Exhibit No.: _____
Issue(s): Future Test Year/
Lead Service Line Replacement/
Affiliate Transaction
Rules (Water Utility)
Witness/Type of Exhibit: Marke/Direct
Sponsoring Party: Public Counsel
Case No.: WR-2017-0285

DIRECT TESTIMONY

OF

GEOFF MARKE

Submitted on Behalf of
The Office of the Public Counsel

MISSOURI-AMERICAN WATER COMPANY

CASE NO. WR-2017-0285

****** ******

Denotes Confidential Information
that has been redacted

November 30, 2017

Public Version

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of Missouri-American Water Company's Request for Authority to Implement General Rate Increase for Water and Sewer Service Provided in Missouri Service Areas.	))))	File No. WR-2017-0285

AFFIDAVIT OF GEOFF MARKE

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

Geoff Marke, of lawful age and being first duly sworn, deposes and states:

1. My name is Geoff Marke. I am a Regulatory Economist for the Office of the Public Counsel.

2. Attached hereto and made a part hereof for all purposes is my direct testimony.

3. I hereby swear and affirm that my statements contained in the attached testimony are true and correct to the best of my knowledge and belief.

Geoff Marke
Chief Economist

Subscribed and sworn to me this 30th day of November 2017.

NOTARY PUBLIC NOTARY SEAL STATE OF MISSOURI

JERENE A. BUCKMAN
My Commission Expires
August 23, 2021
Cole County
Commission #13754037

Jerene A. Buckman
Notary Public

My commission expires August 23, 2021.

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DIRECT TESTIMONY

OF

GEOFF MARKE

MISSOURI-AMERICAN WATER COMPANY

CASE NO. WR-2017-0285

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 Committees 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 provide OPC's policy position on the future test year and lead line replacements. Additionally, this testimony will provide a detailed explanation to the Commission for Public Counsel's request for the future inclusion of affiliate transaction rules for water utilities—including a future Commission-approved cost allocation manual.

II. FUTURE TEST YEAR

Q. Is MAWC seeking a future test year in this rate case?

A. Yes. On June 30, 2017 MAWC submitted tariff sheets initiating a general rate case. In its direct filing MAWC filed testimony in support of its proposed rate increase and a Motion to Establish Future Test Year. MAWC's Future Test Year Motion requests the Commission establish rates based on a future test year covering the period through May 31, 2019.

Q. Did the parties to this rate case submit a joint Response to Motion to Establish Future Test Year and Test Year Recommendation opposing MAWC's future test year request and recommend the Commission order a test year of the 12 months ending December 31, 2016, with a true-up of costs through December 2017?

A. Yes. All parties representing MAWC's customers opposed MAWC's request for a future test year in this rate case. The parties included Midwest Energy Consumers' Group; Missouri Industrial Energy Consumers; Office of the Public Counsel, City of Joplin; City of Jefferson City; City of Warrensburg; City of St. Joseph; City of Riverside; and the Consumers Council of Missouri.

Q. Did the Commission's Staff join the other customer parties to the case in opposing a future test year?

A. No. Staff did not support the position of the parties representing MAWC's customers. Instead, Staff submitted a *Response to Motion to Establish Future Test Year* ("Staff's Future Test Year Proposal") that included 4 separate recommendations on the test year. In its Future Test Year Proposal Staff suggested the Commission establish:

> 1. A test year "starting point" of the 12 months of actual historic data ending December 31, 2016.
> 2. MAWC be directed to update its case-in-chief to incorporate actual revenue and expense data through June 2017,
> 3. MAWC be required to true-up its case in chief through the period ending December 2017.

> 4. Finally, Staff suggests the parties be permitted to present for the Commission's consideration further discrete revenue, expense, and rate base adjustments based upon projected or forecasted data for the period after December 2017.

Q. Did MAWC make a filing with the Commission supporting Staff's Future Test Year Proposal?

A. Yes.

Q. How did the Commission respond to the Staff's Future Test Year Proposal?

A. In its August 9, 2017 *Order Regarding Test Year* the Commission stated that it will not make a decision on the appropriate test period without a complete record provided in this rate case provided through an evidentiary hearing. The Commission stated:

> A decision on the appropriate test period and adjustments to be used when establishing rates is a factual determination. *State ex rel. GTE North, Ins. V. Missouri Public Service Com'n*, 835 S.W.2d 356 (Mo. App.W.D.1992). Presently, only MAWC has submitted testimony. Without a complete record provided through an evidentiary hearing, there is insufficient evidence to establish whether a future test year or a historic test year should be utilized, or what that future test year would encompass. After reviewing the filings and arguments made by the various parties, the Commission concludes that Staff's suggestions will allow the parties to thoroughly present their positions, while not adversely impacting the case procedurally.

