DTSC Laboratory Update

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Report to Scientific Guidance Panel
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Status

- Capability for analysis of chemicals on the Priority List
- Progress with FOX and MIEEP studies
- Other activities
- Challenges

We Have Validated Methods and Capabilities for:

- Polychlorinated Biphenyls (PCBs)
- Organochlorine Pesticides (OCPs)
- Polybrominated Diphenyl Ethers (PBDEs)
- Perfluorinated compounds (PFCs)
- Some Selected Brominated Organic Compounds used as Flame Retardants

Selected Brominated Organic Compounds used as Flame Retardants

We Have Capabilities for:

- Bis(2-ethyl-1-hexyl) tetrabromophthalate (TBPH)
- 1,2-Bis(2,4,6-tribromophenoxy)ethane (BTBPE)
- 1,2-Dibromo-4-(1,2-dibromoethyl)cyclohexane (TBECH)
- 2-Ethyl-1-hexyl-2,3,4,5-tetrabromobenzoate (TBB)
- Pentabromoethylbenzene (PBEB)
- 2,3-Dibromopropyl-2,4,6-tribromophenyl ether (DPTE)
- Hexabromobenzene (HBB)
- Pentabromotoluene (PBT)

- Tetrabromobisphenol A (TBBPA)

Selected Brominated Organic Compounds used as Flame Retardants

No Capabilities yet for:

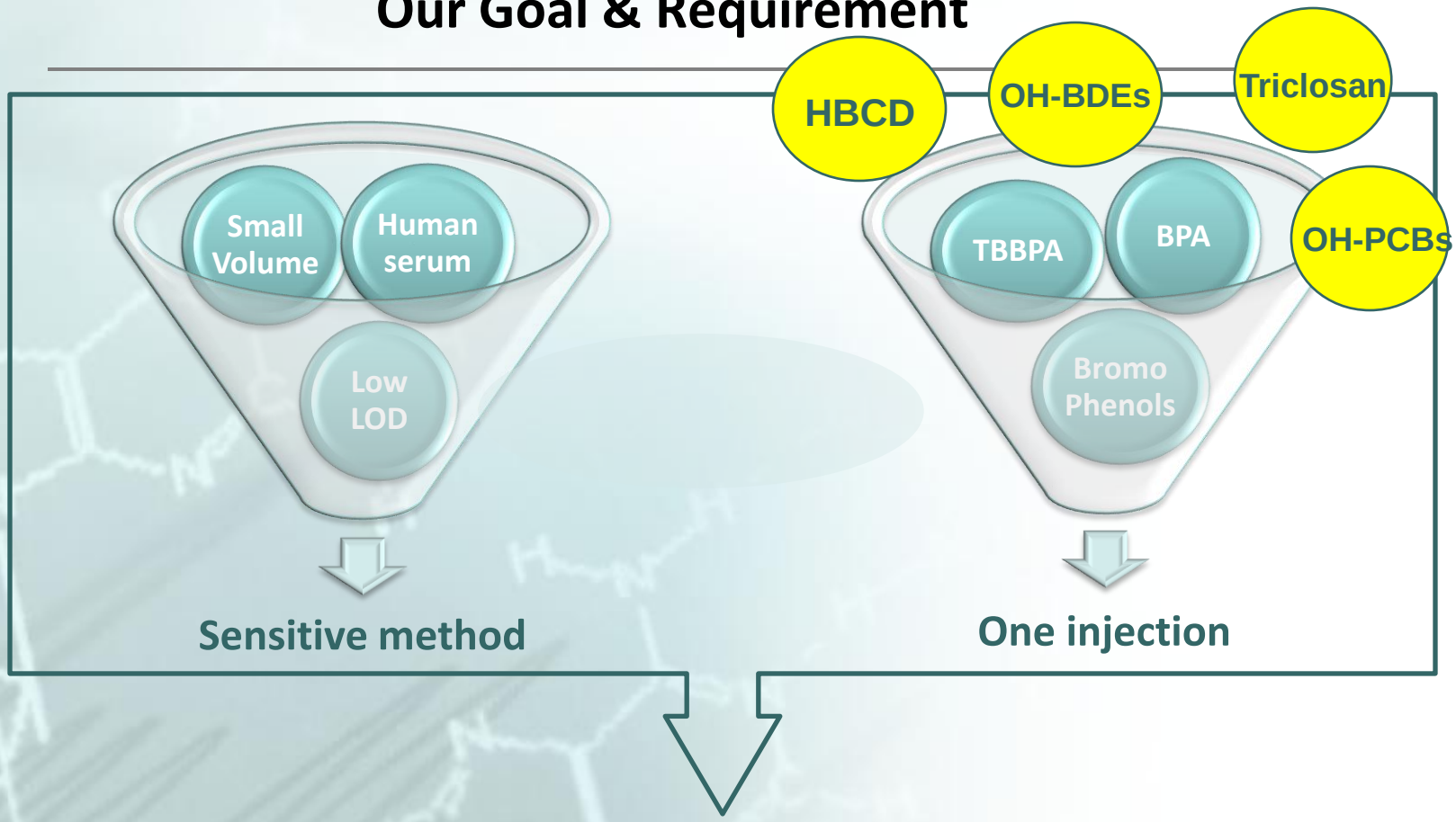
- 2,2-Bis(bromomethyl)-1,3-propanediol
- 2,2-Bis(chloromethyl)trimethylene bis[bis(2- chloroethyl)phosphate]
- Bis(hexachlorocyclopentadieno)cyclooctane (Dechlorane Plus)
- 1,2-Dibromo-4-(1,2-dibromoethyl)cyclohexane
- Chlorendic acid
- Decabromodiphenylethane (DBDPE)
- 2,2',4,4',5,5'-Hexabromobiphenyl (BB 153)
- Hexabromocyclododecane (HBCD)
- Hexachlorocyclopentadienyl-dibromocyclooctane
- N,N'-Ethylenebis(tetrabromophthalimide)
- Short-chain chlorinated paraffins
- Tetrabromobisphenol A bis(2,3-dibromopropyl) ether
- Tetrabromobisphenol A bis(2-hydroxyethyl) ether
- Tetrabromophthalic anhydride
- Tetrakis(2-chloroethyl)dichloroisopentyl diphosphate
- Tris(2-chloroethyl)phosphate (TCEP)
- Tris(1-chloro-2-propyl)phosphate (TCPP)
- Tris(1,3-dichloro-2-propyl)phosphate (TDCPP)
- Tris(2,3-dichloro-1-propyl)phosphate

