District 6
Community Meeting
Discolored Water Investigation Findings
(140-day Report)
June 14, 2016
Today’s Meeting Agenda

1. Review “Next Steps” from April 26th Meeting
2. Background
3. Regulatory Requirements
4. Water Treatment Plant Process Update
5. Water Quality Sampling Program
6. Findings of Special Studies on Pipe Corrosion
7. Under Slab Pipe Failures
8. Financing Option for Discolored Water
9. Investigation Summary and Next Steps
10. What To Do If Your Home Has Discolored Water
11. Questions
Next Steps
Activities Identified at 4/26/2016

1. Continue water quality sampling to compare discolored water conditions for surface water and groundwater.

2. Continue to dose corrosion control inhibitor at surface water treatment plant (historic practice) and at groundwater wells (new practice).

3. Evaluate potential benefits of blending groundwater with surface water prior to delivery to distribution system.

4. Continue to monitor and evaluate water chemistry conditions at surface water treatment plant, groundwater wells, and water distribution system.

5. Further assess the corrosion rate impacts of stagnation, temperature, trace copper concentrations, dissolved oxygen concentrations, use of water softeners, alternate corrosion control inhibitors, and using calcium hydroxide for alkalinity.

6. Continue to coordinate and communicate with residents, SWRCB, and County Health Department.
Discolored Water Reports from Residents

1. *I am the original home owner, and I have observed discolored water:*
   a. Within the past 3 years (meter installation).
   b. Within the past 12 years (NE SWTF placed into service).
   c. Since I moved into the home 20+ years ago.

2. *I observe discolored water:*
   a. On the hot water side of a bathroom fixture that I don’t use very often.
   b. In all fixtures – hot and cold – of a bathroom that I don’t use very often.
   c. In all fixtures of my home, on both the hot water and cold water.

3. *Discolored water appears in my home:*
   a. All the time.
   b. At random times, and doesn’t appear to follow a pattern.
   c. Only at fixtures that I do not use very often.
What Do We Know About Discolored Water?

1. The Investigation Area is NE Fresno, which has approximately 14,800 homes (*Copper to Alluvial, Willow to 41*).

2. 279 residents have *requested* water quality sampling.

3. Approximately 260 residents are reporting discolored water (*134 homes constructed between 1990 and 1999*).

4. Not every home reporting discolored water has discolored water in all fixtures at the home.

5. The reports of discolored water appear to be limited to those homes with galvanized pipe installed for water service.

6. A portion of the discolored water samples are showing the presence of iron, zinc, copper, and lead.

7. A portion of discolored water samples are reporting lead concentrations above the EPA and State of CA Action Level of 15 parts-per-billion.
What Do We Know About Lead in the Discolored Water?

1. There is no Lead detected in the City’s:
   a. Groundwater Supply
   b. Surface Water Supply, or
   c. Water Distribution System

2. The City’s NE Fresno water distribution system is non-metallic (*plastic and asbestos-cement concrete*), and water meters are Lead-free.

3. Portions of Old Fort Washington have iron pipe for water distribution, and contains no Lead (*pipe being replaced due to failed exterior coating – tar wrap*).

4. The discolored water – and the presence of Lead – appears to be the result of:
   a. *Galvanized pipe corrosion*
   b. *Indoor plumbing fixture corrosion*
Regulatory Requirements

*Lead and Copper Rule (LCR)*
Lead and Copper Rule (LCR)  
*June 1991, Safe Drinking Water Act*

1. Sets action levels (AL) for lead and copper inside of residences. Ten percent of samples collected cannot exceed:
   a. 0.015 part-per-million (ppm) Lead
   b. 1.3 ppm Copper

2. The City’s LCR Sampling Program
   a. 131 sampling sites around City
   b. LCR sampling started 1993 (~730 samples collected to date)
   c. Eight (8) LCR samples in 22 years have tested above the Lead Action Level

