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Exhibit No.:	
Issue(s):	Lead Line Replacement Pilot Study
Witness/Type of Exhibit:	Marke/Direct
Sponsoring Party:	Public Counsel
Case No.:	WU-2017-0296

DIRECT TESTIMONY

OF

GEOFF MARKE

Submitted on Behalf of the Office of the Public Counsel

MISSOURI-AMERICAN WATER COMPANY

CASE NO. WU-2017-0296

August 1, 2017

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MISSOURI-AMERICAN WATER COMPANY

CASE NO. WU-2017-0296

I. INTRODUCTION

Q. Please state your name, title and business address.

A. Geoff Marke, PhD, Chief Economist, Office of the Public Counsel (OPC or Public Counsel), P.O. Box 2230, Jefferson City, Missouri 65102.

Q. By whom are you employed and in what capacity?

A. I am employed by the OPC as the Chief Economist.

Q. Please describe your education and employment background.

A. I received a Bachelor of Arts Degree in English from The Citadel, a Masters of Arts Degree from The University of Missouri, St. Louis, and a Doctorate of Philosophy in Public Policy Analysis from Saint Louis University ("SLU"). At SLU, I served as a graduate assistant where I taught undergraduate and graduate course work in urban policy and public finance. I also conducted mixed-method research in transportation policy, economic development and emergency management.

I have been in my present position with OPC since April of 2014 where I have been responsible for economic analysis and policy research in electric, gas and water utility operations. Prior to joining OPC, I was employed by the Missouri Public Service Commission as a Utility Policy Analyst II in the Energy Resource Analysis Section, Energy Unit, Utility Operations Department, Regulatory Review Division. My primary duties in that role involved reviewing, analyzing and writing recommendations concerning electric integrated resource planning, renewable energy standards, and demand-side management programs for all investor-owned electric utilities in Missouri. I have also been employed by

the Missouri Department of Natural Resources (later transferred to the Department of Economic Development), Energy Division where I served as a Planner III and functioned as the lead policy analyst on electric cases. I have worked in the private sector, most notably serving as the Lead Researcher for Funston Advisory based out of Detroit, Michigan. My experience with Funston involved a variety of specialized consulting engagements with both private and public entities.

Q. Have you been a member of, or participant in, any work groups, committees, or other groups that have addressed electric utility regulation and policy issues?

A. Yes. I am currently a member of the National Association of State Consumer Advocates (NASUCA) Distributed Energy Resource Committee which shares information and establishes policies regarding energy efficiency, renewable generation, and distributed generation, and considers best practices for the development of cost-effective programs that promote fairness and value for all consumers. I am also a member of NASUCA's Electricity and Water Committee's each tasked with analyzing current issues affecting residential consumers.

Q. Have you testified previously before the Missouri Public Service Commission?

A. Yes. A listing of the cases in which I have previously filed testimony and/or comments before this commission is attached in GM-1.

Q. What is the purpose of your direct testimony?

A. The purpose of this testimony is to sponsor the conditions and considerations surrounding a lead line replacement pilot study and to recommend that the Commission consider this issue within Missouri American Water's most recently filed rate case (WR-2017-0285).

II. BACKGROUND ON THE ISSUE

Q. Please summarize the application.

A. On May 12th 2017, Missouri American Water Company ("MAWC" or "the Company") filed an application for an accounting authority order ("AAO") concerning the Company's lead service line replacement program. Regarding the overall presence of lead service lines the Company states:

> Nationwide, old lead service lines connect an estimated 6.1 million or more homes and businesses to community drinking water mains.[1] MAWC currently estimates that there are approximately 30,000 service lines containing lead belonging to customers that are connected to MAWC's systems.[2]

Regarding the estimated costs per household of a lead service line replacement the Company states:

> It is estimated that the cost of such service line replacement will be $3,000 - $5,000 for each service line replaced.[3]

The Company then requested that the Commission grant an accounting order to:

> a) [R]ecord and defer on its books a regulatory asset that represents the cost of all customer-owned lead service line replacements made beginning in 2017 and to calculate a monthly carrying charge on the balance in the regulatory asset account equal to the weighted average cost of capital from the Company's last general rate case for use with the Infrastructure Replacement Surcharge, whether established by agreement or in accordance with section 393.1006.4, RSMo; and,
>
> b) That MAWC may defer and maintain this regulatory asset on its books until the effective date of the Report and Order in MAWC's next general rate proceeding.
>
> c) This regulatory asset will remain in place until all eligible costs are amortized and recovered in rates.[4]

[1] Company citation states: Lead service Line Replacement Collaborative – http://www.lslr.collaborative.org/about-us.html.
[2] WU-2017-0296. Application and Motion for Waiver. Missouri American Water Company 5/12/2017.
[3] Ibid.