In its Order Regarding Test Year the Commission ordered:

> 1. The parties shall use a test year of the 12 months ending December 2016, with an update period of the six months ending June 2017, and a true-up period of the six months ending December 2017.
>
> 2. All parties shall use actual historic financial data for Missouri-American Water Company to present their positions based upon the periods set in Ordered Paragraph 1.
>
> 3. Parties may present further adjustments for the Commission's consideration based upon projected or forecasted data past December 2017. No party shall be precluded from opposing such adjustments.

Q. Does OPC support Staff's proposal that parties be permitted to present for the Commission's consideration future discrete revenue, expense, and rate base adjustments based upon projected or forecasted data for the period after December 2017?

A. No.

Q. Has any utility in Missouri proposed a method of accounting and ratemaking that is not based on historical cost test year?

A. Not that I am aware of. While Missouri utilities may have suggested an indirect use of a future test year, and proposed recovery of certain estimated future costs, no Missouri utility to my knowledge has proposed a future test year in a rate case. Moreover, no utility has articulated how a future test year would be superior to the Commission's historical cost test year methodology which relies heavily on the ratemaking matching principle to create rates that are fair and reasonable.

Q. Why does OPC oppose the use of a future test year?

A. OPC's opposition is based on several factors, all of which are centered on the ratemaking principles adopted by the Missouri Commission and the Missouri courts that were designed to protect captive customers and ensure utility rates are set at a level no more than necessary to provide safe and adequate service at a just and reasonable price. These factors, or principles, including the prohibition of single-issue ratemaking, the Commission's rate case matching principle, the Commission's known and measurable standard provide the basis for OPC's position.

Q. Do all of OPC's concerns apply equally to the Staff's proposed future test year of including isolated post-true up revenue requirement adjustments and any other form of a future test year?

A. Yes.

Commission's Rejection of Single Issue Ratemaking

Q. Describe what is meant by single-issue ratemaking.

A. Single-issue ratemaking involves "singling out" certain expenses, or revenue requirement components, from a company's overall cost of service and allowing a utility to recover those single specific costs from ratepayers separately, while ignoring all other factors necessary to determine fair and reasonable rates charged to ratepayers.

The primary means of recovery of expenses under single-issue ratemaking, at least in Missouri, are customer surcharges including: the Infrastructure System Replacement Surcharge ("ISRS"), the utility fuel adjustment clause ("FAC"), the environmental cost adjustment mechanism ("ECAM"), the Missouri Energy Efficiency Investment Mechanism ("MEEIA"), and the renewable energy standard rate adjustment mechanism ("RESRAM").

All of these single-issue ratemaking mechanisms insulate utility shareholders from regulatory lag. Conversely, they also prevent ratepayers from experiencing the benefit of decreases in other utility costs (non-ISRS costs, non-fuel costs, etc…) that may have occurred during the period. In that sense, Missouri utility rates are largely based on the single issue of ISRS related costs for gas and water utilities, and fuel and purchased power costs for electric utilities, if the utility has an approved mechanism.

Q. Have Missouri Courts addressed the issue of single-issue ratemaking?

A. Yes. For just one recent example, In a January 15, 2012 Opinion in Case No. WD74676, ("Opinion WD74676") the Missouri Court of Appeals Western District describes how single-issue ratemaking is generally prohibited in Missouri due to its inherent potential for inequitable ratemaking actions by the Commission:

> In reliance upon § 393.270.4, Missouri courts have traditionally held that the Commission's "determination of the proper rate for [utilities] is to be based on all relevant factors rather than on consideration of just a single factor." ***Midwest Gas Users'***, 976 S.W.2d at 479.

> Thus, when a utility's rate is adjusted on the basis of a single factor, without consideration of all relevant factors, it is known as single-issue ratemaking. *See* ***id.***
>
> Single-issue ratemaking is generally prohibited in Missouri "because it might cause the [Commission] to allow [a] company to raise rates to cover increased costs in one area without realizing that there were counterbalancing savings in another area."

Q. How would Staff's Future Test Year Proposal result in single-issue ratemaking?

A. Simply put, it would cause the Commission to set rates based on certain isolated adjustments and forecasts of expenses to the exclusion of all others. In addition to being single-issue ratemaking, such a proposal abandons the known and measurable standard, instead relying on predictions of expenses or revenues that may or may not ever be realized.

Q. The Commission ordered that all parties, including the parties that represent MAWC's customers, can propose post-true up isolated rate case adjustments. Doesn't this eliminate any single-issue ratemaking concerns?

