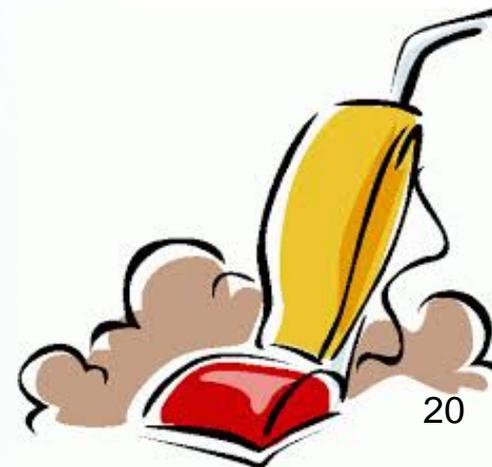
Support DTSC's Safer Consumer Products

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*)



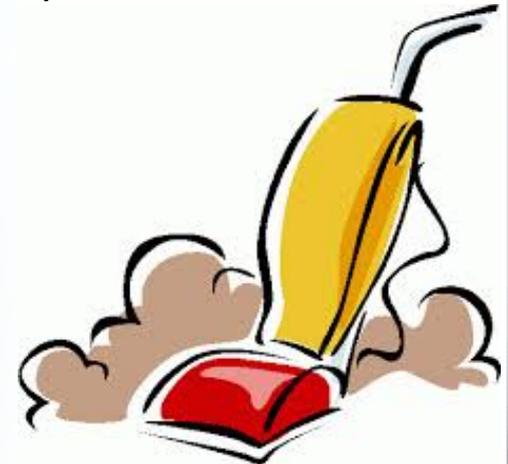
Methods for Dust Analysis

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



Phosphorus Flame Retardants (OPFRs) in Dust (GC-MSMS)	Metabolites in Urine (LC-MSMS)
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)	

QUESTIONS?