3. LCR sites are selected based on EPA-established criteria, with State approval:
   a. Homes that are plumbed with Lead pipes
   b. Homes that are served with a Lead service line
   c. Homes that are plumbed with copper pipes and lead solder installed prior to 1983
4. What is required if Action Levels are exceeded (i.e. number of positive samples > 10 percent of total samples):

a. Public education

b. Additional sampling required, both at sample sites and water sources at entry point to the distribution system

c. Source water treatment where indicated by sampling and corrosion control

5. **LCR Designed for Lead and Copper Plumbing, NOT Galvanized Pipe Plumbing**

6. **LCR is currently being considered for revisions**
Water Treatment Plant Process Update
What is the City’s Corrosion Control Treatment Strategy

1. Corrosion Control Treatment (CCT)
   a. The alteration of a water’s characteristics to reduce the potential for the water to corrode plumbing system components that leach lead and copper.
   b. CCT is typically accomplished through chemical addition to adjust the pH, alkalinity, and hardness of the water.
   c. CCT also includes the addition of corrosion control inhibitors.

2. The City’s State-approved, historic corrosion control strategy (established in 1998) is as follows:
   a. Target pH = 9
   b. Target alkalinity = 30-35 mg/L
   c. Target corrosion inhibitor dose = 1.0 mg/L (as phosphate)
   d. No corrosion control inhibitor for groundwater wells
   e. No blending of groundwater at surface water treatment plant
Water Chemistry Adjustment Considerations

Based on Field Investigations, Soil Testing and Material Testing

1. Deficient Galvanized Pipe Coatings (zinc coating and protective coatings)
2. Soil Corrosion
3. Dissimilar Metal Corrosion
Water Plant Process Update

Special Consultants Retained by City

• Dr. Marc Edwards – 1998 Corrosion Control Strategy
• Bruce Manning – Water Treatment Chemistry
• Cay Strother – Galvanized Iron Pipe Corrosion

• NE SWTF Operating at 24 million gallons per day
• Corrosion Inhibitor (ortho-polyphosphate) added to GW and SW.
• Blending GW with SW at NE SWTF at a ratio of ~1:12.5 (introduce natural minerals to surface water)
• Calcium Hydroxide is being added to increase calcium hardness and alkalinity (better match groundwater)
• Groundwater pH ~ 7.8, and Surface water pH ~8.3
• Target Langelier’s Saturation Index (LSI) > -0.35
• City is calling select residents on a weekly basis to receive reports of water clarity.
Water Quality Sampling Program

Public School and Residential Homes
Findings of Elementary School Sampling

1. Schools Selected Based on Proximity to NE SWTF
2. Six Elementary Schools in NE Fresno Tested for Lead and Copper
   a) Copper Hills (*)
   b) Fort Washington (**)  
   c) Fugman
   d) Liberty
   e) Riverview (*)
   f) Valley Oak
3. Five WQ Samples Collected Randomly at Each School
   a) 26 Lead Samples Returned “Non-Detect”
   b) Remaining 4 Lead Samples (*) Below Action Level (AL) of 15 ug/L  
      \[\text{max} = 8.3 \, \text{ug/L}\]
   c) All 30 Copper Samples Below AL for Copper of 1.3 mg/L  
      \[\text{max} = 0.39 \, \text{mg/L}\]
Status of Residential Water Quality Sampling Program

1. ~14,800 Homes in Study Area

2. 279 homes currently requesting water quality samples

3. 164 homes have been sampled

4. 50 homes have been sampled twice (comparing groundwater and surface water)

5. 39 homes have test results showing the presence of Lead at an indoor plumbing fixture above the Action Level of 15 parts-per-billion.