A. No. A regulators credibility is inevitably challenged by the inherent asymmetric information hurdles innate to the ratemaking process. Post-true up isolated rate case adjustments on future expenses exacerbates this unfortunate bias. MAWC owns and control all information about its current and future costs. The Company has as long as it feels necessary to prepare and request rate increases. Conversely, intervening parties are largely thrust into a reactive role which necessitates a discovery process that is dependent on asking and receiving competent information from the Company in a timely manner. Unless a party to the case asks the "correct" data request about a specific future cost decrease, *and* MAWC is responsive to that data request, there is minimal opportunity for a party such as OPC to obtain knowledge of that potential cost decrease.

The best way to evaluate how all of the Company's expenses and revenues interact and counterbalance each other is by looking at the known and measureable data from a historical test year.

Commission's Matching Principle

Q. What is the matching principle?

A. The fundamental principle in determining rates is the matching principle. Unless there is a matching of costs and revenues, the test year is not a proper one for fixing just and reasonable rates. A rate case test year is used to ensure a matching of rate base investment, utility revenues and utility expenses. If rate base, revenues and/or expenses are mismatched in the rate-setting process, the resulting rates will either over or under recover costs, causing rates to be unjust and unreasonable. This "reasonableness" of rates is what is at risk here if the Commission abandons its longstanding rate case matching principle.

Q. Did the Commission recently describe the importance of its matching principle?

A. Yes. In the Findings of Fact section of its September 2, 2015 Report and Order in Case No. ER-2014-0370, Kansas City Power & Light Company ("KCPL"), The Commission described its understanding of the importance of the matching principle:

> 114. In Missouri, rates are usually established based upon a historical test year where the company's expenses and the rate base necessary to produce the revenue requirement are synchronized. The deferral of costs from a prior period results in costs associated with the production of revenues in one period being charged against the revenues in a different period, which violates the "matching principle" required by Generally Accepted Accounting Principles (GAAP) and the Uniform System of Accounts approved by the Commission. The matching principle is a fundamental concept of accrual basis accounting, which provides that in measuring net income for an accounting period, the costs incurred in that period should be matched against the revenue generated in the same period. Such matching creates consistency in income statements and balance sheets by preventing distortions of financial statements which present an unfair representation of the financial position of the business. One type of deferral accounting, a "tracker", has the effect of either increasing or decreasing a utility's earnings for a prior period by increasing or decreasing revenues in future periods, which violates the matching principle.
>
> 115. A tracker is a rate mechanism under which the amount of a particular cost of service item actually incurred by a utility is tracked and compared to the amount of that item currently included in a utility's rate levels. Any over-recovery or under-

> recovery of the item in rates compared to the actual expenditures made by a utility is then booked to a regulatory asset or liability account and would be eligible to be included in the utility's rates in its next general rate proceeding through an amortization to expense.[170]
>
> 116. The broad use of trackers should be limited because they violate the matching principle, tend to unreasonably skew ratemaking results, and dull the incentives a utility has to operate efficiently and productively under the rate regulation approach employed in Missouri.

Q. Was this Commission policy on the matching principle recognized by the courts?

A. Yes. The Missouri Court of Appeals Opinion filed on September 6, 2016 in Case No. WD79125 Consolidated with WD79143 and WD79189, the Court recognized:

> The PSC has decided that the "use of trackers should be limited because they violate the matching principle, tend to unreasonably skew ratemaking results, and dull the incentives a utility has to operate efficiently and productively under the rate regulation approach employed in Missouri."

Commission's Known and Measurable Standard

Q. What is the known and measurable standard?

A. This Commission rate case standard requires a rate case component (revenue, expense, gain or loss) to be known to have occurred and be able to be measured with a high degree of accuracy.

Q. Are forecasted future costs or expenses capable of meeting this longstanding Commission rate case standard?

A. No.

Q. Has the Staff defined the known and measurable standard in previous rate case testimony?

A. Yes. The Staff defined this standard in Case No. ER-2001-299. This is the standard that the Staff and the Commission have used for many years:

Q. What does the term "known and measurable" mean?

A. A "known and measurable" expense is an expense that is 1) "known," meaning that the amount did or definitely will be an actually incurred cost and 2) "measurable," meaning that the rate impact of the change (for example, property tax expense) can be calculated with a high degree of accuracy. The significance of this term is that historically the Commission has only reflected in rates those revenue requirement changes that were known and measurable at the time the rate decision was made.[1]

Q. Has the Commission defined and described its known and measurable standard?

A. Yes. In Case No. WR-2000-844, St. Louis County Water Company, the Commission ruled:

> The Commission traditionally, and properly, allows recovery of cost increases that are projected to occur after the end of the test year (including any adjustment periods) only if those costs are known and measurable. A cost increase is "known" if it is certain to occur, and it is "measurable" if the Commission is able to determine the amount of the increase with reasonable precision. The Company's projected property tax increases are neither known nor measurable. …Because any increase in the Company's property tax expense is not known and measurable, the Commission will not adopt the Company's proposal.

