Presentation Overview

- Project Background
- Crop Sample Results
- Historical Water Quality Results
- Map of Crop Results and Soil Type
- Summary
Background

- Crop samples collected in 2017:
  - Almonds,
  - Citrus,
  - Garlic,
  - Grapes, and
  - Pistachios.

- Sites irrigated with produced wastewater (Treated Sites)
  - Kern-Tulare Water District
  - Cawelo Water District

- Sites not irrigated with produced wastewater (Control Sites)
Crop Sample Results

Crop Analysis:
- Metals,
- Volatile Organic Compounds, and
- Semi-Volatile Organic Compounds.

Metals:
- Antimony,
- Arsenic,
- Barium,
- Beryllium,
- Cadmium,
- Chromium,
- Cobalt,
- Copper,
- Lead,
- Molybdenum,
- Nickel,
- Selenium,
- Silver,
- Strontium,
- Thallium,
- Vanadium, and
- Zinc.
Crop Sample Results

- Metal Analysis:
  - EPA Method 6020A, and
  - EPA Method 6020B.

- Detectable Results Observed in Control and/or Treated Samples (results are all non-detect)
  - Antimony,
  - Arsenic,
  - Barium,
  - Beryllium,
  - Cadmium,
  - Chromium,
  - Cobalt,
  - Copper,
  - Lead,
  - Molybdenum,
  - Nickel,
  - Selenium,
  - Silver,
  - Strontium,
  - Thallium,
  - Vanadium, and
  - Zinc.
Barium

Figures generated by Dr. Stringfellow, Science Advisor to the Water Board

Units = mg/kg
Scales are different

Almond

Citrus

Garlic

Grape

Pistachio

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Copper

Almond

Citrus

Garlic

Grape

Pistachio

Figures generated by Dr. Stringfellow, Science Advisor to the Water Board

Units = mg/kg
Scales are different
Molybdenum

Almond

Citrus

Garlic

Grape

Pistachio

Units = mg/kg
Scales are different

Figures generated by Dr. Stringfellow, Science Advisor to the Water Board

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Nickel

Units = mg/kg
Scales are different

Almond

Citrus

Garlic

Grape

Pistachio

Figures generated by Dr. Stringfellow, Science Advisor to the Water Board
Strontium

Almond

Citrus

Garlic

Grape

Pistachio

Units = mg/kg
Scales are different

Figures generated by Dr. Stringfellow, Science Advisor to the Water Board

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Zinc

Almond

Citrus

Garlic

Grape

Pistachio

Units = mg/kg
Scales are different

Figures generated by Dr. Stringfellow, Science Advisor to the Water Board
Crop Sample Results

Max_c = Maximum Concentration for Control Sites
Max_T = Maximum Concentration for Treated Sites

- **Control > Treated:**
  - Copper \(\text{Max}_c = 9.9 \text{ mg/kg} \quad \text{Max}_T = 9.7 \text{ mg/kg}\)
  - Nickel \(\text{Max}_c = 1.4 \text{ mg/kg} \quad \text{Max}_T = 1.3 \text{ mg/kg}\)
  - Zinc \(\text{Max}_c = 36 \text{ mg/kg} \quad \text{Max}_T = 32 \text{ mg/kg}\)

- **Control ~ Treated:**
  - Molybdenum \(\text{Max}_c = 0.77 \text{ mg/kg} \quad \text{Max}_T = 0.61 \text{ mg/kg}\)

- **Treated > Control:**
  - Barium \(\text{Max}_c = 1.9 \text{ mg/kg} \quad \text{Max}_T = 2.1 \text{ mg/kg}\)
  - Strontium \(\text{Max}_c = 11 \text{ mg/kg} \quad \text{Max}_T = 9.5 \text{ mg/kg}\)
Potential Sources

Sources of Consideration:
- Herbicides / Pesticides,
- Fertilizer / Nutrient Management,
- Irrigation Water, and
- Soil Classification.

Selection of Control / Treated Sites
- Farmers with property at Control & Treated Sites

Irrigation Water
- Irrigation water results at the outfall of Reservoir B are available
- Looking at other water blended downstream of Reservoir B

Soil
- Soil classifications published by the United States Department of Agriculture
# Water Quality Results

**Barium (mg/l)**

**Water Quality Results**

### Irrigation Water (post-blending)

<table>
<thead>
<tr>
<th>Water Districts</th>
<th>Total No. of Results</th>
<th>Total Detectable Results</th>
<th>First Available Sample Result</th>
<th>Most Recent Available Sample Result</th>
<th>Min Result</th>
<th>Max Detection Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cawelo Water District</td>
<td>9</td>
<td>9</td>
<td>Aug 1985</td>
<td>Dec 2017</td>
<td>0.027</td>
<td>0.200</td>
</tr>
<tr>
<td>North Kern Water Storage District</td>
<td>8</td>
<td>8</td>
<td>Sep 2015</td>
<td>Dec 2017</td>
<td>0.016</td>
<td>0.039</td>
</tr>
<tr>
<td>Kern-Tulare Water District and Jasmin Mutual Water Company</td>
<td>14</td>
<td>10</td>
<td>May 2012</td>
<td>Dec 2017</td>
<td>0.005</td>
<td>0.025</td>
</tr>
</tbody>
</table>