<table>
<thead>
<tr>
<th>Fixtures with Pb &gt; 15 ug/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guest Bath - Tub</td>
</tr>
<tr>
<td>Master Bath - Tub</td>
</tr>
<tr>
<td>Guest Bath - Sink</td>
</tr>
<tr>
<td><strong>Kitchen - Sink</strong></td>
</tr>
<tr>
<td>Laundry Room</td>
</tr>
<tr>
<td>Master Bath - Sink</td>
</tr>
<tr>
<td>Guest Bath</td>
</tr>
<tr>
<td>Master Bath - Shower</td>
</tr>
</tbody>
</table>

*Kitchen Sink Pb Samples: All GW*

15 ug/L, 16 ug/L, 19.3 mg/L, 120 ug/L
Profile of Homes Reporting Discolored Water

279 Homes Requesting WQ Sampling

**Builder Information**
- 85 homes – Builder No. A
- 18 homes – Builder No. B
- 15 homes – Builder No. C
- 11 homes – Builder No. D
- 8 homes – Builder No. E
- 8 homes – Builder No. F
- 7 homes – Builder No. G

**Year of Construction**
- 14 homes - Prior to 1970
- 43 homes - 1970 to 1979
- 54 homes - 1980 to 1989
- **134 homes - 1991 to 1999**
- 34 homes - After 2000

152 homes (55%) by 7 builders

**Data Source:** Development Plans
- 18 homes – no builder identified
- No other builder has more than 7 homes on the list
- 1996 and 1991 reporting discolored water for 40 and 24 homes, respectively
Water Quality Data Results
Homes Sampled Twice

Data Not Conclusive SW vs GW

Fe Comparison SW vs GW (Same Home)

Iron Concentrations, ug/L

GW - Iron
SW - Iron

Front Hose Bib  Kitchen - Sink  Guest Bath - Tub  Master Bath - Tub
Water Quality Data Results
Homes Sampled Twice

Lead Concentrations, ug/L

Pb Comparison SW vs GW

Data Not Conclusive SW vs GW

GW - Lead
SW - Lead

Front Hose Bib
Kitchen - Sink
Guest Bath - Tub
Master Bath - Tub
Water Quality Testing Results
Benefits of Flowing a Fixture

- Resident has double-vanity Master Bath Sink.
- Resident reported discolored water at rarely used vanity.
- Resident requested second sample, and agreed to flow rarely used vanity sink at same time as regularly used vanity.
- Second sample collected from rarely used vanity 5/18/2016.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Master Bath Sink</th>
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<tr>
<td></td>
<td>3/30/2016</td>
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<tr>
<td>Pb</td>
<td>510</td>
</tr>
<tr>
<td>Zn</td>
<td>11,000</td>
</tr>
<tr>
<td>Fe</td>
<td>24,000</td>
</tr>
<tr>
<td>Cu</td>
<td>66</td>
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</table>
Water Quality Testing Results
Adjustments in Water Chemistry

- Resident reported discolored water at Guest Bath Tub.
- Three samples collected at residence in Feb, May and June
- Water Sources: Feb = GW, May = SW, June = SW

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<tr>
<th>Parameter</th>
<th>Guest Bath Tub</th>
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<tr>
<td>Pb</td>
<td>540</td>
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<tr>
<td>Zn</td>
<td>10,000</td>
</tr>
<tr>
<td>Fe</td>
<td>16,000</td>
</tr>
<tr>
<td>Cu</td>
<td>130</td>
</tr>
</tbody>
</table>
Water Quality Testing Results
Flushing, New Service Line and Water Heater

- Resident reported discolored water at Master Bath and Guest Bath.
- Resident purchased new water heater (2 years ago), whole-house flush performed, water heater flush performed, and service line replaced from meter to home.
- Second sample collected 6/10/2016.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Guest Bath Sink</th>
<th>Master Bath Sink</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>2/19/2016</td>
<td>6/10/2016</td>
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<tr>
<td>Pb</td>
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<td>ND</td>
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<tr>
<td>Zn</td>
<td>530</td>
<td>610</td>
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<tr>
<td>Fe</td>
<td>795</td>
<td>150</td>
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<tr>
<td>Cu</td>
<td>25</td>
<td>5.5</td>
</tr>
</tbody>
</table>
Findings of Special Studies of Pipe Corrosion
Special Pipe Testing

