

Contaminants of Emerging Concern (CEC)



Delta/Central Valley Monitoring Planning Workshop

Previous studies and opportunities for partnering

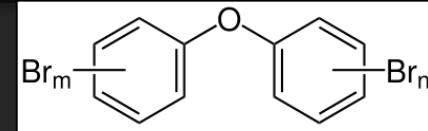
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Classes of CECs Reviewed

1. Flame retardants

- E.g., polybrominated diphenyl ethers (PBDEs)

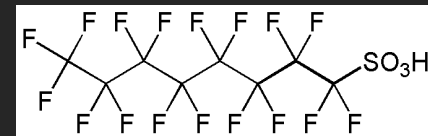


2. Pharmaceuticals

3. Personal Care & Cleaning Products

4. Fluorinated Substances

- Perfluorinated alkylated substances (PFAS)



5. Plastic additives

6. Hormones

7. Everything else (except pesticides!)

Priority CECs From Statewide Pilot Monitoring Plan



Flame Retardants	PBDEs (-47, -99) Triphenyl phosphate, chlorinated phosphates (TCEP, TCPP, TDCPP)
Pharmaceuticals	Diclofenac, ibuprofen, erythromycin, sulfamethoxazole
Personal Care & Cleaning Products	Galaxolide (HHCB), triclosan, p-nonylphenol
Fluorinated substances	PFOS
Plastic Additives	Bisphenol A, phthalates (bis[2-ethylhexyl]phthalate, butylbenzylphthalate)
Hormones	Estrone, 17-beta-estradiol
Others	Sucralose

Blue – Target CECs for Central Valley/Delta Pilot Study Scenarios from 2012 Panel report

Summary of Previous Studies



1. Endocrine disruption in fish
2. Regional ambient surveys
3. POTWs
4. Non-targeted analysis (NTA)
5. Bay Regional Monitoring Program

CEC Classes previously monitored by

	Most	Some	None
	of the previous studies		
Flame Retardants		PBDEs, PBDE alternatives	
Pharmaceuticals	X		
Personal Care & Cleaning Products	X	Alkylphenols & alkylphenol ethoxylates	
Fluorinated substances		X	
Plastic Additives		Bisphenols, phthalates	
Hormones	X		
Others	(Pesticides)	Food additives, caffeine etc.	Numerous others

Flame Retardants

- Monitored by some of the previous studies
- Commonly detected when targeted (or through NTA)
 - PBDEs: Multiple congeners are typically detected.
 - Triphenyl phosphate and chlorinated phosphates detected in multiple studies, including NTA



Pharmaceuticals

Personal Care & Cleaning Products

Key findings

- Monitored by most of the previous studies
- Detected in ambient Delta water and wastewater effluent

Pharmaceuticals



Personal Care & Cleaning Products

- **Ibuprofen** [Pharm], **triclosan** [PCCP], sulfamethoxazole [Pharm]
 - Common analytes frequently detected in wastewater, ambient studies
- **Diclofenac** [Pharm]
 - sporadically detected in wastewater and MWD ambient study
- **Galaxolide** [PCCP], Erythromycin [Pharm]
 - Never monitored
- **Nonylphenol/ nonylphenol ethoxylates** [PCCP & other]
 - Monitored; detected; one of the suspected culprits to cause fish feminization

Pharmaceuticals

Personal Care & Cleaning Products

Metformin [Pharm]

- Wastewater derived
- Not previously monitored
- Detected by NTA in ambient samples
- One of the substances found with the highest concentrations



Pharmaceuticals

Personal Care & Cleaning Products

Recommendations

- Short list of “representative” compounds would help compare detections across studies
- NTA can help identify key compounds to add

Fluorinated Substances

- Detected in Vacaville WWTP study and by NTA
- Both studies detected several substances, including PFOS and PFOA
- Not measured in other studies



Plastic Additives

- Include bisphenols and phthalates
- **Bisphenol A** monitored and detected by some of the previous studies
- NTA study did detect phthalates

Hormones

Key findings

- Monitored by most of the previous studies
- Target analytes are varied
- Sometimes detected and sometimes not
- Endocrine disrupting activity observed in fish



Hormones

Key findings

- Estrone and 17-beta-estradiol monitored several studies, sporadically detected



Key findings

Frequently studied CEC classes:

- Pharmaceuticals
- Personal Care and Cleaning Products
- Hormones

However:

