

American Academy of Environmental Engineers and Scientists 2017 SoCal Annual Conference Developing Uniform Criteria for Direct Potable Reuse

Brian Bernados, P.E.

Technical Operations Section

Division of Drinking Water (DDW)

State Water Resources Control Board

brian.bernados@waterboards.ca.gov



Division of Drinking Water



- DDW regulates public water systems
- Sets standards for wastewater reuse to protect public health
 - “Water Recycling Criteria” in Title 22 of California Code of Regulations
- Recycled Water Unit
 - Reviews proposals for compliance with Title 22 Criteria
 - Provides requirements and recommendations to Regional Boards for discharge permits (DDW would likely permit Direct Potable Reuse)
 - Reviews new and emerging technologies

SB 918 Water Code Definitions

- "Direct potable reuse" is the planned use of recycled water either
 - directly into a public water system
 - or into raw water supply just upstream of a water treatment plant
- In either case, there is no significant environmental barrier.



Logically, if a proposed project does not meet the criteria for Groundwater recharge or Surface water augmentation, then it should be considered DPR.

CA Water Code DPR Investigation required the following

(1) The reliability of treatment to protect public health.

(2) Multiple barriers needed.

(3) Health effects.

(4) Mechanisms to protect public health if problems occur.

(5) Monitoring needed.

(6) Any other scientific or technical issues, including the need for additional research.



Expert Panel



- 12 experts in the fields of toxicology, wastewater treatment, drinking water treatment, drinking water standards, epidemiology, limnology, microbiology, and chemistry
- Expert Panel found it is technically feasible to develop uniform criteria for DPR
- Replace the environmental barrier by enhancing the reliability of mechanical systems and treatment plant performance

AB 574 Quirk. Potable reuse

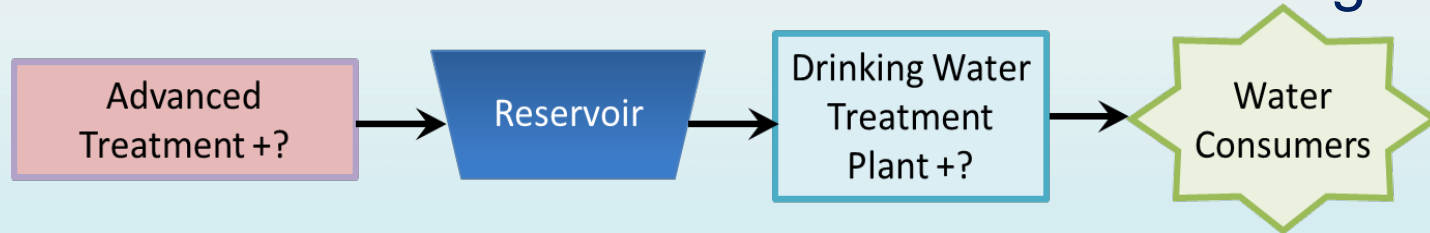
- By December 31, 2023, adopt uniform water recycling criteria for direct potable reuse through raw water augmentation.
- Before adopting the uniform water recycling criteria, submit the proposed criteria to a new expert review panel.
- Can't adopt criteria until the expert review panel adopts a finding that the proposed criteria would adequately protect public health.

AB 574 New Definitions

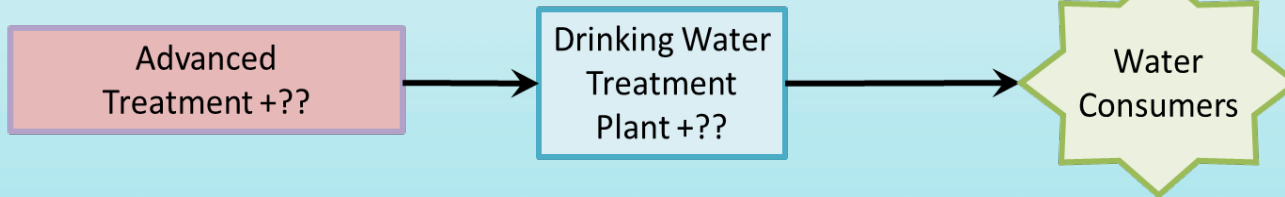
- “Raw water augmentation” means the planned placement of recycled water into a system of pipelines or aqueducts that deliver raw water to a drinking water treatment plant
- “Reservoir water augmentation” means the planned placement of recycled water into a raw surface water reservoir used as a source of domestic drinking water supply
- “Treated drinking water augmentation,” means the planned placement of recycled water into the water distribution system of a public water system

