Realizing the Potential of Potable Water Reuse

Water Science and Technology Board 35th Anniversary
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Washington, DC

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Merger of WE&RF and Water Research Foundation Announced in October
Overview

• Purpose
  • Status of potable reuse in the U.S.
  • Benefits of NAS/NRC water reuse reports
  • How science has been used to inform policy
Indirect Potable Reuse: Groundwater Replenishment

**Injection and spreading**

- **Talbert Barrier**
- **Kraemer-Miller Basins**

**Layers:**
- **Shallow Aquifer**
- **Deep Aquifer**

**Distance:**
- 0' to 3,000'

**Miles:**
- 0 to 20

**Formation:**
- NON-WATERBEARING FORMATION

*Courtesy of OCWD*
Direct Potable Reuse

Water Treatment → Urban Water Use → Wastewater Treatment → Advanced Water Treatment

Environmental Buffer

Advanced Water Purification Steps
- Reverse Osmosis
- UV Disinfection

Diagram showing the cycle of direct potable reuse, including treatment processes and environmental buffer.
1982 NRC Water Reuse Report

• Inform a program commissioned by Congress to study:
  • Use of wastewater contaminated Potomac Estuary as a new water source for District of Columbia
• Focused on water quality criteria
• Findings:
  • Importance of treatment reliability
  • Need for confirmatory data
  • Limitations on detecting trace organic chemicals
## Potable Reuse in 1982

Drivers are “case by case”

<table>
<thead>
<tr>
<th>Project</th>
<th>Year</th>
<th>Type</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montebello Forebay (CA), LACSD</td>
<td>1962</td>
<td>Ground water – via spreading basin</td>
<td>Water Supply</td>
</tr>
<tr>
<td>Water Factory 21 (CA), OCWD</td>
<td>1976</td>
<td>Groundwater – via injection wells</td>
<td>Salt water intrusion barrier</td>
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<tr>
<td>Upper Occoquan Service Authority (VA)</td>
<td>1978</td>
<td>Reservoir augmentation</td>
<td>Address water quality issues in reservoir</td>
</tr>
<tr>
<td>Denver’s Direct Potable Reuse Demonstration Project (Study)</td>
<td>1979-1992</td>
<td>DPR – directly into distribution system</td>
<td>EPA requirement with a diversion project – examine alternatives</td>
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</table>
Montebello Forebay (CA)

Upper Occoquan Service Authority (VA)

Water Factory 21 demolition (2007)
Role of Non-Potable Reuse

• Non-potable reuse experience:
  • Change in thinking
  • Meeting customer needs
  • Need for additional treatment
  • Reliability of treatment
  • Water quality requirements

• Non-potable not a panacea:
  • High costs
  • Need for dual distribution system and/or storage
  • Not significant increase in water supply
1998 NRC Potable Reuse Report

• Changes at the time:
  • Best available water sources were developed
  • Better wastewater and water treatment technologies
  • Public health studies on reclaimed water
  • Increasing interest by communities and utilities

• 1998 study supported by:
  • EPA, USBR, AwwaRF, WERF, NWRI, USBR, and utilities
## Potable Reuse in 1998

Water supply is becoming the driver

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<td>El Paso Water Utilities (TX)</td>
<td>1985</td>
<td>GW recharge via injection</td>
<td>Water supply</td>
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<tr>
<td>West Basin Water Recycled Plant (CA)</td>
<td>1993</td>
<td>GW recharge via injection</td>
<td>Salt water intrusion barrier and <strong>water supply</strong></td>
</tr>
<tr>
<td>Gwinnet County Water Authority (GA)</td>
<td>1999</td>
<td>SW augmentation</td>
<td>Water supply</td>
</tr>
<tr>
<td>Scottsdale Water Campus (AZ)</td>
<td>1999</td>
<td>GW recharge via injection</td>
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The committee views the planned use of reclaimed water to augment potable water supplies as a solution of last resort...