Q. Does OPC agree with MAWC's estimated lead service line replacement total of approximately 30,000 units?

A. No. OPC believes these estimates are incorrect and will address this issue in full in rebuttal testimony if necessary based on MAWC's direct testimony.

Q. Does OPC agree with MAWC's estimated cost for service line replacement at $3,000 to $5,000?

A. No. OPC believes these costs are understated and will address this issue in full in rebuttal testimony if necessary based on MAWC's direct testimony.

Q. Does OPC support MAWC's proposed accounting and ratemaking treatment?

A. No. OPC witness Charles Hyneman proposes an alternative accounting and ratemaking treatment in conjunction with OPC's proposed pilot study for Commission consideration. The inappropriateness of the Company's proposed treatment will be addressed in rebuttal testimony in full if necessary based on MAWC's direct testimony.

Q. Does OPC have additional concerns?

A. Yes. OPC believes that full lead service line replacement is a complex problem that needs to be approached both holistically from a systems perspective and transparently to help inform ratepayers and stakeholders of both the costs and relevant health-related information. The decision to move forward with full lead service line replacement will unavoidably produce secondary and tertiary impacts that the current application does not presently consider which raises potential deficiency concerns.[5]

[4] Ibid
[5] Relevant deficiency concerns will be addressed at length in rebuttal testimony if necessary based on MAWC's direct testimony.

To be clear, OPC acknowledges that MAWC's current practice of partial lead line replacement is most likely flawed.[6] However, it would be inappropriate to move forward with the Company's present application without consideration of the many confounding variables that are interdependent on successful and prudent eradication of lead from a given system's water supply. This is especially true considering the pending revisions to the U.S. Environmental Protection Agency's ("EPA") long-term revisions to the Lead and Copper Rules ("LCR"),[7] revisions to the EPA's lead modeling review,[8] and potential for increased federal water infrastructure spending[9] and/or increased reliance on public-private partnership ("P3") spending models.[10] At a minimum, further dialogue is warranted.

Q. What is OPC's recommendation?

A. OPC recommends that the Commission reject the Company's current application and, if the Company seeks relief within the pending rate case, consider OPC's alternative for a two-year pilot study in which no more than $4 million annually (or $8 million in total can be spent on planned full lead service line replacement and third-party administrative costs associated with the collaborative research efforts. The pilot study will explore the feasibility, legality and associated policy implications of full lead service line replacement across MAWC's entire territory and the state of Missouri with the results presented to the Missouri Public Service

[6] The University of Wisconsin Population Health Institute, School of Medicine and Public Health, in conjunction with the Robert Woods Foundation, gives an "Expert Opinion" Evidence Rating. The "Expert Opinion" is the fourth valuation designation out of a possible six in terms of scientific credibility. According to the Institute, an "Expert Opinion" rating denotes: "Strategies with this rating are recommended by credible, impartial experts but have limited research documenting effects; further research, often with stronger designs, is needed to confirm effects." See also: http://www.countyhealthrankings.org/policies/lead-pipe-plumbing-material-replacement

[7] US EPA (2017) Lead and Copper Rules Long-Term Revisions. https://www.epa.gov/dwstandardsregulations/lead-and-copper-rule-long-term-revisions

[8] Federal Register (2017) EPA's proposed modeling approaches for a health-based benchmark for lead in drinking water-final list of peer reviewers, final charge questions and notice of the public peer review meeting. https://www.federalregister.gov/documents/2017/05/26/2017-10933/epas-proposed-modeling-approaches-for-a-health-based-benchmark-for-lead-in-drinking-water-final-list

[9] Walton, B. (2017) Trump proposal to fix U.S. water infrastructure invites large role for private investors. Circle of Blue. http://www.circleofblue.org/2017/water-management/trump-proposal-fix-u-s-water-infrastructure-invites-large-role-private-investors/

[10] University of North Carolina, Environmental Finance Center (2017). The financial impacts of alternative water project delivery models: A closer look at nine communities. https://efc.sog.unc.edu/reslib/item/financial-impacts-alternative-water-project-delivery-models-closer-look-nine-communities

Commission, the Missouri Legislature and the Missouri Governor's Office for consideration. Finally, it is OPC's hope that a byproduct of the pilot study may help substantiate selection of future "shovel ready" infrastructure funding from the federal government to help offset cost considerations.