DPR Types Old and New

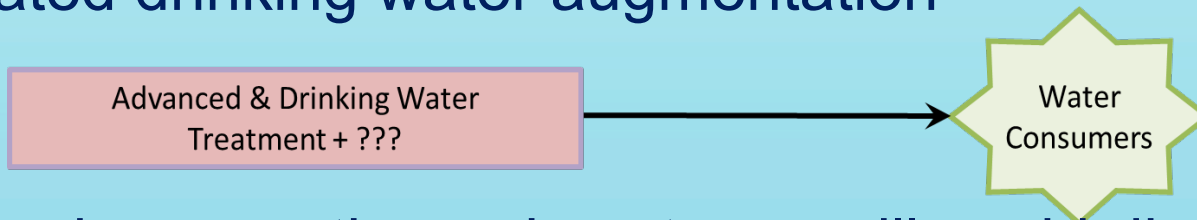
1. Small environmental buffer or “Reservoir water augmentation”



2. Inlet to SWTP or “Raw water augmentation”



3. Inlet to distribution system or “Treated drinking water augmentation”



A framework across the various types will avoid discontinuities in the risk assessment / risk management approach

Framework

June 1, 2018, establish a framework for the regulation, which should consider the following:

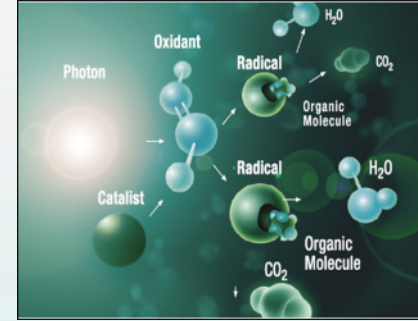
- (a) The recommendations in the state board's "Investigation on the Feasibility of Developing Uniform Water Recycling Criteria for Direct Potable Reuse."
- (b) The recommended research in the report
- (c) A regulatory framework for potable reuse projects that will be protective of public health.
- (d) Update, if necessary, uniform water recycling criteria for potable reuse through reservoir water augmentation.

Groundwater Recharge Treatment Requirements Title 22, Section 60320

- Significant and effective natural barrier with time to identify and respond to problems
- Industrial pretreatment, with enhanced source control
- Multiple barrier treatment processes to provide:
 - Pathogen log reduction of 12 for virus, 10 for Giardia and 10 for Cryptosporidium
 - Chemical Contaminant reduction to meet primary, secondary and notification levels (NLs)
 - Constituents of Emerging Concern (CECs)
 - Unknown unknowns
- Water quality and treatment process monitoring
- Provide full advanced treatment, including RO, for injection projects.



Reverse Osmosis & Advanced Oxidation

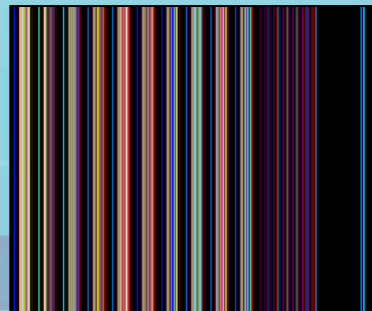


- RO is effective at removing large ionic compounds
- Most large organic molecules with a MW > 250 are over >90% removed; however,
- RO is less effective at removal of small non-ionic, neutral compounds
 - NDMA (74); 1,4-dioxane (88); Chloroform (119);
 - Acetone (58)
- AOP for NDMA < 0.010 and 1,4-dioxane < 1 ppb
- High dose UV breaks down NDMA, but can't effectively photolyze 1,4-dioxane (or many other organics)

Experts Identified Reliability Features

In addition to requirements already in IPR criteria:

- 1) multiple, independent barriers;
- 2) barriers representing a diverse set of processes;
- 3) parallel independent treatment trains;
- 4) providing diversion of inadequately-treated water;
- 5) Final treatment to “average” out chemical peaks;
- 6) monitoring of surrogate parameters at each step to ensure treatment processes are performing properly;
- 7) developing and implementing rigorous response protocols, such as a formal Hazard Analysis Critical Control Point (HACCP) system.



