Types of Challenged Systems

- **Small disadvantaged communities**
  - Economically disadvantaged
  - TMF challenged

- **Large disadvantaged communities**
  - Population > 10,000
  - Can go from full compliance to all sources out of compliance
  - Los Banos hexavalent chromium (all 13 wells)

- **Mutual water companies**
  - 10 – 40 homes
  - Not necessarily disadvantaged
  - TMF challenged
  - Poor economy of scale for needed projects
Early involvement in water supply projects

Feasibility Study to evaluate all feasible alternatives is typically the first step
  - Non-treatment: blending, well modification/replacement
  - Consolidation
  - POU/POE
  - Centralized treatment

Engineer collaborates with water system staff and SWRCB District Engineer
Feasibility Study Framework

- Centralized Treatment
- POU/POE
- Source Replacement / Consolidation
Source Replacement
Source Replacement – Zone Testing

- **Zone testing**
  - Starts with deep test well or pilot hole
  - Water producing formations isolated and tested from bottom to top
  - Water quality in each zone tested for a wide range of contaminants

- **Cost**
  - Additional 15-20% if well constructed during planning project
  - Additional 50-60% if well must be completed during construction project

- **Limitations**
  - No guarantee good water exists
  - Must use a qualified driller
  - Need for field observation by experienced geologist/engineer
Well Zone Testing (Tulare Lake Basin)

![Graph showing arsenic levels at various depths.](image-url)
Well Zone Testing (Tulare Lake Basin)

Temp (Deg F)

- 890 ft
- 1,040 ft
- 1,120 ft
- 1,300 ft
- 1,510 ft
- 1,850 ft
- 1,930 ft
- 2,010 ft
Flow Available to WS2
South Well Only = 25 GPM
North Well Only = 134 GPM
Both Wells = 240 GPM

WS1 ADD = 184 GPM
Supply Pressure = 45 PSI

Consolidation
System Consolidation

• Preferred alternative when small systems are TMF deficient

• Cost of physical consolidation is often not the issue
  • One mile of pipe is less than $0.5 million
  • Constructing centralized treatment is typically several million

• Primary obstacles are:
  • Regional extent of water quality issues
  • System cooperation
  • Technical (e.g. fire flow, water age)
Obstacles to Consolidation

Operational Considerations
- Water quality
- Supply capacity
- Pressure
- Fire Flow

System Infrastructure
- Services
- Distribution
- Metering
- Fire hydrants

Jurisdictional Challenges
- Outside boundaries
- Rights-of-Way
- Who's in / who's out

Utility/Customer Concerns
- Water rates
- Bill payment
- Account setup
- Opening the floodgates
Point-of-Use Technology

Reverse Osmosis
- Metals (As, Cr, Pb)
- Nitrate
- Uranium
- Salts
- Limited at full scale by waste

Granular Activated Carbon
- Volatile organics
- Synthetic organics
- Pesticides
- Tastes and odors

POU
- Combination of RO and GAC
- Manageable RO waste quantities
- Highly versatile
- Inexpensive
# Point-of-Use Effectiveness

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Under-Sink Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic (pentavalent)</td>
<td>✔</td>
</tr>
<tr>
<td>Arsenic (trivalent)</td>
<td>?</td>
</tr>
<tr>
<td>Chromium (hexavalent)</td>
<td>✔</td>
</tr>
<tr>
<td>1,4-Dioxane</td>
<td>✗</td>
</tr>
<tr>
<td>Lead</td>
<td>✔</td>
</tr>
<tr>
<td>Nitrate</td>
<td>✔</td>
</tr>
<tr>
<td>PFCs (long-chain)</td>
<td>✔</td>
</tr>
<tr>
<td>PFCs (short-chain)</td>
<td>✔</td>
</tr>
<tr>
<td>1,2,3-Trichloropropane</td>
<td>✔</td>
</tr>
<tr>
<td>Uranium</td>
<td>✔</td>
</tr>
</tbody>
</table>
Point-of-Use Device Selection