III. PROPOSED LEAD LINE REPLACEMENT PILOT STUDY

Q. Please describe OPC's proposed pilot program?

A. The pilot study will involve five policy tracks with one final deliverable report synthesizing each tracks progress and results to date. The tracks include the following elements and considerations:

1. Advisory Committee

Invitations to relevant stakeholders to serve for feedback on the Lead Line Replacement Advisory Committee ("LLRAC") will be extended to the following entities:

a. Local and state elected/appointed leaders from St. Louis County
b. Missouri American Water
c. Missouri Public Service Commission
d. Missouri Office of the Public Counsel
e. Missouri Department of Natural Resources
f. Washington University; University of Missouri, St. Louis; and Saint Louis University
g. Missouri and St. Louis County Public Health
h. St. Louis County non-profit(s) representing at-risk communities
i. Other (real estate, hospitals, US EPA…)

Within fifty days of the Commission's order approving a pilot program, MAWC will issue a request for proposal to interested independent third-party consultants to serve as the LLRAC's facilitator and primary author of the pilot study's comprehensive analysis. Costs of said consultant shall not exceed 12.5% of the overall pilot study's cost. The consultant will design a survey and synthesize the results based on feedback from the LLRAC members,

industry best practices, and emerging regulatory changes. Additional topics for consideration include the following elements:

- Literature review of historic and current lead exposure sources (water, paint, toys, etc....) and explanation of health-related benchmark metrics (blood, parts-per-million, parts-per-billion);
- Current Lead and Copper Rule methodology and limitations;
- Explanation of sources of lead in water, "treatment to tap" and potential confounding variables for consideration in determining relative risk exposure;
- Case study: Flint, Michigan and Madison, Wisconsin;
- Cost estimate ranges (rate impact) and allocation considerations examining at a minimum, pricing that is: customer-specific compared to various subsidized rates including: system (district), zonal, single-tariff, and single-state specific as well as allocations that inter-rate class related;
- Cost collection should also be addressed with a range of potential options (e.g., flat fee, volumetric-based, other?).

The consultant will also be charged with synthesizing the results and recommendations from the other four tracks mentioned below for the final comprehensive pilot report.

2. Scoping Analysis

The LLRAC will designate a single entity to compile a public database of all known and estimated lead service lines within each water system in MAWC's footprint. And, if deemed appropriate, the estimated amount of lead service lines in other Missouri water systems. The single entity may be a member of the LLRAC (e.g., government agency, university, non-profit) or an independent third-party consultant. Funding opportunities should also explore the feasibility of implementing a geographic information system ("GIS")" database as a repository for historic, current, and planned infrastructure replacements and/or the results of system and site-specific testing of lead in water for public transparency and historical record keeping purposes.

The objective of the scoping analysis will center on providing accurate estimates of the size and status of lead service lines and on the feasibility of providing an open and transparent repository for all water system service line replacements and potentially lead water testing results moving forward. Legal and funding implications will also be explored and noted for the final comprehensive pilot study analysis. At a minimum MAWC will be charged with responding to the following questions:

- A description of how the replacement of customer owned lead service lines will be accomplished in conjunction with distribution system infrastructure replacement projects.
- The number of lead, copper, or galvanized mains and lead, copper, or galvanized service lines estimated to be part of each MAWC water system.
- A range for the number of customer owned lead, copper or galvanized service lines and total feet estimated to be replaced annually by each MAWC water system.
- A range for the total feet of lead or galvanized mains estimated to be replaced annually.
- MAWC's proposal for addressing the costs of unusual site restoration work necessitated by structures or improvements located above the customer owned portion of the lead service lines as well as excavation costs related to:
  - Permits, fees and inspections
  - Finished basements
  - Garbage days
  - Water and sewer service in same trench and potential
  - Fixture repairs
  - Large pipe or odd-fittings
  - Tree
  - Contaminated soil
  - Dust
  - Worker identification
  - Other

3. Testing and Planned Lead Service Line Replacement

MAWC will present a two-year planned lead-line replacement pilot proposal to the Commission and the LLRAC. The Company will be charged with the contractual

procurement of third-party contractors for the excavation and replacement of lead service lines to the extent that this service is not done by in-house personnel.

MAWC, with advice from the LLRAC, will solicit a contractor through a Request For Proposal ("RFP"), to provide independent testing and modeling verification of the link between lead service line replacements and lead abatement in water at the tap. In-state academic institutions will receive selection prioritization. The on-site tests may consider current practices enforced under the LCR as well as those methods outlined in the EPA's most recent "Lead in Drinking Water Modeling External Peer Review" which include variations on the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children.[11]

Testing should also consider on-site audits with an emphasis on internal plumbing and fixtures, stagnant water, changes in water pressure and temperature as well as lead contamination from external sources separate from the distribution system (e.g., lead paint). The results of the tests will be included in the final comprehensive analysis report. Additional health related testing and verification input from relevant Public Health agencies may be warranted.