Chapter 8 & 9 Performance & Analysis

- Reliability - ability to verify performance meets public health protection consistently
- Resilience – adapt and respond quickly to failure
 - Sufficient maintenance & parts
 - Trained personnel (advanced level)
- Robustness - barriers capable of removing various types of contaminants by different mechanisms
- Microbial Contaminants
 - Use multiple, independent treatment barriers
 - Redundancy such that if one treatment train fails, the minimum LRV for microorganisms is still met



Six Key Research Needs

1. Source control and monitoring (CECs)
2. Probabilistic Quantitative Microbial Risk Assessment (QMRA)
3. Confirm LRV targets with new pathogen data
4. Confirm worst case raw pathogen levels (outbreak and seasonal variation)
5. Evaluate options to reduce chemical spikes
6. Analytical methods for unknown low molecular weight chemicals



DPR Expert Panel Report

Chapter 8 Chemicals

Source control



Research Recommendation #1:

“To better inform targeted monitoring for source control and final water quality”

Expert panel states, “Because of the lack of an adequate environmental buffer ..., short-duration releases of chemical contaminants could be problematic for DPR projects.

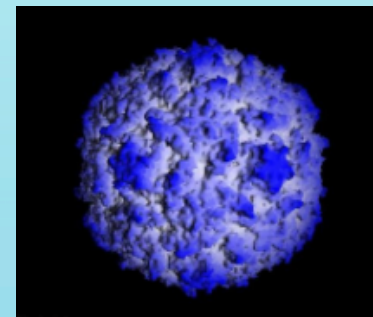
Of specific concern are chemicals that adversely affect the development of fetuses and children.”

Quantitative Microbial Risk Assessment

Research Recommendation #2: “The State Water Board should adopt the use of probabilistic QMRA to confirm the necessary LRVs of viruses, *Cryptosporidium*, and *Giardia* needed to maintain a risk of infection equal to or less than 10^{-4} per person per year.”

Regulators should be aware of the various model inputs to the QMRA. Some have wide ranges, including several orders of magnitude:

- Pathogen concentrations
- Selection of the target pathogen
- Dose-response models
- Selection of overall treatment train
- Treatment process removal effectiveness



Analytical Methods



- **Research Recommendation #3:**
- “To better inform decisions associated with updating LRVs as well as probabilistic-based QMRA modeling, ... measure pathogens (i.e., *Giardia* cysts, *Cryptosporidium* oocysts, and several human viruses) in raw (untreated) wastewater feeding a DPR system that provide more complete information on concentrations and variabilities. Improved methods should be used that will allow better characterization and improved precision of concentrations of pathogens. See **Chapters 5 and 7.**”

Outbreaks of Disease

Research Recommendation #4:

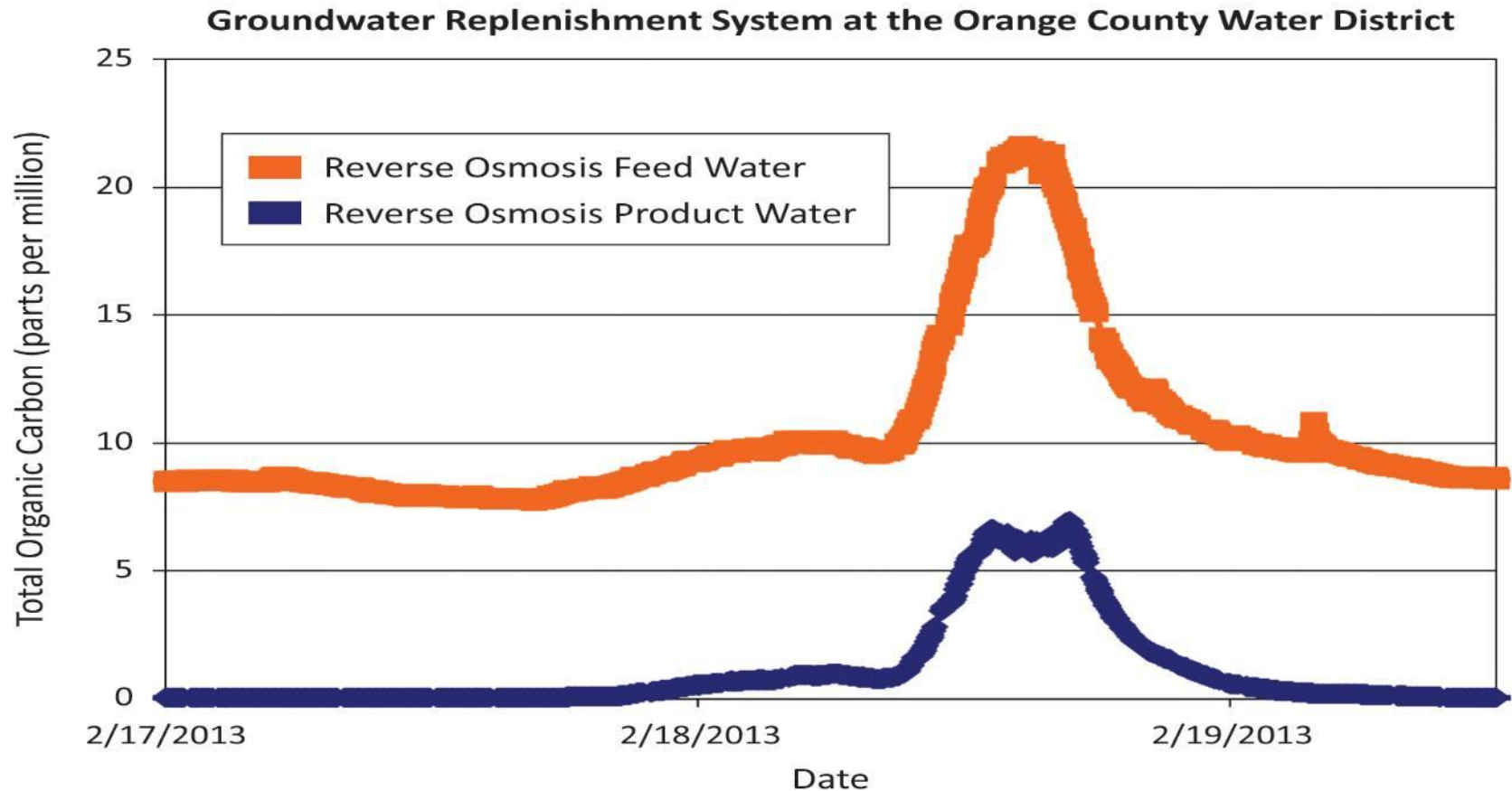
The State Water Board should investigate the feasibility of collecting pathogen concentration