City staff has conducted testing to assess the corrosion rate impacts of:

1. Stagnation
2. Temperature
3. Trace copper concentrations
4. Soil Corrosion
Zn Corrosion Rate Impact Stagnation

Stagnation Test Results for Zn - All Samples

- SW Zn
- SW Zn + Cu
- GW Zn
- GW Zn + Cu
- GW-T Zn
- GW-T Zn + Cu

Zinc Concentrations, mg/L

Days

3 days
Fe Corrosion Rate Impact Stagnation

Stagnation Test Results for Fe - All Samples

Iron Concentrations, mg/L

Days

6 days
Zn Corrosion Rate Impact Heat Addition (SW)

SW Heat Test Results, Zinc mg/L

- SW - No Heat
- SW - 110 Degrees, F
- SW - 150 Degrees, F
Zn Corrosion Rate Impact Heat Addition (GW)

GW Heat Test Results, Zinc mg/L

- GW - No Heat
- GW - 110 Degrees, F
- GW - 150 Degrees, F
Special Pipe Testing Results

1. Stagnation results in elevated concentrations of:
   a) Zn after 3 days, and
   b) Iron after 6 days
2. Temperature increases the rate of corrosion
3. The presence of copper increases the rate of corrosion
4. External pipe corrosion (soil) impact on the rate of interior pipe corrosion *(more testing required)*
Under Slab Pipe Failures
Galvanized Pipe Failure  
Piping Under Concrete Slab

- The City has received reports *(pipe samples and photos)* from residents and plumbers of galvanized pipe failures under concrete slabs.

- As the Building Code (609.3.1), *Ferrous piping shall have a protective coating* of an approved type, machine applied and conforming to recognized standards. Field wrapping shall provide equivalent protection and is restricted to those short sections and fittings necessarily stripped for threading. *Zinc coating (galvanizing) shall not be deemed adequate protection for piping or fittings. Approved non-ferrous piping need not be wrapped.***

- If the protective coating is compromised in any way, soil corrosion will result and the galvanized pipe will fail.
Galvanized Pipe Failure
Piping Under Concrete Slab
Galvanized Pipe Failure
Piping Under Concrete Slab

Portion of pipe that was removed. You can see the hole from the corrosion.
How Do I Check the Condition of My Under Slab Galvanized Pipe

• Inspect for Unusual “Hot Spots” on Flooring.
• Inspect for Unusual “Wet Spots” on the Flooring or around Property
• Check Moisture Contents of Home
• Inspect Hourly Water Meter Data (10 gallon per hour readings)
• Inspect Energy Bill Readings for Unusually High Use (gas or electric)
• Conduct Pressure Testing of Home (does home hold pressure)
• Conduct Acoustical Testing of Home (is audible leak present)
Investigation Summary and Next Steps

Discolored Water Investigation
Summary

1. City has received reports of discolored water in NE Fresno (279 residents requesting testing out of ~14,800 homes)

2. City has initiated an investigation of discolored water:
   a. Retained corrosion control experts to assist with investigation
   b. Conducted water quality testing, soil testing, and material testing
   c. Conducted onsite residential inspections and testing
   d. Conducted special studies of pipe corrosion
   e. Re-evaluated 1998 Corrosion Control Treatment Strategy

3. A portion of the discolored water samples are showing the presence of iron, zinc, copper, and lead.

4. The reports of discolored water appear to be limited to those homes with galvanized pipe installed for water service.

5. Galvanized pipe corrosion has been observed to be occurring as a result of dissimilar metal corrosion, soil corrosion, and deficient galvanized pipe coatings.
Summary

6. 164 homes have been sampled, and 50 homes have been sampled twice (comparing groundwater and surface water)
   a. No observable pattern comparing GW to SW
   b. Thirty-nine (39) homes have test results showing the presence of Lead at an indoor plumbing fixture above the Action Level (AL) of 15 parts-per-billion.
   c. Eight (8) homes have tests results for Pb above the AL at two indoor plumbing fixtures.
   d. 118 homes have tested Non-Detect for Lead at all fixtures tested in the home.