4. Communications, Disclosure, and Implementation Considerations

The independent third-party consultant will be charged with soliciting and synthesizing feedback from LLRAC members either individually and/or in conjunction through working group meetings or workshops on the following policy considerations related to communications, disclosure, prioritization and implementation:

- Is a communication plan necessary? If yes, what elements should it contain?
- Who should be charged with providing the public information and deciding what is included (local, state, other)?

[11] US EPA (2017) Lead in Drinking Water Modeling External Peer Review: Draft Charge Questions. https://www.epa.gov/sites/production/files/2017-01/documents/lead_in_drinking_water_modeling_external_peer_review_charge_questions_final.pdf

- What are the real estate and legal implications of Missouri's Seller Disclosure Statement for properties with lead service lines?
- Is the utility obligated to inform homeowners of the presence of lead service lines? If yes, at what point?
- Should certain housing or commercial units be prioritized (e.g., day cares)? Or should lead service lines be replaced based on a first identified and first served basis in conjunction with main replacements?
- Should past partial lead service lines now be replaced in full? If yes, what priority should they receive?
- When and how should customers be notified that they have lead service lines?
- How will consent from homeowners be obtained?
- Should the estimated replacement schedule of the lead service line replacements be made public? In what form/medium?
- Should customers be notified of any and all infrastructure repairs that may disturb lead in the distribution system (e.g., road construction)?
- Should customers who have replaced their service lines at their own expense be reimbursed?
- Other considerations?

5. Ancillary Considerations

Finally, OPC recommends that the comprehensive report include potential ancillary considerations related to potential job creation as well as lead paint and soil abatement messaging or service offerings. The report and LLRAC should also explore available and potential funding streams and recommendations including:

- A review of existing funding streams at both the public and private level as well as potential anticipated funds as a result of being a potential "shovel-ready" project consideration for federal funds related to future infrastructure investment.

- The availability of grants or low interest loans and how the water utility plans to use available grants or low interest loans to help the water utility finance or reduce the cost of customer lead service line improvements for the water utility and the water utility's customers, including any arrangements for the customer to receive available grants or financing directly.

IV. CONCLUSION

Q. Should the Commission be aware of anything else?

A. Yes. It should not be forgotten that MAWC is presently in compliance with the EPA's Lead and Copper Rule. Furthermore, based on Staff's "Overview of lead in Missouri's drinking water" report to the Commission:

> All of the water utilities regulated by the Public Service Commission are subject to compliance with the Lead and Copper Rule, and are presently in compliance.[12]

Given the dynamic regulatory environment and uncertainty surrounding the Lead and Copper Rule Revisions, OPC strongly recommends that additional dialogue is both prudent and essential to ensure the best possible path in the prioritization of clean and safe water investments. A hard look at both the short and long-term opportunity costs and potential unintended consequences needs to be explored and OPC's proposed pilot study provides the framework in which that may occur.

Q. Does this conclude your testimony?

A. Yes.

[12] See GM-2.

CASE PARTICPATION OF
GEOFF MARKE, PH.D.

Company Name	Employed Agency	Case Number	Issues
Missouri American Water	Office of Public Counsel (OPC)	WU-2017-0296	**Direct:** Lead line replacement pilot program
KCP&L Greater Missouri Operations Company	OPC	EO-2017-0230	Comments on Integrated Resource Plan, preferred plan update
Working Case: Emerging Issues in Utility Regulation	OPC	EW-2017-0245	Comments on Emerging Issues in Utility Regulation / Presentation: Inclining Block Rate Design Considerations
Rule Making	OPC	EX-2016-0334	Missouri Energy Efficiency Investment Act Rule Revisions, Comments
Great Plains Energy Incorporated, Kansas City Power & Light Company, KCP&L Greater Missouri Operations Company, and Westar Energy, Inc.	OPC	EE-2017-0113 / EM-2017-0226	**Direct:** Employment within Missouri / Independent Third Party Management Audits / Corporate Social Responsibility
Union Electric Company d/b/a Ameren Missouri	OPC	ET-2016-0246	**Rebuttal:** EV Charging Station Policy **Surrebuttal:** EV Charging Station Policy
Kansas City Power & Light		ER-2016-0156	**Direct:** Consumer Disclaimer **Direct:** Response to Commission Directed Questions **Rebuttal:** Customer Experience / Greenwood Solar Facility / Dues and Donations / Electric Vehicle Charging Stations **Rebuttal:** Class Cost of Service / Rate Design **Surrebuttal:** Clean Charge Network / Economic Relief Pilot Program / EEI Dues / EPRI Dues
Union Electric Company d/b/a Ameren Missouri	OPC	ER-2016-0179	**Direct:** Consumer Disclaimer / Transparent Billing Practices / MEEIA Low-Income Exemption **Direct:** Rate Design **Rebuttal:** Low-Income Programs / Advertising / EEI Dues **Rebuttal:** Grid-Access Charge / Inclining Block Rates /Economic Development Riders
KCP&L Greater Missouri Operations Company	OPC	ER-2016-0156	**Direct:** Consumer Disclaimer **Rebuttal:** Regulatory Policy /