data for raw wastewater associated with community outbreaks of disease and collect such data where possible.



Peaks - TOC Analyzer Detected Acetone

- RO feed went from 9 to 21 permeate went from 0.1 to 7.0



Final Treatment Processes - #5

“ . . . treatment options for final treatment processes that can provide some “averaging” with respect to potential chemical peaks . . .

These options might involve:

- (1) the use of a buffer tank
- (2) the removal of volatile contaminants during a degassing step (decarbonization)
- (3) the use of a biologically active filter after RO/AOP”



DPR Report Chapter 8

Chemical Unknowns



Research Recommendation #6:

“It is important to focus on non-targeted analysis and, furthermore, low molecular weight compounds.”

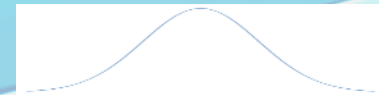
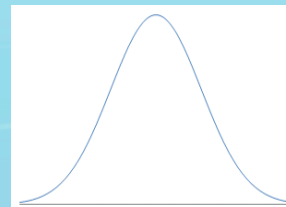
“Contaminants that are difficult to remove . . . such as

acetone, methyl ethyl ketone, and methanol”

“In addition, these methods also could address the potential vulnerability of AWTF treatment processes to unintended spills or batch releases of chemicals in the sewershed. See **Chapter 3.**”

Waterboard Report to Legislature Identified Knowledge Gaps

- How much *additional LRV capacity* is necessary for DPR in order for criteria to be health protective?
- Diversity of independent treatment barriers: how should DPR criteria specify “treatment diversity” and the degree of “diversity” necessary to be health protective?
- Control of chemical spikes: how should criteria specify “averaging” and what is the degree of “averaging” necessary?



Division of Drinking Water Next Steps

- Form expert technical workgroups on 6 key research needs
- Address Knowledge Gaps
- Develop framework for regulating DPR
- Determine Technical Managerial & Financial elements essential to the success of DPR projects
- Advanced Water Treatment Certification Committee



Questions?

State Water Resources Control Board
Division of Drinking Water

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Updates on regulations at Division of Drinking Water website:

- [http://www.waterboards.ca.gov//drinking_water/certlic/
drinkingwater/RecycledWater.shtml](http://www.waterboards.ca.gov//drinking_water/certlic/drinkingwater/RecycledWater.shtml)

Recycled Water staff

- Brian Bernados, RW and Treatment Technology Specialist
 - Brian.bernados@waterboards.ca.gov
- Randy Barnard, RW Specialist
 - Randy.Barnard@waterboards.ca.gov