• California Water Treatment Device Registration

• Practical Considerations
  • Built-in flow and TDS monitoring
  • Capital cost
  • Cost of replacement cartridges
  • Availability
  • Quality
  • Technical support

• Low cost, big-box store devices appear to be as effective as those from specialized suppliers.
Point-of-Use Device Limitations

- Not allowed for residential applications with volatile contaminants (including TCP)

- NSF testing
  - Performed using essentially perfect water
  - Chloroform used as a surrogate for VOCs

- Nitrate removal effectiveness is limited (60 – 75%)

- Supply pressure is important for reverse osmosis
Point-of-Entry

- Point-of-entry treats all water entering a building
  - Relatively common in commercial/industrial facilities
  - Difficult to implement in residential settings

- Issues:
  - Device availability is more limited than for POU
  - Waste generation from reverse osmosis becomes substantial
  - Building plumbing corrosion becomes a concern
  - Solid waste disposal may become an issue

- Activated carbon most viable POE technology
Example Costs – Nitrate Treatment at 34 Homes

<table>
<thead>
<tr>
<th></th>
<th>Centralized Treatment¹</th>
<th>POE</th>
<th>POU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Cost</td>
<td>$775,000</td>
<td>-</td>
<td>$15,000</td>
</tr>
<tr>
<td>Annual O&amp;M</td>
<td>$35,300</td>
<td>-</td>
<td>$10,000</td>
</tr>
<tr>
<td>Treatment Capacity</td>
<td>75 gpm</td>
<td>5-7 gpm</td>
<td>6.5 gpd</td>
</tr>
<tr>
<td>Daily Volume Treated</td>
<td>97,200 gallons (for 34 homes)</td>
<td>300 gallons (per home)</td>
<td>6.5 gallons (per home)</td>
</tr>
<tr>
<td>Waste Volume</td>
<td>5,000 gallons (brine)</td>
<td>1,000+ gallons (per home)</td>
<td>32 gallons (per home)</td>
</tr>
</tbody>
</table>

¹) Assumes system consolidated and re-plumbed to isolate domestic water use
“Fluoridated water linked to ADHD in alarming study
…the new EPA regulation isn’t low enough to protect you!”

The Most Dangerous Types of Water You Can Drink

Including one that is just as unhealthy as soda... another which has 36
harmful pollutants... and this "healthy water" which invites devastating health
consequences as it condenses the toxic byproducts into your drinking supply
and sucks the good minerals out of your body. Read this before you consume
another drop...

“…water from your tap may not be pure, despite
passing through a water treatment facility. It is because
it is easy for water to pick up contaminants after it has
left the water treatment facility.”
POU/POE: Working With the Customers

- 100% compliance means 100% compliance
- Every home has to be treated
- Every device has to be inspected once per year

Issues
- Access agreement
- Room under sink
- Liability
- Operator safety
- Scheduling
- Cats and other beasts
POU/POE Summary

- **Great choice for**
  - Commercial facilities
  - Contaminated private wells

- **Challenging for**
  - Residential homes under common ownership

- **May be problematic for**
  - Residential community water systems
Centralized Treatment
Centralized Treatment

- Cost and operability vary widely among contaminants and even with the same contaminant
  - No good options (e.g. nitrate)
  - Highly variable performance (e.g. arsenic and hex chrome)
  - Disposal challenges (e.g. uranium)
  - Regionally challenging water (e.g. Tulare Lake Basin)

- Multiple contaminants greatly increase treatment challenge

- Waste disposal can be a major complicating factor
Closing Observations

• DDW collaborative model carried over from CDPH works well

• Public acceptance of projects is greatly influenced by aesthetic quality of water

• The current SWRCB financial assistance program fails to address larger disadvantaged communities and Mutual water companies exposed to scorched earth regulations

• Greater coordination between DDW and RWQCB would lead to more economical solutions
Questions
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