

***Monitoring for  
Chemicals of Emerging Concern (CECs)  
in California's Aquatic Ecosystems***

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**California Water Quality Monitoring Collaboration Network**

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# ORIGIN OF THE ECOSYSTEMS PANEL

- **Regulatory requirements need to be based on best available peer-reviewed science**
  - established and enforced by State & Regional Water Boards
- **State of knowledge regarding CECs is incomplete**
- **Advisory panel needed to guide future actions relating to CECs in**
  - recycled water (original Panel convened in 2009)
  - aquatic ecosystems (this effort)
- **Respond to questions most relevant to Water Boards**

# PANEL SELECTION PROCESS

- **SCCWRP solicited input from stakeholders to guide panel member selection**
- **All members of Recycled Water Panel retained**
- **Expertise in marine resources/antibiotic resistance added**
- **Ecosystems Panel convened in January 2010**

# PROCESS & PHILOSOPHY

- **Open and transparent process**
  - Panel member selection
  - Meeting agendas & information exchange
  - Comments and feedback
- **Stakeholder advisory group with diverse interests**
  - Public interest groups
  - Wastewater dischargers and stormwater permittees
  - State regulatory and resource agencies
- **Public commentary & panel report out at each meeting**
- **Recommendations based on best available science**

# STAKEHOLDER ADVISORS

- **Jim Colston (Tri-TAC)**
- **Chris Crompton (CA Stormwater Quality Association)**
- **Mark Gold (Heal the Bay)**
- **Amber Mace (CA Ocean Science Trust)**
- **Rick Moss\* (SWRCB)**
- **Linda Sheehan (CA Coastkeeper Alliance)**

\* succeeded by G. Dickenson, M. Emanuel

# PANEL MEMBERS

- **Dr. Paul Anderson**
  - Human Health Toxicologist
  - Arcadis US
- **Dr. Nancy Denslow**
  - Biochemist
  - University of Florida
- **Dr. Jörg Drewes**
  - Civil Engineer
  - Colorado School of Mines
- **Dr. Adam Olivieri**
  - Risk Assessor
  - EOA Incorporated
- **Dr. Daniel Schlenk (Chair)**
  - Environmental Toxicologist
  - UC Riverside
- **Dr. Shane Snyder**
  - Analytical Chemist
  - University of Arizona
- **Dr. Geoff Scott**
  - Marine Resources
  - NOAA

# HOW DO WE MONITOR FOR CECs?

- **What are the relative contributions from stormwater & WWTP effluent?**
- **What are the appropriate CECs to be monitored, including analytical methods and detection limits?**
- **What is the fate of CECs in WWTPs, storm & receiving waters?**
- **What approaches should be used to assess biological effects?**
- **What is the appropriate monitoring design?**
- **What levels of CECs should trigger additional action? What range of actions should be considered?**

# PANEL DELIVERED FOUR PRODUCTS

- **Decision making “risk-based” framework**
  - A tool to prioritize CECs now and into the future
- **Application of framework to discharge scenarios of interest**
  - Initial list of CECs to monitor in water, sediment, biota
- **Monitoring recommendations and interpretation**
  - How, where and when to monitor; how to respond to results
  - A process that can *adapt* to changing science & chemical use
- **Future recommended activities**
  - Develop better monitoring tools to improve & refine the process



# RISK-BASED SCREENING FRAMEWORK

- **Step 1: measure or predict occurrence (MEC or PEC)**
  - Provided through investigative monitoring (e.g. regional, special studies)
- **Step 2: determine concentration that is protective of resource (aka “monitoring trigger level” or MTL)**
  - Published information on no/low observable effects concentrations
- **Step 3: calculate “Monitoring Trigger Quotient” (MTQ)**  
**= MEC (or PEC) / MTL**
  - If  $MTQ < 1$ , no concern
  - If  $MTQ \geq 1$ , add to candidate list

# DISCHARGE SCENARIOS

- ***Effluent dominated inland waterway***
  - Low flow (dry weather) conditions
  - No dilution of WWTP effluent
- ***Coastal embayment***
  - WWTP effluent and stormwater discharge
  - 10 fold dilution of source input
- ***Offshore ocean discharge***
  - Large WWTP outfalls in deeper water
  - 100 fold dilution of WWTP effluent