National Research Council – 1998
2012 NRC Report on Water Reuse

• Dramatic increase in interest in water reuse
  • Experience grows, led by CA, FL, AZ, and TX
  • Water scarcity is a driver
  • However, there were several projects that failed
• WateReuse Association goes national (2001)
• WateReuse Foundation receives annual USBR grant (2001)
• NRC interest:
  • Understand the role water reuse could play in nation’s water future
• Study supporters: EPA, USBR, NSF, NWRI, CDC, WaterRF, utilities
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<tr>
<td>Water Replenishment District (CA)</td>
<td>2005</td>
<td>GW recharge via injection</td>
<td>Salt water intrusion barrier and <strong>water supply</strong></td>
</tr>
<tr>
<td>Inland Empire Utility Agency (CA)</td>
<td>2007</td>
<td>GW recharge via spreading</td>
<td><strong>Water supply</strong></td>
</tr>
<tr>
<td>Groundwater Replenishment System – Orange County Water District (CA)</td>
<td>2008</td>
<td>GW recharge via injection and spreading</td>
<td>Salt water intrusion barrier and <strong>water supply</strong></td>
</tr>
<tr>
<td>Prairie Waters Project (Aurora, CO)</td>
<td>2010</td>
<td>GW recharge via riverbank filtration</td>
<td><strong>Water supply</strong></td>
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NRC Report (2012) – Importance to Potable Reuse

Address the notion of “option of last report”

“...the use of treated wastewater for beneficial purposes including irrigation, industrial uses, and drinking water augmentation – could significantly increase the nation’s total available water resources.”

(NRC 2012)
De Facto Water Reuse in the US

- Report acknowledged unplanned potable reuse is common
- Wastewater effluent can account for a substantial fraction of a potable water supply in some areas
- Concept helps with public understanding and acceptance

Assessment of De Facto Wastewater Reuse across the U.S.: Trends between 1980 and 2008
2012 NRC Report – Importance of Science

• **Treatment, Monitoring, and Operations:**
  - A range of treatment options exists
  - Treatment reliability and robustness is important
  - Monitoring and operational plans are needed

• **Assessment of Risks:**
  - Methods to assess risks exist
  - An occurrence of a contaminant does not necessarily post a significant risk
  - Compare risk of potable reuse with current supplies
  - Conducted “risk exemplar” to show risks don’t exceed risks of existing supplies
Planned Projects

- Metropolitan Water District of So. Cal.
  - 160 mgd IPR facility

- Hampton Roads Sanitation District, VA (GW Replenishment – 120 mgd)
  - Reduce nutrients to Bay, mitigate subsidence, groundwater overdrafting

- El Paso Water (DPR)
  - “Drinking water augmentation”

- Altamont Springs (FL)
  - DPR demonstration

- Reno, NV (GW spreading)
  - Adopted IPR regulations in 2016
Direct Potable Reuse

- **Advantages for utilities**
  - Increases flexibility
  - GW basin or reservoir is not needed

- **Part of an Integrated Water approach**
  - Reliable and sustainable water supply

- **Texas experience (2013)**
  - Big Spring (only operational DPR facility)
  - Wichita Falls (emergency supply – 1 yr)

- **California**
  - State Water Board Expert Panel
  - Verified that DPR criteria could be developed (2016)

- **Other states interested in regulations**
  - AZ, FL, and CO
DPR – Key Questions – Need for Research

- **Treatment requirements**
  - Inform criteria for pathogen and chemical control

- **On-line monitoring**
  - Performance monitoring (including for indicators and surrogates)

- **Treatment technologies**
  - Defining reliability and understanding performance

- **Source control**
  - Actively managing the collection system

- **Operations and operators**

- **Response time** (respond to off-spec water)

- **Public acceptance**
Summary

• **Potable reuse is expanding**
  • Utilities and research foundations are conducting studies and research
  • IPR is still very viable, but Direct Potable Reuse will occur
  • State regulators are playing a strong role

• **NRC water reuse reports are playing an important role in the advancement of potable reuse in the U.S.**
  • Use of experts and science-based
  • Verified and validated potable reuse concepts and approaches
  • Supported regulations and permitting of projects that are protective of public health
  • Identified important areas (treatment performance, monitoring, risk)