Method development with new LC-MS/MS

- **Currently using new LC-MS/MS for Phenols in serum:**
  - Tetrabromobisphenol A (TBBPA)
  - Bisphenol A (BPA)
  - 2,4,6 Tribromophenol (2,4,6-TBP)
  - 2,4 Dibromophenol (2,4-DBP)

- **Next goals:**
  - Triclosan
  - PCB and PBDE hydroxy-metabolites
  - Hexabromocyclododecane (HBCD)

Our Goal & Requirement



One, sensitive, LC-MS/MS method for human serum
Can we include HBCD, Triclosan and hydroxy-metabolites?

Progress on FOX and MIEEP

Study	Number of Samples	Number of Samples Aliquoted	Number of Samples Analyzed (%)			
			PFCs	PBDEs	BFRs	PCBs /OCPs
FOX	101	101 (100%)	101 (100%)	10 (10%)	10 (10%)	10 (10%)
MIEEP	140	50 (36%)	40 (28%)	0 (0%)	0 (0%)	0 (0%)

Other DTSC Activities

- Work initiated by DTSC and/or funded through extramural grants
- Of benefit to the Biomonitoring Program

Blood Draw Options to Address Field Work Constraints
(Pilot for the CA Teachers' Study)

- **Can we have more flexibility in the field?**
- **How long can samples be stored frozen?**