### Produced Wastewater (pre-blending)

<table>
<thead>
<tr>
<th>Operators</th>
<th>Total No. of Results</th>
<th>Total Detectable Results</th>
<th>First Available Sample Result</th>
<th>Most Recent Available Sample Result</th>
<th>Min Result</th>
<th>Max Detection Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chevron &amp; VWMC</td>
<td>14</td>
<td>13</td>
<td>Jul 1996</td>
<td>Dec 2017</td>
<td>0.0075</td>
<td>0.120</td>
</tr>
<tr>
<td>California Resources Corporation</td>
<td>10</td>
<td>10</td>
<td>Sep 2015</td>
<td>Dec 2017</td>
<td>0.0021</td>
<td>0.057</td>
</tr>
<tr>
<td>Hathaway, LLC</td>
<td>21</td>
<td>5</td>
<td>May 1967</td>
<td>Dec 2017</td>
<td>0</td>
<td>0.0056</td>
</tr>
</tbody>
</table>

*Title 22 Primary MCL (Drinking Water) = 1.0 mg/l*
# Water Quality Results

## Strontium (mg/l) Water Quality Results

<table>
<thead>
<tr>
<th>Water Districts</th>
<th>Total No. of Results</th>
<th>Total Detectable Results</th>
<th>First Available Sample Result</th>
<th>Most Recent Available Sample Result</th>
<th>Min Result</th>
<th>Max Detectable Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cawelo Water District</td>
<td>6</td>
<td>6</td>
<td>Apr 2015</td>
<td>Dec 2017</td>
<td>0.120</td>
<td>0.460</td>
</tr>
<tr>
<td>North Kern Water Storage District</td>
<td>8</td>
<td>8</td>
<td>Sep 2015</td>
<td>Dec 2017</td>
<td>0.059</td>
<td>0.360</td>
</tr>
<tr>
<td>Kern-Tulare Water District and Jasmin Mutual Water Company</td>
<td>12</td>
<td>9</td>
<td>May 2012</td>
<td>Dec 2017</td>
<td>0.018</td>
<td>0.110</td>
</tr>
</tbody>
</table>

## Produced Wastewater (pre-blending)

<table>
<thead>
<tr>
<th>Operators</th>
<th>Total No. of Results</th>
<th>Total Detectable Results</th>
<th>First Available Sample Result</th>
<th>Most Recent Available Sample Result</th>
<th>Min Result</th>
<th>Max Detectable Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chevron &amp; VWMC</td>
<td>10</td>
<td>10</td>
<td>Jan 2012</td>
<td>Dec 2017</td>
<td>0.140</td>
<td>0.510</td>
</tr>
<tr>
<td>California Resources Corporation</td>
<td>10</td>
<td>10</td>
<td>Sep 2015</td>
<td>Dec 2017</td>
<td>0.130</td>
<td>1.000</td>
</tr>
<tr>
<td>Hathaway, LLC</td>
<td>18</td>
<td>14</td>
<td>Apr 2013</td>
<td>Dec 2017</td>
<td>0.085</td>
<td>0.520</td>
</tr>
</tbody>
</table>

Title 22 Primary MCL (Drinking Water) = NA
Soil Classification Map

Legend

Soil Types
- Clay
- Clay Loam
- Silty-Clay
- Silty Loam
- Sand
- Fine-Sandy Loam
- Sandy Loam
- Coarse Sandy Loam
- Gravel
- Gravelly Loam
- Loam
- Complex
- Association
- Other
- Urban Areas
- Water

Legend

Fruit Sample Results
- Barium Results: <0.5 mg/kg
- Barium Results: 0.5-0.75 mg/kg
- Barium Results: 0.76-1.29 mg/kg
- Barium Results: 1.3-2.1 mg/kg
- Barium Results: >2.1 mg/kg
- Strontium Results: <0.25 mg/kg
- Strontium Results: 0.25 - 1.4 mg/kg
- Strontium Results: 1.5-4.0 mg/kg
- Strontium Results: >4.0 mg/kg

Legend

Fruit Sample Locations
- Almond Sample Locations
- Citrus Sample Locations
- Garlic Sample Locations
- Grape Sample Locations
- Pistachio Sample Locations

Treated Sites

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Soil Classification Map

Legend
Soil Types
- Clay
- Clay Loam
- Silty-Clay
- Silty Loam
- Sand
- Fine-Sandy Loam
- Sandy Loam
- Coarse Sandy Loam
- Gravel
- Gravelly Loam
- Loam
- Complex
- Association
- Other
- Urban Areas
- Water

Legend
Fruit Sample Results
- Barium Results: <0.5 mg/kg
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- Barium Results: 0.76-1.29 mg/kg
- Barium Results: 1.3-2.1 mg/kg
- Barium Results: >2.1 mg/kg
- Strontium Results: <0.25 mg/kg
- Strontium Results: 0.25-1.4 mg/kg
- Strontium Results: 1.5-4.0 mg/kg
- Strontium Results: 5.0-11.0 mg/kg

Legend
Fruit Sample Locations
- Almond Sample Locations
- Citrus Sample Locations
- Garlic Sample Locations
- Grape Sample Locations
- Pistachio Sample Locations

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Summary

- Water Quality Results
  - Reviewed water quality results
  - Water quality results have been shared with the Panel

- Soil Analysis Goals
  - Comparison between soil type and crop sample results
  - Look for potential trends
  - Compare 2017 and 2018 data

- Soil Analysis Status
  - Too few data points
  - Wait for 2018 sample results to continue
Questions?