			Customer Experience / Historical & Projected Customer Usage / Rate Design / Low-Income Programs **Surrebuttal:** Rate Design / MEEIA Annualization / Customer Disclaimer / Greenwood Solar Facility / RESRAM / Low-Income Programs
Empire District Electric Company, Empire District Gas Company, Liberty Utilities (Central) Company, Liberty Sub-Corp.	OPC	EM-2016-0213	**Rebuttal:** Response to Merger Impact **Surrebuttal:** Resource Portfolio / Transition Plan
Working Case: Polices to Improve Electric Regulation	OPC	EW-2016-0313	Comments on Performance-Based and Formula Rate Design
Working Case: Electric Vehicle Charging Facilities	OPC	EW-2016-0123	Comments on Policy Considerations of EV stations in rate base
Empire District Electric Company	OPC	ER-2016-0023	**Rebuttal:** Rate Design, Demand-Side Management, Low-Income Weatherization **Surrebuttal:** Demand-Side Management, Low-Income Weatherization, Monthly Bill Average
Missouri American Water	OPC	WR-2015-0301	**Direct:** Consolidated Tariff Pricing / Rate Design Study **Rebuttal:** District Consolidation/Rate Design/Residential Usage/Decoupling **Rebuttal:** Demand-Side Management (DSM)/ Supply-Side Management (SSM) **Surrebuttal:** District Consolidation/Decoupling Mechanism/Residential Usage/SSM/DSM/Special Contracts
Working Case: Decoupling Mechanism	OPC	AW-2015-0282	**Memorandum:** Response to Comments
Rule Making	OPC	EW-2015-0105	Missouri Energy Efficiency Investment Act Rule Revisions, Comments
Union Electric Company d/b/a Ameren Missouri	OPC	EO-2015-0084	Triennial Integrated Resource Planning Comments
Union Electric Company d/b/a Ameren Missouri	OPC	EO-2015-0055	**Rebuttal:** Demand-Side Investment Mechanism / MEEIA Cycle II Application **Surrebuttal:** Potential Study / Overearnings / Program Design

			Supplemental Direct: Third-party mediator (Delphi Panel) / Performance Incentive **Supplemental Rebuttal:** Select Differences between Stipulations
The Empire District Electric Company	OPC	EO-2015-0042	Integrated Resource Planning: Special Contemporary Topics Comments
KCP&L Greater Missouri Operations Company	OPC	EO-2015-0041	Integrated Resource Planning: Special Contemporary Topics Comments
Kansas City Power & Light	OPC	EO-2015-0040	Integrated Resource Planning: Special Contemporary Topics Comments
Union Electric Company d/b/a Ameren Missouri	OPC	EO-2015-0039	Integrated Resource Planning: Special Contemporary Topics Comments
Union Electric Company d/b/a Ameren Missouri	OPC	EO-2015-0029	Ameren MEEIA Cycle I Prudence Review Comments
Kansas City Power & Light	OPC	ER-2014-0370	**Direct** (Revenue Requirement): Solar Rebates **Rebuttal:** Rate Design / Low-Income Weatherization / Solar Rebates **Surrebuttal:** Economic Considerations / Rate Design / Cyber Security Tracker
Rule Making	OPC	EX-2014-0352	Net Metering and Renewable Energy Standard Rule Revisions, Comments
The Empire District Electric Company	OPC	ER-2014-0351	**Rebuttal:** Rate Design/Energy Efficiency and Low-Income Considerations
Rule Making	OPC	AW-2014-0329	Utility Pay Stations and Loan Companies, Rule Drafting, Comments
Union Electric Company d/b/a Ameren Missouri	OPC	ER-2014-0258	**Direct:** Rate Design/Cost of Service Study/Economic Development Rider **Rebuttal:** Rate Design/ Cost of Service/ Low Income Considerations **Surrebuttal:** Rate Design/ Cost-of-Service/ Economic Development Rider
KCP&L Greater Missouri Operations Company	OPC	EO-2014-0189	**Rebuttal:** Sufficiency of Filing **Surrrebuttal:** Sufficiency of Filing
KCP&L Greater Missouri Operations Company	OPC	EO-2014-0151	Renewable Energy Standard Rate Adjustment Mechanism (RESRAM) Comments
Liberty Natural Gas	OPC	GR-2014-0152	**Surrebuttal:** Energy Efficiency
Summit Natural Gas	OPC	GR-2014-0086	**Rebuttal:** Energy Efficiency **Surrrebuttal:** Energy Efficiency
Union Electric Company d/b/a Ameren Missouri	OPC	ER-2012-0142	**Direct:** PY2013 EM&V results / Rebound Effect **Rebuttal:** PY2013 EM&V results **Surrebuttal:** PY2013 EM&V results **Direct:** Cycle I Performance Incentive

