PORTLAND WATER BUREAU
LEAD AND COPPER RULE

April 21, 2016
Meeting with OHA and EPA
Part 1
Presentation Outline

Morning Presentation:
• Reasons for Revisiting Portland’s LCR Program
• System Overview
• Portland’s LCR History
• Lead Hazard Reduction Program
• Questions and Discussion

Afternoon Presentation:
• Corrosion Study
• Next Steps
Reasons for discussing Portland’s approach to the LCR

• Open reservoirs coming offline
  • Corrosion treatment enhancements were delayed after receiving treatment variance until Open Reservoir removal is completed.

• LCR Exceedances
  • Fall 2013 PWB (and consecutive systems) exceeded LCR Action Level
  • Since 2014, lead levels have held at 14 ppb.

• Corrosion Study
  • PWB embarked on a distribution system corrosion study in 2014

• Health effects of Lead
  • Lower level of concern (10→5 ug/dL)
  • Better understanding of low level exposures
Service Area and Water Sources
Supply System Overview

1. Disinfection
   - Chlorine

2. Chloramination
   - Ammonia

3. pH Adjustment
   - Sodium Hydroxide

Groundwater is treated to match Bull Run water. Chlorine, ammonia, and sodium hydroxide are added at the Groundwater Pump Station.

Bull Run Watershed

Headworks Treatment Facility

Lusted Hill Treatment Facility

Reservoirs and Storage Tanks

Your Faucet
Service Population & System

Population
- 958,765 total service
- 588,365 retail
- 370,400 wholesale
20 wholesale customers
Sources of Lead in Portland

• Portland never used lead service lines

• Removed all known lead pigtails

• Copper pipes and lead solder - most common in homes plumbed or built from 1970 - 85

• In Portland lead paint is the greatest source of exposure to lead
Removal of Lead in the Water System

Lead-based Solder
• Worked with the state of Oregon to ban the use of lead-based solder in water systems in 1985.

Lead Pigtails
• Completed the removal of all known lead pigtails (>10,000) in the distribution system, 1998. ($10M)

Lead-component Meters
• 364 large meters serving schools, hospitals, childcare facilities, community centers, public housing complexes and large apartment building were replaced from 2001-2008.
Portland’s Lead and Copper Rule Timeline

1992: LCR goes into effect

1992: Initial home tap sampling
  • Lead = 48 ppb, Copper = 1.5 ppm

1994: Corrosion Control Study
  • Optimized Treatment: pH = 9.0-9.5, Alkalinity = 20 mg/L
  • 70-85% reduction in lead levels expected

1994: Portland City Council directs the PWB to investigate alternatives to optimal treatment

1997: Portland funds a study to model lead exposure through drinking water
Conclusions of Lead Exposure through Drinking Water Study

- Drinking water is not the major route of lead exposure in the Portland area.
- Water treatment alone would not sufficiently reduce exposure in homes with significant sources of lead in water.
- Lead-based paint is the most significant source of lead in the Portland area and presents the highest risk.
- Efforts to prevent exposure from lead-based paint could provide significant health benefit to the community.
Portland’s Lead and Copper Rule Timeline

1997: PWB develops a comprehensive approach to corrosion control: Lead Hazard Reduction Program
  • Water Treatment and Monitoring
  • Lead in Water Education and Testing
  • Public Education and Community Outreach
  • Home Lead Hazard Control Program

1997: The State approves the LHRP as optimized treatment

1997: PWB raises pH from 6.5-7 to 7.5 & implements the state-approved joint monitoring plan

2002: PWB raises pH to 7.8

2002: EPA Technical Advisory Committee (TAC)
  • Dr. Michelle Frey, Gregory J. Kirmeyer, Anne Sandvig, Michael Schock, Dr. Vernon Snoeyink, Dr. Rhodes Trussell
TAC Recommendations

• Confirms pH 9.0, alk 20 as OCCT as a long-term recommendation
• Short-term: Increase pH to 7.8 – 8.0
• Change JMP from consumption based to Tier 1 home based
• Increase monitoring of pH in distribution system
• Investigate nitrification in the distribution system
• Recommended further study of the effect of the open reservoirs, phosphate related issues, analogous systems
Portland’s Lead and Copper Rule Timeline

- 2005: PWB raises pH to 8.0
- 2006 & 2013: LCR Tier 1 Home exceedance
- 2013: Targeted UDF Program
- 2014: PWB starts Water Quality Corrosion Study
- 2015: Mt. Tabor disconnected from system
- April 2016: PWB meets with OHA and EPA to discuss next steps
Components of the Lead Hazard Reduction Program (LHRP)

