Science Advisory Panel for CECs in Recycled Water

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EXPERT PANEL REVISIT

- Six experts convened in 2009 to provide guidance for monitoring of CECs statewide

- In their 2010 report, the Panel recommended
  - a list of known CECs to be monitored in potable reuse applications
  - developing better tools to address unknowns

- Periodic updates are needed to keep policies current
  - knowledge of CECs evolving at a rapid pace
  - are original recommendations relevant after 7 years?
RECYCLED WATER USES HAVE EXPANDED

• NON-POTABLE USES ("TITLE 22")
  – Then: landscape irrigation
  – Now: crop irrigation, industrial cooling, recreational impoundments (45 different practices)

• INDIRECT POTABLE REUSE (IPR)
  – Then: groundwater recharge (surface spreading, subsurface injection)
  – Now: surface (raw) water augmentation

• DIRECT POTABLE REUSE (DPR) NOT ADDRESSED
  – report on feasibility of regulating DPR released in 2016
MORE DATA IS NOW AVAILABLE

- Monitoring of CECs by recycled water facilities
  - Supplied by 8 utilities in CA covering period 2009-2017
  - sample sizes from < 10 to > 200

- Data quality and comparability greatly improved
  - a single lab generated 90% of monitoring data

- Toxicity thresholds expanded, updated
  - new sources for a wider list of known CECs
SUMMARY OF FINDINGS

• Should the list of CECs to be monitored be revised?
  – Yes, but the number of chemicals remains small

• How do we screen for unknown chemicals?
  – Bioanalytical tools for endocrine disrupting chemicals are ready to go

• What is the risk posed by antibiotic resistance?
  – The science is not mature enough to make a sound assessment

• Are there ways to improve the CEC monitoring program?
  – A more dedicated, cohesive and responsive program is recommended
UPDATING THE LIST OF CECs

• Monitor CECs in recycled water
  – Measured environmental concentration (MEC)

• Select thresholds protective of human health
  – Monitoring trigger level (MTL)

• Compare MEC to MTL (MEC/MTL)
  – If ratio is ≤ 1, no concern
  – If ratio is > 1, add to monitoring list

  – estradiol; MEC = 0.5 ng/L; MTL = 0.9 ng/L → ratio = 0.6  NO
  – NDMA; MEC = 77 ng/L; MTL = 10 ng/L → ratio = 7.7  YES
THERE ARE NO SMOKING GUNS

• Out of ~100 CECs, none had MEC/MTL > 10
  – For potable reuse, only 3 CECs had 1 < MEC/MTL > 10
  – For non-potable reuse, no CECs had MEC/MTL > 1

• The Panel’s framework allows for on- and off-ramping
  – 17β-estradiol (removed) - 1,4-Dioxane (added)
  – Triclosan (removed) - Nitrosomorpholine (NMOR) (added)
  – Caffeine (removed) - Nitrosodimethylamine (NDMA) (retained)

• Very conservative assumptions were applied:
  – 90th percentile exposure concentrations (MECs)
  – effects thresholds for sensitive populations (MTLs)
  – Non-nitrified secondary effluent as feed
  – No attenuation credit for treatment/environmental barriers
ARE WE DONE YET?

- CECs will continue to evolve:
  - Changing chemical use
  - New treatment practices and recycled water applications
  - New science on toxicity
  - New technologies for monitoring
SCREENING FOR UNKNOWNSS

- Bioanalytical tools measure groups of bioactive chemicals
- Cell lines have been standardized for water quality monitoring
  - estrogen receptor (ER-α)
  - aryl hydrocarbon receptor (AhR)
- Screening thresholds are being established
  - similar to MTLs

![Estrogen Receptor (ER) transactivation assay]

- Bar graph showing bioassay equiv. or BEQs (ng/L) for different water samples (Raw effluent, Treated effluent, Recycled water, Ambient water) across three labs (Lab A, Lab B, Lab C).
IDENTIFYING UNKNOWNS

• **Use existing targeted methods that are informed by bioscreening results**
  - e.g. EPA 1698 hormone list for ER-α

• **If not successful, non-targeted analysis is an option**
  - broadens search for bioactive chemicals

• **Only select labs have resources/expertise to conduct advanced identification evaluations**

*The Panel does NOT recommend routine application of non-targeted analysis, but encourages more research to better develop diagnostic methodologies and databases*
ANTIBIOTIC RESISTANCE

The Panel’s literature review revealed that:

• Microbes, including antibiotic resistant bacteria (ARB), are removed during water treatment

• Transfer of antibiotic resistance genes (ARGs) in water reuse practices (like agricultural irrigation) has been documented

• We lack standardized methods to quantify ARB/ARGs
  • Human health risks cannot be assessed

• Current weight of evidence does not suggest a clear-cut problem

• The Panel recommends that regulators consider the results of more definitive research on relationships among antibiotic resistance, recycled water and human health before changing the Policy
REMAINING SCHEDULE

• **Draft Panel Report Released 31 January 2018**
  - 30-day public comment period
  - comments due March 2, 2018

• **Draft Policy Amendment with updated CEC monitoring recommendations**
  - expected release in Spring 2018
  - 45-day public comment period

• **Peer-review of Panel recommendations**
  - Summer-Fall 2018

• **Consideration of adoption of Policy Amendment by SWB**
  - December 2018