Thank you to our Patrons

We will begin our presentation in a few minutes...
Potable Reuse in California: Past, Present and Future

R. Shane Trussell, Ph.D., P.E., BCEE
February 8, 2023
California declares historic water emergency measures amid drought
California Needs to Develop More Local Water Supplies

- Climate Change Adaptation
- Local Sustainability
- Water Supply Certainty
- Ecosystem Pressure
- Cost Control
California Has Deep Roots in Potable Reuse
Spreading Projects Play an Important Role and Offer a Non-RO Solution

Average recharge of 215 ML/day
Total Organic Carbon Removal

![Graph showing Total Organic Carbon Removal](image_url)
NDMA

n=1  n=5  n=5  n=7

NDMA, ng/L

Secondary  Influent  After  After
Vadose  Saturated

CI2 Soil Column System
O3 Soil Column System

95  95
448  384
41  4
<2  <2
# DBP Attenuation

<table>
<thead>
<tr>
<th></th>
<th>Event 3</th>
<th>Event 4</th>
<th>Event 5</th>
<th>Average</th>
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<tr>
<td><strong>Cl₂ Soil Column</strong></td>
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<tr>
<td><strong>System</strong></td>
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<td>HHAs</td>
<td>Influent</td>
<td>30</td>
<td>36</td>
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<td>&lt;1.0</td>
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<td>&lt;1.0</td>
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<tr>
<td><strong>TTHMs</strong></td>
<td>Influent</td>
<td>34.7</td>
<td>24.3</td>
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<td>&lt;0.50</td>
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<tr>
<td><strong>O₃ Soil Column</strong></td>
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<tr>
<td><strong>System</strong></td>
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<tr>
<td>Bromate</td>
<td>Influent</td>
<td>5.5</td>
<td>&lt;0.50</td>
<td>1.4</td>
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<td>Saturated</td>
<td>&lt;0.50</td>
<td>&lt;0.50</td>
<td>&lt;0.50</td>
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Advent of Integrated Membrane Systems in the Late 90s
West Basin Municipal Water District Commissions First Full-Scale Microfiltration Reverse Osmosis Facility in 1999
Terminal Island Begins Full-Scale Operation of MF/RO in 2003
Orange County Water District Commissions the Groundwater Replenishment System in 2008
Rapid Development of Potable Reuse Regulations

- **2010**: SB 918
- **2013**: Final Groundwater Recharge Regulations
- **2014**: Expert Panel confirms DPR feasibility
- **2016**: DPR Regulatory Framework Ed. 1
- **2017**: Final Surface Water Augmentation Regulations
- **2018**: DPR priority research complete
- **2019**: DPR Regulations due
- **2021**: Draft DPR Regulations
- **2023**: DPR Regulations due
Terminal Island Expansion (12 MGD) and UV-HOCl
Groundwater Replenishment System (130 MGD)
Albert Robles Center (14 MGD)
Pure Water Monterey (5.5 MGD)
Pure Water Oceanside (4.5 MGD)
Pure Water Soquel (1.25 MGD)
San Diego North City Pure Water Treatment Train (34 MGD)
Phase 1 Pure Water San Diego (34 MGD)
East County AWPF (12.5 MGD)
First Potable Reuse Facility with 95% RO Recovery
Las Virgenes MWD (6 MGD)
Draft Direct Potable Reuse Criteria Released
>$10M in Research to Support DPR Regulations

Figure credit: Water Research Foundation
Major Provisions

- Technical, Managerial, Financial Capacity
- Monitoring & Control
- Pathogen Control
- Chemical Control
- Organization
Pathogen Control

- 4 processes providing at least 1-log for *each* pathogen
  - GWR is 3 processes total
  - SWA is 2-3 processes total

- 3 *mechanisms* including:
  - UV disinfection
  - Physical separation
  - Chemical disinfection

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Groundwater Recharge</th>
<th>Surface Water Augmentation</th>
<th>Direct Potable Reuse</th>
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<tr>
<td><strong>Virus</strong></td>
<td>12</td>
<td>12 to 14</td>
<td>20</td>
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<tr>
<td><strong>Giardia</strong></td>
<td>10</td>
<td>10 to 12</td>
<td>14</td>
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<tr>
<td><strong>Cryptosporidium</strong></td>
<td>10</td>
<td>10 to 12</td>
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Chemical Control – Treatment Requirements

New requirement

New operational triggers

Treatment must be in this order
O3/BAC Requirements

**Ozone (O3):**
- TOC > 1
- O3:TOC > 1

**1-log reduction:**
- Sulfamethoxazole
- Carbamazepine

**BAC (Biofilm Aeration Chamber):**
- EBCT ≥ 15 min
- 1-log reduction:
  - Formaldehyde
  - Acetone

Chemical structures:
- Formaldehyde (HCHO)
- Acetone (CH₃COCH₃)
- Carbamazepine
- Sulfamethoxazole
Central Area Project to Produce 53 MGD

Phase 2 Central Area Delivery Reservoir Alternatives:
- Option 1 – 53 mgd Purified Water Delivery to Murray Reservoir
- Option 2 – 53 mgd Purified Water Delivery to San Vicente Reservoir
Pure Water Southern California (150 MGD)
Advanced Purification Center (0.5 MGD)
City of Los Angeles

Operation NEXT

- Largest Potable Reuse Project (200 MGD)
- 1/3 City’s Water Demand
- $16 Billion
Potable Reuse Will Dramatically Change California
More Seawater Desalination Facilities in Our Future
Thank you for listening!

R. Shane Trussell
President
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