**Water Treatment & Monitoring**
- pH raised to 8.0

**Lead in Water Education and Testing**
- Free water testing to all customers in the Bull Run service area

**Public Education and Community Outreach**
- Raising awareness of all potential sources of lead, focus on highest risks to children

**Home Lead Hazard Control Program**
- In-home risk assessments, lead hazard reduction measures
Portland’s LHRP: Treatment and Monitoring

Treatment: Sodium Hydroxide pH adjustment to 8.0

Monitoring at Taps – Joint Monitoring Plan with 11 wholesalers
  • Every 6 months – minimum 100 “Tier 1” Homes (worst case)

Water Quality Parameter Monitoring
  • Daily pH at entry point
  • Quarterly pH and alkalinity at 25 sites in Bull Run distribution system
  • Collect pH at all TCR sample locations
Portland’s Compliance with the LCR

Portland Joint Monitoring 90th Percentile Lead Levels

90th Percentile Lead (ppb)

Pre-treatment
Post-treatment
(pH raised to 7.5 Jan 1997)

Sampling Period

March 31, 2016
Portland’s LHRP: Lead in Water Education & Testing

A Guide to Lead in Household Plumbing and Your Drinking Water

Does Your Home Plumbing Contain Lead?

Reducing Exposure to Lead

Easy Steps to Reduce Exposure to Lead

Lead brochure

LWET mailer

CCR

Website
Portland’s LHRP: Lead in Water Education & Testing

Customer Sampling

2015 90th Percentile

Portland: 4.4 ppb
Wholesalers: 9.8 ppb
Follow up with customers who have results above 15 ppb:

- Direct contact: phone call
- Easy steps to reduce exposure
- Offer running and faucet and plumbing standing samples

### Portland’s LHRP: Lead in Water Education & Testing

#### Customer Sampling

<table>
<thead>
<tr>
<th>2010-2015 customers who collected a single set of running and standing samples and had a result above the action level in the standing sample (n=67).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of homes that saw a reduction in the running sample.</td>
</tr>
<tr>
<td>Percent of homes that saw an 90% or better reduction in the running sample.</td>
</tr>
<tr>
<td>Percent of homes that saw an 80% or better reduction in the running sample.</td>
</tr>
<tr>
<td>Percent of homes that went from above the action level to below the action level.</td>
</tr>
<tr>
<td>Average percent reduction.</td>
</tr>
</tbody>
</table>
Portland’s LHRP: Public Education and Community Outreach

Examples of programs funded by the LHRP:

- LeadLine - centralized resource
- Blood Testing
- Paint Stabilization in Schools
- Lead Poisoning Prevention Workshops
- Soil testing for lead contamination
- Trainings
- Home Investigations
- Equipment Lending
- Outreach at community events
- Playground equipment replacement
LHRP Community Grant Stats

Since 2004:

19,800 tenants have received lead information through Community Alliance of Tenants’ Renters’ Rights Hotline

6,816 people have attended a Community Energy Project lead workshop

14,090 landlords have been reached by Fair Housing Council of Oregon

996 soil samples have been tested for lead through Growing Gardens

7,600 new and expecting mothers have received lead information from the International Center for Traditional Childbirth

40,500 people have called or emailed the LeadLine

12,625 blood lead level tests

98 pieces of playground equipment with lead paint were replaced by Portland Parks and Rec

186 paint stabilization projects have been completed by Portland Public Schools
Portland Housing Bureau Home Lead Hazard Control Grant Program

Since 2001, LHRP funds have been used as local match to receive 5 HUD grants

<table>
<thead>
<tr>
<th>Year Awarded</th>
<th>Amount</th>
<th>Units Completed</th>
<th>Number of Kids</th>
</tr>
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<tbody>
<tr>
<td>2001</td>
<td>$3,000,000</td>
<td>318</td>
<td>636</td>
</tr>
<tr>
<td>2004</td>
<td>$3,000,000</td>
<td>281</td>
<td>625</td>
</tr>
<tr>
<td>2006</td>
<td>$3,000,000</td>
<td>335</td>
<td>700</td>
</tr>
<tr>
<td>2009</td>
<td>$4,000,000</td>
<td>529</td>
<td>1,000</td>
</tr>
<tr>
<td>2013*</td>
<td>$3,000,000</td>
<td>118</td>
<td>118</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$16,000,000</td>
<td>1,543</td>
<td>3,061</td>
</tr>
</tbody>
</table>

*As of 3/24/2016
LHRP Evaluation

Program Design and Evaluation Services (PDES) group will be conducting an evaluation of the LHRP during FY 2016-17. PDES is a partnership between OHA and MCHD

Questions posed by the evaluation:
• Are the LHRP partner organizations raising awareness and knowledge about lead hazard risks in the community?
• Do partner organizations improve knowledge about and use of resources for reducing lead exposure?
• Are the LHRP partner organizations targeting and reaching the most at-risk populations in the Portland community for lead exposure?