# HOW THE FRAMEWORK WAS APPLIED

- **Panel considered chemicals for which both occurrence and toxicity data was available**
  - Priority on those with known low level effects and occurrence in CA systems
- **Panel considered both effluent and receiving water monitoring data**
  - Maximum concentrations to be conservative
- **Panel focused on non-traditional effects**
  - Many CECs are suspected “endocrine disrupters” at sub-lethal concentrations
- **Robust analytical methods must be available**
  - Survey of commercial services industry

# CECs IN WATER\*

- **Pesticides**
  - bifenthrin, permethrin, chlorpyrifos
- **Consumer products**
  - bisphenol A, diclofenac, galaxolide, ibuprofen
- **Natural hormones**
  - 17b-estradiol, estrone
- **Antibiotics**
  - triclosan (River scenario only)
- \* River & Bay scenarios only

# CECs IN SEDIMENT AND TISSUE

- **Sediments (Bay & Ocean scenarios)**
  - Plasticizers (bis-2-ethylhexyl, butylbenzyl phthalates)
  - Flame retardants (PBDE-47, -99)
  - Detergents (4-nonylphenol)
  - Pyrethroids (bifenthrin, permethrin) – Bays only
- **Biological tissue (All Scenarios)**
  - Polybrominated diphenyl ethers (PBDEs)
  - Perfluorinated chemicals (e.g. PFOS)

# ADAPTIVE MONITORING STRATEGY INCLUDES “OFF-RAMPS” ...

Monitoring Trigger Quotient (MTQ)

*High* concern – control (all controllable) sources

*Elevated* concern – confirm levels; expand monitoring (ID sources); refine risk assessment; control (easy) sources

*Moderate* concern – continue monitoring to ensure concentrations are not increasing

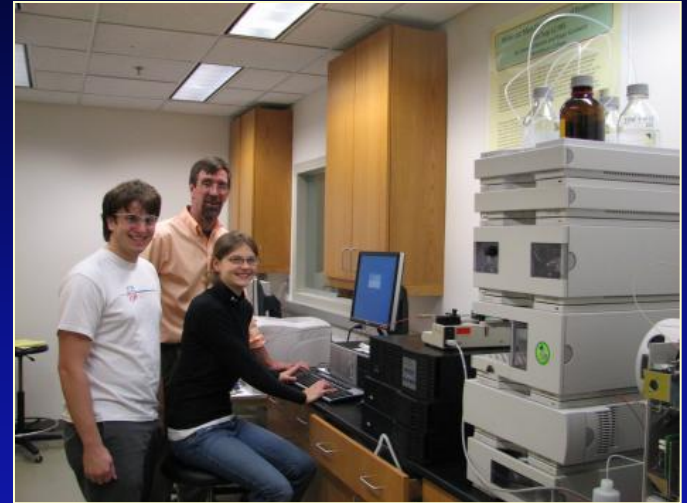
*Little/No* concern – Discontinue monitoring

## ...AND “ON-RAMPS”

- **Panel recommended *investigative* monitoring and special studies for “data poor” CECs**
  - Newly developed and/or registered drugs, pesticides and flame retardants
- **Panel recommended development of *modeling tools* to pre-screen for problematic CECs**
  - Consider production, usage, fate and potential for toxicity
- **Use Panel’s assessment framework to determine if CECs warrant inclusion in future monitoring (“On-Ramp”)**
- **Incorporate new information and revisit recommendations every 3-5 years**
  - Infuse the latest science and update CEC lists and tools

# DEVELOP BIOLOGICAL SCREENING TOOLS

- **Targets impact to resources**
  - more relevant than simple exposure
  - different types of damage are targeted
- **Greater efficiency**
  - less time & money than exhaustively analyzing countless chemicals
  - works for priority pollutants & CECs
- ***In vitro* bioassays to screen for CECs in recycled water**
  - commercially available technology
  - SWRCB Contract 10-096-250
  - results due in 2014





# MOVING FORWARD

- **CECs are a moving target**
  - Incorporate better monitoring and assessment tools
  - gather necessary data to assess high priority CECs
  - revisit and revise target CEC list periodically
- **Develop bioanalytical screening methods and establish linkages to high order effects**
  - Integrates exposure and effects of known and unknown chemicals
  - Incorporate into a more comprehensive, tiered monitoring approach
- **Develop a statewide CEC Monitoring Plan**
  - Includes pilot and special studies
  - 12 month effort, due Feb 2014

# A NEW CHEMICAL MONITORING APPROACH