- **Type of blood draw tube**
  - Red Top (RT) requiring centrifuging and lab processing within 24 hrs is the standard method
  - Serum Separator Tube (SST) only requires centrifuging in the field
- **Time between blood draw and processing:**
  - 2hr vs. 48 hr
- **Time in lab freezer between processing and analysis:**
  - 1 month vs. 2 yrs

Blood Draw Options to Address Field Work Constraints
(Pilot for the CA Teachers' Study)

Blood from 11 volunteers was:

- drawn in 6 tubes (3 RT and 3 SST)
- processed at different times (2hr vs. 48hr)
- stored frozen for 1 month
- analyzed for Persistent Organics (OCPs, PCBs, PBDEs, PFCs, BFRs) and lipids

- No difference between SST-48hr and RT-2hr (standard)
- SST-48hr can be used for Persistent Organics and lipids in this and future studies (BEST?)

- Effects of storage will be examined in 2 years

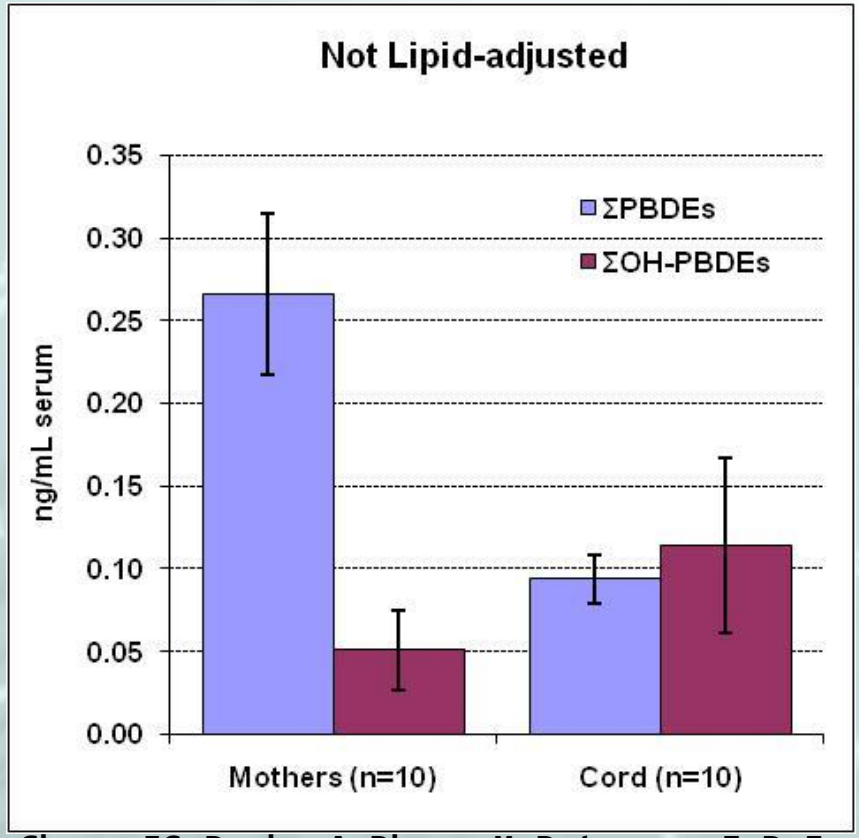
Maternal Serum and Cord Blood (Pilot for Univ. Cincinnati)

