CECs: The San Francisco Bay Story

Tom Mumley, SF Bay Regional Water Board
Karin North, City of Palo Alto
Rebecca Sutton, SFEI - ASC
Contaminants of Emerging Concern

- PFOS
- PFAS
- PBDEs & Flame Retardants
- Pesticides

William Duke, NYTimes
San Francisco Bay

BIG, URBANIZED
Area = 4,100 km²

SHALLOW, COMPLEX
Median Depth = 4 m

LARGE WATERSHED
40% of CA
Regional Monitoring Program

Partnership to understand the health of San Francisco Bay

Celebrating our 25th year!
RMP Participants

RMP Fees by Sector: 2017

- Municipal WWTFs: 45%
- Industry: 11%
- Stormwater: 24%
- Dredgers: 18%
- Cooling Water: 2%

Budget: $3.5M
RMP Focus on CECs

- 10+ years of monitoring and studies
  - Primarily ambient water, sediment, biota
  - Some wastewater and stormwater
- 2013 CEC Synthesis and Strategy
  - Added non-targeted analysis, bioanalytical tools
- 2017 Strategy Revision
Informed and Informed-By


http://www.waterboards.ca.gov/water_issues/programs/swamp/cec_aquatic/docs/cec_ecosystems_rpt.pdf
Management Questions

Which CECs have the potential to adversely impact beneficial uses in San Francisco Bay?

What are the sources, pathways, loadings, and processes leading to CEC pollution in the Bay?

Have the concentrations of CECs in the Bay increased or decreased?

Which management actions may be effective in reducing CEC levels?
CECs Science Advisors

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Dr. Derek Muir
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Dr. Lee Ferguson
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CEC Strategy: Three Elements

1. CEC monitoring, evaluating risk

2. Learning from others, sharing expertise

3. Non-targeted monitoring (bioassays, broadscans)
Risk Tiers

**TIER 4**
High probability of moderate or high level effect on Bay wildlife

**TIER 3**
High probability of low level effect on Bay wildlife

**TIER 2**
High probability of no effect on Bay wildlife

**TIER 1**
Uncertainty in Bay levels or toxic thresholds
Monitoring Strategy

Studies to support Total Maximum Daily Load (TMDL) or alternatives

Trends monitoring and/or fate, effects, and sources and loadings studies

Periodic ambient and/or source trend screening

Ambient and source screening
Management Strategy

303(d) list → TMDL or alternative(s)

Action plan or strategy
  – Aggressive pollution prevention
  – Seek product or chemical alternatives

Track product use and market trends
Easy, low-cost source identification
and pollution prevention actions

Identify and prioritize potential CECs
Develop bio and chemistry methods
CEC Strategy: Three Elements

1. CEC monitoring, evaluating risk

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3. Non-targeted monitoring (bioassays, broadscans)
Work Underway in 2017

1. CEC monitoring, evaluating risk

- Alternative Flame Retardants in Bay Water
- Neonic Pesticides and Degradates in Bay Water
- Bisphenols in Bay Water
- Triclosan and Methyl Triclosan in Small Fish
- PFAS Synthesis and Strategy
- Advancing modeling capabilities
None currently

**LOW IMPACT**
- PFOS
- Fipronil
- Nonylphenol

**NO IMPACT**
- PBDEs and HBCD
- Pyrethroids*
- Pharmaceuticals and Personal Care Products
- PBDDs and PBDFs

**UNCLEAR**
- Alternative Flame Retardants
- PFAS (Fluorinated Chemicals)
- Pesticides, Plasticizers
- Microplastic
- PCB 11, PHCZs, others
Tracking the Science

2. Learning from others, sharing expertise

• Read the literature
• Attend scientific conferences
• Communicate with decision-makers
• Educate stakeholders
• Collaborate with leading minds
Work Underway in 2017

3. Non-targeted monitoring

• Non-targeted Analysis of Bay Water and Effluent

• Bioassays of South and Lower South Bay Margin Water and Sediment for Estrogenicity (EEWG)

• 2018 Proposal: Non-targeted Analysis of Sediment
Multi-Year Plan: Proposed Special Studies

Moderate Concern Priorities

• PFOS/PFAS
  • Focus on trends, unknown PFAS
• Nonylphenol/Ethoxylates
  • Broad screening, temporal trends, synthesis
• Fipronil & degradates
  • Fish tissue

Coordinate with Status & Trends monitoring
Multi-Year Plan: Proposed Special Studies

- Alternative flame retardants
- Dyes
- Pharmaceuticals
- Personal care & cleaning products
- Plastic additives
- Pesticides

3. Non-targeted monitoring

- Series of studies in different matrices
- Followup targeted studies
RMP CEC Strategy: Themes

Focus on chemical and functional classes

Policy-relevant science
PBDE Recovery

Shiner Surfperch

![Graph showing PBDE concentration over years (2003, 2006, 2009, 2014)]
Alternative Flame Retardants

PBDE replacements detected in consumer products and San Francisco Bay led to management actions.