→ **Few standardized analytical methods**

→ **No common target lists of analytes**

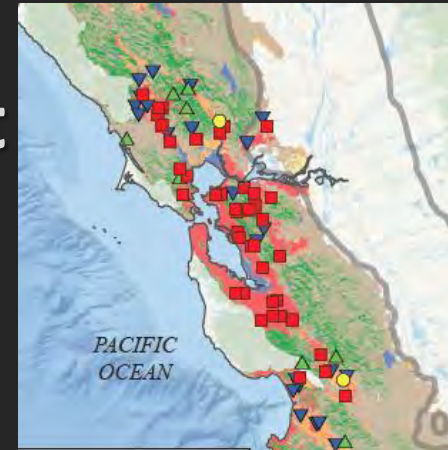
Less frequently studied:

- Flame retardants
 - Fluorinated substances
 - Plastic additives
- **NTA useful screening tool, can help prioritize target analytes**

Leveraging Opportunities

USGS National Water Quality Program California Stream Quality Assessment

- Target analytes include pharmaceuticals and other CEC compounds
- Water sampling and integrated water sampling (POCIS)



Sample collection is wrapping up.
Future opportunities?

Future Studies – Leveraging Opportunities

Delta RMP: Aquatic Toxicity/Pesticide Monitoring at Hood

- If funded, planned for FY17/18
- Includes passive sampling for pesticides



Opportunity: samples can be preserved for CEC analysis

Leveraging Opportunities

Coordination/piggybacking/opportunistic sampling

→ Coordination with Bay RMP

→ Surface Water Ambient Monitoring Program –
sediment/water sample collection at SPoT Central Valley sites

→ Delta RMP – e.g., fish sampling, co-locating stations



Summary of Previous Studies

1. Endocrine Disruption in Fish

a. University of California (UC) Riverside/UC Berkeley (Lavado et al. 2009)

- > 16 sites; 100+ constituents incl. steroid hormones, pharmaceuticals, pesticides; fish feminization
- > Feminization when alkylphenols /alkylphenol ethoxylates mixed with bifenthrin

b. UC Davis – Bodega Lab (Brander et al. 2012)

- > 2 sites in Suisun Marsh
- > Bioassay; endocrine disruption found at both urban and ranch site



2. Ambient studies

a. Metropolitan Water District /Orange County Water District (Guo et al. 2010)

- > Targeted EDCs, Pharmaceuticals and Personal Care Products (PPCPs), and Organic Wastewater Contaminants @ 11 State Water Project source water sites (quarterly sampling)
- > Detected 21 of 49 CECs; detectable amounts at all sites/events except April 2008 @ American River

b. Pollutant Presence and Effect – UC Davis/DWR/EPA/DFW (Biales et al. 2015)

- > Targeted: hormones, active pharmaceutical ingredients, and pesticides @ 4 Sacramento River sites incl. Hood
- > Number and concentrations of pharms detected in Sacramento River increased moving downstream and were greatest at Hood
- > Urban contaminant concentrations higher during dry season, but larger number of compounds detected during wet season

Summary of Previous Studies

3. Wastewater Treatment Plant studies

a. Regional San (Ohlinger et al. 2013)

-> Assess treatability of 12 indicator compounds, incl. Carbamazepine, Ibuprofen, Triclosan, Tris(2-chloroethyl) phosphate (TCPP)

-> 8 of the 12 compounds were reduced through biological nitrogen removal (BNR)

a. Vacaville (RBI 2013)

-> Monthly monitoring of effluent, upstream, and downstream sampling point

-> Hormones; PPCPs; Consumer/Industrial Products; Nitrosamines, Perfluorinated Chemicals

-> Detected some always (e.g. acetaminophen, carbamazepine, perfluorinated chemicals) ; some sometimes (e.g., ibuprofen, progesterone, estrone), some never (nonylphenols and nonylphenol ethoxylates)

4. Non-Targeted analysis (NTA; Moschet et al. 2017)

-> Cache Slough, winter 2016, >5000 compounds screened

-> Organic wastewater contaminants showed highest concentrations (sucralose, PPCPs, 2,4-dichlorophenol)

-> Also detected: Industrial products, Flame retardants, Per- and Polyfluoroalkyl Substances (PFAS)

5. Bay Regional Monitoring Program (RMP) sampling in western Delta/confluence (Sutton et al. 2014)