			Rebuttal: Cycle I Performance Incentive
Kansas City Power & Light	Missouri Public Service Commission Staff	EO-2014-0095	**Rebuttal:** MEEIA Cycle I Application testimony adopted
KCP&L Greater Missouri Operations Company	Missouri Division of Energy (DE)	EO-2014-0065	Integrated Resource Planning: Special Contemporary Topics Comments
Kansas City Power & Light	DE	EO-2014-0064	Integrated Resource Planning: Special Contemporary Topics Comments
The Empire District Electric Company	DE	EO-2014-0063	Integrated Resource Planning: Special Contemporary Topics Comments
Union Electric Company d/b/a Ameren Missouri	DE	EO-2014-0062	Integrated Resource Planning: Special Contemporary Topics Comments
The Empire District Electric Company	DE	EO-2013-0547	Triennial Integrated Resource Planning Comments
Working Case: State-Wide Advisory Collaborative	OPC	EW-2013-0519	Presentation: Does Better Information Lead to Better Choices? Evidence from Energy-Efficiency Labels
Independence-Missouri	OPC	Indy Energy Forum 2014	Presentation: Energy Efficiency
Independence-Missouri	OPC	Indy Energy Forum2015	Presentation: Rate Design
NARUC – 2017 Winter	OPC	Committee on Consumer Affairs	NARUC – 2017 Winter Presentation: PAYS Tariff On-Bill Financing
NASUCA – 2017 Summer	OPC	Committee on Water Regulation	NASUCA – 2017 Summer Presentation: Regulatory Issues Related to Lead-Line Replacement of Water Systems

Overview of lead in Missouri's drinking water[1]

April 2017

Historical Lead in Plumbing, Standards, Sampling and Testing:

The most common source of lead in water in the United States is from its extensive, historical use in household and commercial plumbing components.[2] These common plumbing components include, but are not limited to: lead pipe joints within a distribution system, lead service lines, lead in-structure plumbing, and in-structure leaded plumbing joints and fixtures. While standards over the past several decades have changed eliminating the majority of lead additives and alloys from plumbing, [3] any home built prior to the early 1990s is likely to have some levels of lead in its in-house plumbing.

Lead in plumbing can become a health threat when it dissolves into water, when water in contact with the leaded bare metal is "soft" and corrosive.[4] Fortunately, for Missouri, those circumstances are not common. Most water sources in Missouri are not naturally corrosive, and the majority of water sources in Missouri are "hard."[5]

The U.S. Environmental Protection Agency (EPA) is the governmental agency that establishes the "action level" allowed for lead and copper in public drinking water.[6] In the State of Missouri,

[1] This report largely focuses on PSC-regulated utilities, although some of the discussion is likely applicable to non-PSC-regulated entities.

[2] The use of lead in plumbing was extremely common throughout history due to the metal's chemical and physical properties, dating back to the Roman Empire. In Latin, the word for lead is "plumbum," and is the linguistic basis for the modern root "plumb."

[3] "Section 1417 of the Safe Drinking Water Act (SDWA) establishes the definition for "lead free" as a weighted average of 0.25% lead calculated across the wetted surfaces of a pipe, pipe fitting, plumbing fitting, and fixture and 0.2% lead for solder and flux. The Act also provides a methodology for calculating the weighted average of wetted surfaces.