California Bureau of Home Furnishings

- TB117-2013: New standard for foam furniture, exemptions for baby products
- SB 1019: Furniture labeling law
PFOS Recovery

South Bay Harbor seals

PFOS in Serum (ng/g or ng/mL)

2004 to 2008

2009 to 2012

2014
3,000

Perfluorocarboxylic acids (ex. PFOA)
Perfluorosulfonic acids (ex. PFOS)
Fluorotelomer alcohol (ex. 8:2 FTOH)
Perfluorophosphonic/phosphinic acids (ex. If R=OH then PFOPA, If R=C8 perfluoroalkane then 8:8 PFPi)
Perfluorosulfonamide (ex.)
Perfluorinated cyclo sulfonates (ex. PFECHS)
Perfluorosulfonamidoethanol (ex. N-EtFOSE)
Fluorotelomer phosphate esters (ex. if R=OH then 8:2 monoPAP, if R=8:2 FTO ester then 8:2 diPAP)
Polyfluorinated ether carboxylates (ex. 4,8-dioxo-3H-perfluorononanoate)
Polyfluorinated polymeric unit (ex. 1H,1H,2H,2H-perfluorodecyl acrylate)
Polyfluorinated ether sulfonates (ex. Perfluoro [hexyl ethyl ether sulfonate])
Microplastic

2015 Bay study levels higher than:

• Great Lakes
• Chesapeake
• Salish Sea

Sutton et al. 2016
Microplastic: Broader Impacts

Policy:
• Federal **Microbead-Free Waters Act** signed into law (2015)

Funding:
• Gordon & Betty Moore Foundation 2-year, $880,000 grant for further study
• Guided by RMP Microplastic Monitoring and Science Strategy
Management Strategy

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Track product use and market trends
Easy, low-cost source identification and pollution prevention actions

Identify and prioritize potential CECs
Develop bio and chemistry methods
**Tier 4**
High Concern

**Moderate or High Impact**

None currently

**Tier 3**
Moderate Concern

**Low Impact**

- PFOS
- Fipronil
- Nonylphenol

**Tier 2**
Low Concern

**No Impact**

- PBDEs and HBCD
- Pyrethroids*
- Pharmaceuticals and Personal Care Products
- PBDDs and PBDFs

**Tier 1**
Possible Concern

**Unclear**

- Alternative Flame Retardants
- PFAS (Fluorinated Chemicals)
- Pesticides, Plasticizers
- Microplastic
- PCB 11, PHCZs, others
Management Actions: Moderate Concern (Tier III)

Regional CEC Action Plans:

• Source identification
• Source control identification and evaluation
• Track product use and market trends
• Communication and outreach
• Monitoring/study strategy
• Track recovery
• Referral to other regulatory authority(s)
Fipronil: Spot-on Flea Control

RMP study establishes wastewater as pathway

Final Wastewater Effluent Concentrations (ng/L)

- Wastewater Treatment Plants
- Fipronil
- Fipronil degradates
- Imidacloprid
Managing Pesticides in Wastewater

- Regulation: DPR reviewing uses & mitigation
- Prevention: Down-the-Drain model to support registration recommendations
- Monitoring, source identification, education
Triclosan

Palo Alto and other SF Bay wastewater agencies

- Consumer education
- Purchasing
Triclosan

2016: FDA bans triclosan and 18 other antibacterials from hand & body washes

Other uses may be addressed via DTSC:
• Safer Consumer Products Program (Green Chemistry)
Pharmaceuticals

Support for extended producer responsibility:

• RMP data for Senate hearings, council meetings, boards of supervisors

• 2016-2017 testing by wastewater agencies
Leveraging Resources

- Partnership with other organizations
  - Department of Toxic Substances Control
  - Department of Pesticide Regulations
  - Pro bono academic projects

- Alternative Monitoring Permit – provides RMP with extra funding for CECs ($235,000)
- Supplemental Environmental Projects (Enforcement) funding possible
Keys to RMP’s Success

Forum for Collaboration

Clear Objectives

Adaptability

Long Range Planning

Stable Funding

Allocation of RMP Fees by Sector

- Municipal WWTFs: 44.0%
- Industry: 11.0%
- Stormwater: 23.5%
- Cooling Water: 4.0%
- Dredgers: 17.5%
RMP Data: Reliable, Available

Quality Assurance

Formatting and Databases

Online Access
Communicating RMP data

www.sfei.org/rmp
Thank you

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