PDES will provide a final report to the Water Bureau in Fall 2017.
Multnomah County Health Department
EBLL Investigations (Jan. 2013 – March 2016)

### Probable Source Table

<table>
<thead>
<tr>
<th>Possible Source</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint/Dust</td>
<td>106</td>
</tr>
<tr>
<td>Country of Origin</td>
<td>29</td>
</tr>
<tr>
<td>Not Identified by Investigation</td>
<td>21</td>
</tr>
<tr>
<td>Antiques/Toys/Jewelry</td>
<td>6</td>
</tr>
<tr>
<td>No Investigation-Refusal/No Response</td>
<td>6</td>
</tr>
<tr>
<td>Occupational (Parent Take-Home)</td>
<td>5</td>
</tr>
<tr>
<td>Hobby</td>
<td>4</td>
</tr>
<tr>
<td>No Record of Investigation</td>
<td>3</td>
</tr>
<tr>
<td>Shot/Sinkers/Bullets</td>
<td>3</td>
</tr>
<tr>
<td>Soil</td>
<td>3</td>
</tr>
<tr>
<td>Travel to Foreign Country</td>
<td>3</td>
</tr>
<tr>
<td>Ceramics/Pottery/Cooking Vessels</td>
<td>2</td>
</tr>
<tr>
<td>No Investigation-LHD Decision</td>
<td>2</td>
</tr>
<tr>
<td>Traditional Medicine/Cosmetics</td>
<td>2</td>
</tr>
<tr>
<td>No Investigation-Moved Out of Jurisdiction</td>
<td>1</td>
</tr>
</tbody>
</table>
### Reporting

<table>
<thead>
<tr>
<th>Data/Report</th>
<th>Reported to</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1 Home Monitoring Compliance Reports</td>
<td>OHA</td>
<td>Every 6 months</td>
</tr>
<tr>
<td>LHRP Update</td>
<td>EPA and OHA</td>
<td>Twice a year</td>
</tr>
<tr>
<td>Customer Results</td>
<td>Customer</td>
<td>As results are received from lab</td>
</tr>
<tr>
<td>Customer Results</td>
<td>OHA</td>
<td>Annually</td>
</tr>
<tr>
<td>Compliance Results</td>
<td>Posted to website</td>
<td>Updated as needed</td>
</tr>
</tbody>
</table>
Recommendations from LCRWG/NDWAC:

1- Replace Lead Service Lines
2- Stronger Public Education
3- Improve Corrosion Control Treatment
4- Modify Monitoring Requirements
5- Health-based Home Action Level
6- Establish Separate Requirement for Copper
EPA recommendations

Website Disclosure
  • Lead sampling protocols
  • Lead sampling results
  • Lead service line inventory information

Tier 1 Home Sampling
  • Pre-stagnation flushing
  • Appropriate sample bottles
  • Aerator removal

Customer Notification
  • Immediate notification of excessive levels
Near-term Actions

- Water Quality Corrosion Control Study
- Taking open reservoirs offline
- Continued nitrification control measures
- Continued targeted UDF
- Work with schools and daycares
Questions?
PORTLAND’S WATER QUALITY CORROSION STUDY

April 21, 2016
Meeting with OHA and EPA
Part 2
PRESENTATION OUTLINE

Corrosion Study
  ◦ Background
  ◦ Project Objectives
  ◦ Study Plan

Corrosion Control Decision
  ◦ Decision
  ◦ Treatment Considerations
  ◦ Schedule
$240,000 project with B&V

Project objectives include:

- Better understand the causes of lead release in PWB’s system
- Identify data gaps and conduct additional sampling required to better understand the role of water quality on lead release
  - Is uniform corrosion contributing to lead observed in LCR samples?
  - Is scale release (caused by hydraulic or physical disturbances) or dissolution (caused by chemical changes) contributing to lead observed in LCR samples?
- What premise plumbing and fixture materials are contributing to lead release for PWB customers?
- Is nitrification or other microbiological activity contributing significantly to lead release?
- What impact does the use of groundwater have on lead release?
- Are operational changes affecting lead release in the distribution system? If so, how?
Convene a panel of utility, consultant, and academic experts to be a technical advisory committee for this study