7. There is no Lead detected in the City’s:
   a. Groundwater Supply
   b. Surface Water Supply, or
   c. Water Distribution System

8. The City has been fully compliant with the requirements of the Lead and Copper Rule (corrosion-related regulation) since 1993.
Summary

9. A consistent and repeatable pattern has NOT yet been identified for the corrosion of galvanized pipe and fixtures in NE Fresno.
   a. Age of Home (pipe material, fixture material)
   b. Geographic Location of Home (corrosive soils)
   c. Builder/Developer of Home (material selection, workmanship)
   d. Water Supply Source to Home (surface water, groundwater, blend)
   e. Water Use Patterns (stagnant conditions, total usage)

<table>
<thead>
<tr>
<th>Same Street</th>
<th>Guest Bath Sink</th>
<th>Kitchen Sink</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address 1</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Address 2</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Address 3</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Address 4</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Address 5</td>
<td>15</td>
<td>1.3</td>
</tr>
<tr>
<td>Address 6</td>
<td>109</td>
<td>3.3</td>
</tr>
</tbody>
</table>
Next Steps

1. Continue water quality sampling to compare discolored water conditions for surface water and groundwater.
   
a) Analyze data for patterns and correlations
b) Identify potential field tests to confirm findings of special pipe studies

2. Continue to control and monitor water chemistry at water treatment plant and groundwater wells
   
a) Blend groundwater at water plant (PS 185)
b) Dose calcium hydroxide at water plant
c) Control pH at 8.3 at water plant
d) Dose corrosion inhibitor at water plant and wells

3. Continue to coordinate and communicate with residents, SWRCB, and County Health Department.

4. Consider prohibition of galvanized pipe for residential water service.
If You Have Discolored Water

Discolored Water Investigation
What To Do If Your Home Has Discolored Water

1. Flush discolored water from faucets until clear before using.
   a. If you need hot water for preparing foods and beverages, use cold water, and heat the cold water to required temperature.
   b. 157 faucets have been flushed to clear and all results are below AL for Lead (4 faucets were not clear after 2 minutes)

2. Contact a licensed plumber to inspect your home for soil corrosion or dissimilar metal corrosion of galvanized pipe.

3. Consider a full-house flush of all water fixtures in the home, including the water heater.

4. Replace existing indoor plumbing fixtures with Lead-free plumbing fixtures.

5. Purchase point-of-use devices for fixtures used to draw water for drinking and cooking.
What To Do If Your Home Has Discolored Water

6. Inspect home for unusual hot spots or wet spots on flooring; review hourly water meter data for 10 gph readings; and review monthly utility bill data.

7. Install new plumbing fixtures, fittings, and piping in the home
   a. Hot water piping only
   b. Hot and cold water piping
   c. City will waive permit and inspection fees for re-plumbing work upon inspection of completed projects.

8. For questions regarding Lead exposure risks, you can contact:
   a. California Department of Public Health, Childhood Lead Poisoning Prevention Branch at 510-620-5600, or
   b. Fresno County Department of Public Health at (559) 600-3590.
Questions/Comments

Thomas C. Esqueda, Director
City of Fresno
Department of Public Utilities
Office: 559-621-8610
Email: thomas.esqueda@fresno.gov
Soil Corroded Pipe Sample
Service Line from Meter to Home
Pipe Specimen
Subject of Class Action Lawsuits
Zn Corrosion Rate Impact Presence of Copper

Zn Corrosion Rate Change with Trace Copper (4 days)

GW - No Copper
GW - With Copper

~ 9.6 percent increase in Zn corrosion with trace Copper (0.8 mg/L)
Fe Corrosion Rate Impact Presence of Copper

Fe Corrosion Rate Change with Trace Copper (4 days)

