

# Regulating Potable Reuse in California

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# Path to Potable Reuse

- Conventional Sources
- De facto potable reuse
  - No experience with > 5% wastewater contribution
  - No precedents for semi-potable reuse, unlike other states
- Extremely impaired source procedure
- Indirect potable reuse
  - Groundwater replenishment
  - Surface water augmentation
- Maybe direct potable reuse

# Legal Environment for Potable Reuse

- Water Code
  - Recycling Criteria for specific uses (Title 22)
  - Other recycled water uses considered on a case-by-case basis
- Health and Safety Code
  - Evaluate and permit individual sources
  - “may impose conditions ... necessary to ensure ... Water ... that is pure, wholesome, potable, and does not endanger the health of consumers.”
  - Drinking Water Regulations (Title 22)

# California

## Potable Reuse Principles

- Pure, Wholesome, Potable, and Healthful
- As safe as the high quality conventional California sources
- Unregulated chemicals of concern kept below levels found in conventional sources
- Pathogenic microorganism annual risk of infection below  $10^{-4}$
- Two independent analyses of safety
  - Safe relative to previous steps on the path
    - Conventional
    - De facto potable reuse
    - Groundwater replenishment indirect potable reuse
    - Surface water augmentation indirect potable reuse
  - compensate for the differences at each step
  - Absolute evaluation of safety

# Indirect Potable Reuse Criteria

## Chemical Contaminant Control

- Meet Drinking Water MCLs
- Treatment standard to control organic chemicals lacking a regulatory limit – contaminants of emerging concern (CECs)
  - Soil treatment (robust, resilient, and sustainable) + dilution, or
  - Multi-barrier treatment
    - Reverse Osmosis (RO)
    - Advanced Oxidation (AOP)

# Indirect Potable Reuse Criteria

## Pathogenic Organism Control

- Organism log reduction treatment objective
  - Initial point – highest organism density observed in raw sewage and round up
  - Endpoints are USEPA densities that yield a  $10^{-4}$  annual risk of infection
    - 12-log enteric virus
    - 10-log *Giardia*
    - 10-log *Cryptosporidium*

# Indirect Potable Reuse Criteria

## Environmental Buffer

- Groundwater or surface water basin or reservoir
- Benefits
  - Provides some cushion for treatment fluctuations (attenuation)
  - Allows the water system to draw from the reservoir when the recycled water flow is interrupted
  - Treatment, but often hard to quantify
  - Residence time
  - Mixing
- **Enhances system reliability**

# Indirect Potable Reuse Criteria

## - Other Criteria

- Public hearing(s)
- Industrial pretreatment and pollutant source control program
- Financial, managerial, and technical capability
- Monitoring:
  - Treatment performance
  - Priority Toxic Pollutants
  - Chemicals having notification levels
  - Others contaminants if required in permit
  - Environmental buffer (source water)



# Groundwater Replenishment

- Treatment
  - Soil treatment + dilution or RO/AOP for CECs
  - Pathogen log reductions
- Environmental buffer quantifiable benefits
  - Virus log reduction
  - Time to identify and respond to a treatment failure
    - Possible to determine the amount of time needed for a project
    - Possible to quantify the actual travel time with models and tracers
    - Time of travel in the ground is dependable (semi-plug flow)
  - The groundwater source can become 100% recycled water

# Surface Water Augmentation

- Treatment
  - RO/AOP for CECs
  - Pathogen log reductions
- Environmental buffer
  - Not primarily time - not dependable because mixing/short-circuiting
  - Mixing
    - The critical role of the reservoir is to attenuate a discharge of inadequately treated reclaimed water by ensuring that reclaimed water entering the reservoir during a treatment failure is blended with other water
    - The augmented reservoir can become 100% recycled water

# Surface Water Augmentation Reservoir Mixing Criteria

- The volume of water withdrawn from the reservoir must contain no more than:
  - (1) one percent recycled wastewater that was delivered to the reservoir during any 24-hour period, or
  - (2) ten percent recycled wastewater that was delivered to the reservoir during any 24-hour period, with treatment to provide an additional 1-log reduction of virus, *Giardia* cysts, and *Cryptosporidium* oocysts
- Criteria must be met at all times under all operating conditions
- Demonstrate mixing using hydrodynamic modeling and tracer studies

# Direct Potable Reuse

- No environmental buffer
- Without the environmental buffer it becomes critical to know that the organism log reductions necessary to meet the risk goal are continuous
- How can we write a regulation to ensure that any project meeting the letter of the regulation is always producing safe water?

Questions?