- List of TAC panel members:
  - Dan Giammar (Washington University),
  - Rick Sakaji (EBMUD),
  - Salmone Freud (NYCDEP),
  - Melinda Friedman (Confluence Engineering),
  - Mark Knudson (TVWD)

This is **not** a treatment study

- Any significant changes to treatment would require pilot testing
CORROSION SAMPLING PLAN

Weekly sampling over the course of a year in the distribution system
- 3 Process Research Solution (PRS) Monitoring Stations were installed
- 2 distribution system sites

Follow-up sampling at select LCR and customer homes
- Goal is to sample ~ 50 customer homes as well as several of PWB’s Tier 1 homes with elevated lead levels

= PRS Stations
= Distribution system sites
PRS STATIONS

These stations allow for controlled stagnation cycles to replicate worst case water quality as seen in customer homes

◦ Previous PRS monitoring station results have tracked well with LCR first draw samples in other systems

Each station includes four stagnation chambers, each containing different metals types

◦ **Copper with Lead Solder**
  ◦ Represents material commonly found in Portland Tier 1 homes

◦ **Galvanized Iron**
  ◦ Galvanized iron plates represent indoor piping and plumbing fixtures commonly found in Portland homes

◦ **Brass**
  ◦ Similar to galvanized iron, brass plates represent indoor piping and plumbing fixtures commonly found in Portland homes

◦ **Lead**
  ◦ Even though PWB does not have lead service lines, lead is used in order to magnify the response of lead to the water characteristics
PARAMETERS MONITORED AS PART OF THE WATER QUALITY CORROSION STUDY

**Field**
- pH
- Temperature
- ORP
- Chlorine residual
- Monochloramine
- Free ammonia
- Turbidity
- Conductivity
- ATP

**Lab**
- Total and dissolved metals
  - lead, copper, aluminum, arsenic, cadmium, calcium, chromium, cobalt, iron, magnesium, manganese, nickel, zinc
- Total organic carbon
- Dissolved organic carbon
- Total phosphorus
- Alkalinity
- Hardness
- Chloride
- Sulfate
- Nitrate
- Nitrite
- TDS
May 2014
Black and Veatch started work on the corrosion study

Oct 2014
Workshop 1 Held at PWB

June 2015
Technical Memo 1 Completed

Oct 2015
Technical Memo 2 Completed

Nov 2015 – Jan 2017
Distribution System Sampling
• April 2016: Q1 Report
• July 2016: Q2 Report
• Oct 2016: Q3 Report
• Jan 2017: Q4 Report

Mid 2017
Water Quality Report Due
Summer 2016: Washington Park disconnected from system
January 2017: 4th quarterly sampling report for corrosion study
Mid 2017: Results from corrosion study
January 1, 2020: Washington Park reservoir online
January 2017 4th quarterly report
Mid 2017 Final Report

**Corrosion Study**

- **Go to Treatment?**
  - Yes: **Corrosion Treatment Study**
    - pH=9.0 and alk=20mg/l
    - Pilot test
    - Distribution Impacts
  - No: **Distribution System Optimization Implementation**
    - Continue LHRP
    - Optimize Program

- **3 years**
  - **Corrosion Treatment Design**
  - **Review Optimization**

- **2 years**
  - **Corrosion Treatment Construction**

*CORROSION CONTROL DECISION TREE*
• Meet OCCT requirement of LCR
• Reduce corrosiveness of our water
  • Reduces lead and copper
  • Potentially extend useful life of our pipes
• Water should become more stable
  • System pH would be more consistent
  • Potential for greater formation of monochloramines above pH 8
• WQ Impacts – want to avoid unintended consequences
  • Potential red water
  • DBPs – THMs might increase, but HAAs might decrease
  • Aesthetics
  • Unknown
CORROSION CONTROL DECISION
TREATMENT CONSIDERATIONS

- Adding chemicals to Portland’s water (Fluoride experience)
- Possible reduction in public health benefit if reduction of other sources of lead exposure is no longer funded
- Discharge issues
- Schedule
  - Next Slide
- Cost
  - Capital: approximately $15 Million
  - Operational: will be higher (chemicals, staffing, flushing)
CORROSION CONTROL DECISION SCHEDULE CONSIDERATIONS

Year 1
- Treatment Study
- Council Approvals
- Pilot Study
- Regulatory Approvals

Year 2
- 18+ months

Year 3
- Treatment Design
- Land Use Approvals
- Permitting
- Contracting

Year 4
- 18+ months

Year 5
- 12+ months

Year 6
- Treatment Construction

Year 7

Year 8

Year 9

Optimization Implementation
Discussion