The Act prohibits the "use of any pipe, any pipe or plumbing fitting or fixture, any solder, or any flux, after June 1986, in the installation or repair of (i) any public water system; or (ii) any plumbing in a residential or non-residential facility providing water for human consumption, that is not lead free."

https://www.epa.gov/dwstandardsregulations/use-lead-free-pipes-fittings-fixtures-solder-and-flux-drinking-water, Last accessed, April 13, 2017.

[4] "Soft" refers to the water's "hardness" or calcium and magnesium content. Corrosive means having a low pH level, or acidity.

[5] "Hardness" is a term for the concentration of calcium carbonate in milligrams per liter (mg/L) of water. Concentrations between 0 – 60 mg/L are "soft." Concentrations above 61 mg/L begin the range of "hard" water. https://water.usgs.gov/owq/hardness-alkalinity.html, Last accessed, April 13, 2017.

[6] See, 40 CFR 141.

the Missouri Department of Natural Resources (DNR) is the primary agency that implements and enforces the federal standards.[7]

In the Lead and Copper Rule promulgated by DNR in accordance with EPA's rule,[8] the "action level" for lead in drinking water is 15 parts per billion (ppb), or 15 micrograms per liter (ug/L), in more than 10% of samples taken.[9] Because the primary sources for lead is generally old plumbing within the customer's property, the EPA and DNR require that testing for lead must occur *at a customer's tap*.

To determine if there is a possible source of lead in a home, testing procedure requires that a sample be taken from a "first draw" at a representative tap. The "first draw" is the first flow of water out of an in-house tap after the water has not been used for a period of time, such as overnight. The selected sites are intended to include those that are *likely* to have lead components in building plumbing. There are other sample procedures for those sites that *have* lead service lines. If the drinking water lead level is found to be above the action level of 15 ppb in more than 10% of the samples taken, then certain procedures are to be followed to mitigate the health impact. Those procedures include, in any combination or all inclusively, modifications to water treatment, addition of corrosion control inhibitor chemical agents, a lead service line replacement program, and public education to address minimizing lead absorption.

If the lead level is determined to be less than the action level after a positive test, there are provisions to reduce monitoring. Testing of water samples taken from customer taps is the only sure way to positively determine if lead is present in drinking water. Once steps have been taken to eliminate the negative health impact, the water provider must periodically check levels at the customers tap.

The water provider must always be cognizant of the level of lead as determined by the terms of the Lead and Copper Rule based on samples and the corrosive characteristics of the treated water supplied to customers that could cause that water to absorb lead from the pipe and plumbing fixtures. Corrosive water absorbs lead from lead pipes, copper pipe with lead-soldered joints, and lead from older faucet fixtures. When the water provider is treating the water to combat corrosiveness, it must keep in mind that other undesirable or potentially damaging effects, albeit not health detriments, may occur.[10]

In practice, obtaining samples for lead evaluation is not simple, and requires extensive cooperation from homeowners. Generally, the homeowner takes the "first draw" samples by

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[7] Chapter 640 RSMo, "Missouri Safe Drinking Water Law." The author will hereinafter refer to the Missouri Safe Drinking Water Law standards.

[8] Title 10 Code of State Regulations, Section 60, Chapter 15

[9] The action level for copper is 1,300 ppb in more than 10% of samples taken.

[10] An example would be extreme scaling of calcium in the system.

following instructions from water system personnel and as outlined in the Lead and Copper Rule. This process must be repeated at the same house several times, at least six months or more apart.

The Lead and Copper Rule requires that if any significant changes are made to the water treatment process, or if there is a change in the source of supply, then the whole lead and copper testing and monitoring process must start all over again.

To the extent that water is somewhat corrosive and lead containing components exist in plumbing within homes, commercial buildings, schools, etc., water providers must institute public education measures. For example, when water is not used overnight, the water is in contact with lead components for a substantial amount of time and any lead absorption is maximized.[11] One form of consumer education would be to encourage customers to not drink first-draw water, but instead use the first-draw water for non-consumptive purposes, such as for toilet flushing or showering. This should clear the line of potential lead contamination so safe water may be used for drinking and cooking.

EPA is in the process of revising the federal lead and copper rules. Recommendations being considered include: removal of lead service lines, stronger public education, establishing a household action level, and separate requirements for copper. Though lead service lines are a clear hazard, in Staff's opinion, many water utilities do not know the location of and how many lead service lines are attached to their distribution system.

Missouri water utilities, both unregulated and regulated by the Public Service Commission:

In general, most of the small water systems in Missouri use noncorrosive "hard" ground water. Some of the larger systems use treated surface water, but they also have higher operational expertise than some of the small systems and have treatment and monitoring procedures in place to deliver noncorrosive water.