10 pairs analyzed for: PBDEs and OH-BDEs

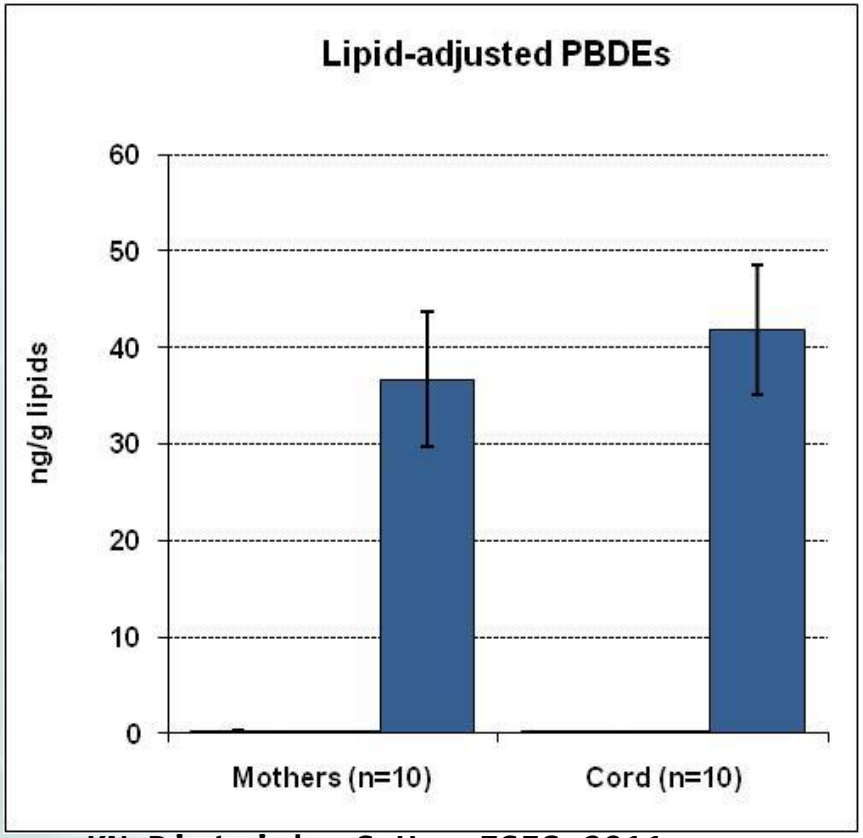
- All congeners measurable in both serum and cord blood
- OH-PBDEs in cord blood were higher than in paired maternal serum
- Fetuses may receive higher PBDE and OH-PBDE exposure compared with their mothers

Maternal Serum and Cord Blood (Pilot for Univ. Cincinnati)

Cord blood has similar levels of PBDEs and OH-PBDEs; higher OH-BDEs than maternal serum



Similar PBDE levels in maternal serum and cord blood



A Chen, JS Park, A Rhee, M Petreas, E DeFranco, KN Dietrich, S Ho. ISES 2011

Flame Retardants in Dust

- **Household Dust (UC Berkeley Childhood Leukemia Study)**
  - Use of Penta-BDEs (furniture) and Octa-BDEs (electronics) restricted after 2006; Deca-BDE unrestricted
  - Vacuum cleaner dust from 204 houses sampled twice (2001-07 and 2010)
  - No significant decrease in Penta- and Deca-BDEs; some decrease in Octa-BDEs (preliminary data, n=52)
  - Reflecting different use patterns?
  - Expanded analysis to new BFRs
  - Evidence of Deca-BDE debromination

Whitehead et al., BFR 2011 Conference
Whitehead et al., Dioxin 2011 Conference

- **Firehouse Dust**
  - Work in progress (PBDEs and new BFRs)

Challenges: Work more complex than expected

- **Separate analyses for various subgroups**
  - Persistent Organics (PCBs/OCPs, PBDEs, BFRs, “Other”) extracted from same sample require separate instrumental analyses (HRMS)

- **Limited equipment for competing analyses**
  - One HRMS for all Persistent Organics and future analytes
  - One LC-MS/MS for PFCs (dedicated to avoid contamination)
  - One LC-MS/MS for hydroxy- metabolites, phenols and some “Other” and future analytes

Challenges: Staff shortages

- 40% vacancy rate at DTSC Biomonitoring Section
  (4 out of 10 PYs)
- Of the 6 filled positions, both of our 2 CECBP-funded staff are on leave
- Uncertainty in APHL Fellowship

Challenges: Balancing Priorities

- **Method development vs. sample analysis**
- **DTSC Biomonitoring Section Capability vs. Capacity for Biomonitoring Program**

DTSC Biomonitoring Section