GW - No Copper
GW - With Copper

~ 500 percent increase in Fe corrosion with trace Copper (0.8 mg/L)
Zn Corrosion Rate Impact
Soil Corrosion Simulation (GW)

GW Induction Test Results, Zinc mg/L

- GW Induction - Control
- GW Induction Coated Wire
- GW Induction Direct Wire Contact
Water Quality Data Results
All Data

GW - Iron
SW - Iron

Fe Comparison SW vs GW (All Data)

Iron Concentrations, ug/L

Front Hose Bib  Kitchen - Sink  Guest Bath - Tub  Master Bath - Tub
Water Quality Data Results
All Data

Pb Comparison SW vs GW (All Data)

Lead Concentrations, ug/L

GW - Lead
SW - Lead

Front Hose Bib
Kitchen - Sink
Guest Bath - Tub
Master Bath - Tub
City of Fresno
Building Inspections Process

1. Galvanized pipe has been, and continues to be, allowed for use in residential plumbing systems.

2. For homes over 3,000 square feet, Plumbing Plans are required, and Inspectors confirm plumbing is installed in accordance with Approved architect drawings.

3. For homes less than 3,000 square feet, Plumbing Plans are not required, and Inspectors confirm that plumbing is installed in accordance with building code requirements.

4. The Building Code has, and currently does, allow bare galvanized pipe to be installed for water service from the meter to the front of the house.
Financing Option for Discolored Water

PACE Program
PACE Program Financing

• An equity-based financing option for property owners for energy efficiency and water conservation upgrades.

• PACE is a property assessment charge that can be included in escrow accounts administered by mortgage servicers.

• All fees are included in the loan (~5 %), no upfront costs to homeowners.

• Annual percentage rate (APR) typically ranges from 9.00% to 9.25%.

• Income verification not required.

• Applications not approved or denied based on credit score.

• PACE loan does not affect a homeowner’s debt-to-income ratio

<table>
<thead>
<tr>
<th>TERM</th>
<th>INTEREST RATE</th>
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<tbody>
<tr>
<td>5 Years</td>
<td>6.50 – 6.75 %</td>
</tr>
<tr>
<td>10 Years</td>
<td>7.49 – 7.69 %</td>
</tr>
<tr>
<td>15 Years</td>
<td>7.99 – 8.15 %</td>
</tr>
<tr>
<td>20 Years</td>
<td>8.29 – 8.35 %</td>
</tr>
<tr>
<td>25 Years</td>
<td>8.39 %</td>
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</tbody>
</table>
PACE Program Financing

• Applicants must be owners of record for subject property, and all property owners must sign the documents.

• Property owners must be current on their property taxes, and must certify that property taxes have not been late more than once during the prior three (3) years.

• Property owners must be current on all property-related debt, and cannot have had more than one 30-day, mortgage related late payment in the prior 12 months.

• There must be no Notices of Default or Foreclosure filed against the property within the last 2 years.

• No bankruptcies (business or personal) in the last two (2) years. The property must not be an asset in any bankruptcy proceeding.
PACE Program Financing

- Property title cannot be subject to power of attorney, no outstanding involuntary liens, easements or subordination agreements restricting authority of the Property Owner to a PACE Lien.
- 10-percent equity is the minimum to qualify for a PACE loan.
- PACE can finance projects up to 15 percent of the property value.
- The all-in tax rate on the property (including the PACE assessment and other assessments) cannot exceed 5 percent of the property value.

$10,000 Project, 5 percent fees, financed for 10 years = $1,500 per year repayment schedule
PACE Program Financing

The PACE program will finance two types of plumbing retrofits:

1. Whole-House Manifold System
2. Core Plumbing System

*Figure 2. A General Configuration Typical of Core Systems*
*Figure 3. A General Configuration Typical of Whole-House Manifold Systems*
PACE Program Financing

**Ygrene** (Residential/Commercial)
George Apostolopoulos
Manager, District Development
Ygrene Energy Fund
P: **408.772.7669**
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