All of the water utilities regulated by the Public Service Commission are subject to compliance with the Lead and Copper Rule, and are presently in compliance. Staff reviewed system-specific information by primarily contacting DNR and reviewing drinking water quality data; however, Staff also contacted some larger PSC-regulated water utilities. DNR states that lead contamination is, in general, not a problem in Missouri, because utilities are following the Lead and Copper Rule and produce noncorrosive water. Further, Missouri provides laboratory testing, unlike some other states that require their utilities to do their own laboratory work or seek laboratory service. DNR also assists Missouri water providers by using the sample results to calculate lead levels in the manner as provided for in the Lead and Copper Rule.

Generally, traces of lead and/or copper show up in some samples for most water utilities. For a few small water systems, including one PSC-regulated system where lead content exceeds the

[11] Since lead absorption is maximized by lack of use overnight, first-draw samples at customer taps are necessary when sampling for lead content.

action level, the water providers are cooperating with DNR and following the Lead and Copper rule requirements. Two non-PSC regulated systems have copper levels that exceed the action level, but these systems are following the Lead and Copper rule requirements as well.

Details regarding some specific PSC-regulated water utility systems in Missouri:

Rogue Creek Utilities, Inc., a small regulated utility near Potosi, Missouri, and currently in receivership, is in an area of Missouri known as the "lead belt" where lead mining was historically prevalent. This water system has lead particulate in the source water. A utility-owned water softening system located at the well removes some of the lead, to a level that is below the action level. If the operator were to set the treatment level to remove more lead, it would result in additional softening of the water, thereby increasing the corrosiveness of the water. Missouri-American Water Company (MAWC) recently began operating the Rogue Creek water system and has fine-tuned the level and consistency of the water softening system, achieving lead removal results that are averaging less than half the lead action level.

MAWC owns both large systems and small systems of various ages throughout Missouri. Older portions of water systems in St. Louis County as well as some of MAWC's other municipal systems still have some lead water main joints. There are approximately 16,000 lead service lines in MAWC's St. Louis County service area, of which MAWC owns no part of those lines, and approximately another 14,000 lead service lines in the remainder of its service areas. For its systems where chemical water treatment is utilized, MAWC takes measures to be sure water is not corrosive. MAWC has lead and copper information on its website. It reports in its consumer confidence reports (CCR) that no individual samples are found to be above the action level for lead or for copper.

Middlefork Water Company is a regulated wholesale provider to three municipal utilities and two public water supply districts serving older communities in northwest Missouri. Because of the age of the communities, it is possible those systems could have lead issues in their distribution systems, and there may be lead issues in customers' homes. The individual utilities have the responsibility of sampling at customers' taps, but Middlefork Water Company takes measures to supply water with low corrosiveness to its wholesale customers.

Raytown Water Company indicates it has no lead in its distribution system; however, it does serve a municipal area in the Kansas City metropolitan area with older homes and commercial buildings so it is possible there may be lead in the their plumbing components. Raytown Water Company is responsible for working with its customers to lead sample. Raytown Water Company purchases all of its water from the City of Kansas City, which chemically treats surface water and takes measures to ensure its water is not corrosive.

Empire District Electric Company, now owned by Liberty, serves the towns of Aurora, Marionville and Mount Vernon in southwest Missouri. Empire utilizes hard well water, but the communities consist of older homes and buildings; therefore, it is possible they may contain lead

components. Empire indicated it is unaware of any lead pipelines in its system. Empire has cast iron water mains, some of which may or may not utilize lead for joint material. Empire states that it has no lead concerns in its system. Lead tests have been taken and reported in the CCR. The lead levels are reported to be between 1.16 and 3.95 in the Aurora/Verona system, and between 1.19 and 7.96 in the Marionville system, all of which are below the concentrations used to determine the Lead and Copper rule action level, and even though noncorrosive well water is used, it is assumed these lead levels may be attributed to corrosion of household plumbing systems.

Liberty Utilities, serving the City of Noel in southwest Missouri, utilizes hard well water, but the community consists of older homes and buildings so it is possible the building fixtures and plumbing joints may have some lead.

The remaining systems that the PSC regulates serve relatively small service territories with customer numbers under 1,000. Generally speaking, the risks to any of these systems would be in the customer-owned service line and the plumbing fixtures in the customer's homes since the systems are newer. Staff has reviewed the data the utilities provide to DNR, and it appears that these systems are currently in compliance with DNR rules and regulations regarding lead levels.