Q. Please summarize OPC's position on a future test year.

A. The use of a historic test year, as well as the update of financial information through a true-up, allows the Commission to measure and match MAWC's revenues, costs, rate base and rate of return all as of the same date. This is the essence of the matching principle. Importantly, since all of these financial items are capable of being measured with certainty, there are no concerns that forecasted future rate base additions have not been made. This is important for several reasons but also because it maintains the integrity of the Commission's "known and measurable" standard. As such, the historic test year and adherence to the matching principle and the known and measurable standard are not only entirely consistent, but the historic test year is entirely needed to maintain this basis of Commission ratemaking in Missouri.

[1] ER-2001-299 True-Up Surrebuttal Testimony Roy M. Boltz, Jr page 6, 4-10.

There is no doubt that the use of a future test year would be a major departure from past Commission practice. In addition, the resultant abandonment of the matching principle and known and measurable standard, as well as the acceptance of another form of single-issue ratemaking, would be a "major" change in the Commission's approach to utility ratemaking. To justify such a departure, there must be a serious need. There is not. Or at least, MAWC has not demonstrated such a need.

In its *Report Regarding Policies to Improve Electric Utility Regulation*, Case No. EW-2016-0313, issued December 6, 2016, page 4, the Commission considered potential ratemaking changes and concluded "Missouri's current regulatory structure has functioned very effectively for over a century, and there is no need for a massive, radical overhaul." OPC believes the use of a future test year would be a major change and would be contrary to the conclusions that the Commission reached in its legislative workshop report less than one year ago. OPC believes the Commission is capable of establishing just and reasonable rates through a historical test year. The continued reliance on a historical test year will not only lead to just and reasonable rates, it would also preserve the numerous safeguards designed to protect Missouri ratepayers.

III. CUSTOMER-OWNED LEAD SERVICE LINE REPLACEMENT

Q. What is Public Counsel's position on the company's customer-owned lead service line replacement program?

A. The Company's program is flawed from a legal perspective, a policy perspective, and an accounting perspective. The company began replacing customer-owned service lines in January 2017. Importantly, it began doing so without demonstrating whether its program was legal, without demonstrating its program was necessary, and without providing any cost-benefit study. As the Commission is aware, MAWC sought an accounting authority order permitting it to defer certain costs related to its program. In this rate case, the Company seeks 1) to recover the costs deferred; and 2) to be able to record future costs of

its program in a Company plant account. While considering the company's request, the Commission must consider and make findings about the legal and many policy issues associated with the program.

Q. What are the legal questions about the Company's program?

A. While I am not an attorney, Public Counsel raised certain legal issues in the context of the company's AAO application, WU-2017-0296. To summarize broadly, OPC raised two questions: 1) whether the company is authorized to replace customer-owned service lines and 2) whether the company is violating its Commission-approved tariff. The company's rate case testimony does not address either question.

Q. What are the policy questions about the Company's program?

A. My direct (see GM-2), rebuttal (see GM-3) and surrebuttal testimony (see GM-4) in WU-2017-0296 speak to the many unanswered questions that surround this program as well as the potential unintended consequences that could result from the Company's current haphazard approach. Conversely, my three rounds of testimony offered a reasonable and comprehensive alternative path forward. As of the time of this writing, the Commission has not issued a Report and Order regarding OPC's proposed pilot project. As such, OPC reserves the right to respond accordingly in rebuttal testimony regarding policy considerations in light of those forthcoming orders. Additionally, I will address any cost allocation considerations stemming from the order in my direct rate design testimony if need be.

Q. Are there any immediate issues that concern OPC?

A. Yes. The most immediate would be if the Commission's Report and Order remains silent on the policy and legal implications raised by Public Counsel. As such, OPC is unsure how this issue will be handled within the context of the upcoming public hearings and accompanying rate case notice.

IV. AFFILATE TRANSACTION RULES (WATER UTILITY)

Q. What is the purpose of the Commission's Affiliate Transaction Rule?

A. To protect captive ratepayers and the public at large from monopolistic abuse. The rules are designed to prevent a regulated utility from subsidizing its nonregulated operations. The rules, coupled with effective enforcement, should provide the public with assurance that utility rates are not adversely impacted by the utilities' nonregulated activities (and vice versa).

Q. Are Missouri ratepayers afforded the same level of regulatory assurance for each of its electric, gas and water utilities?

A. No. There is no Commission Affiliate Transaction Rule for water utilities. Affiliate transaction rules only presently exist for electric and gas utilities in Missouri.

Q. Why?

A. It is my understanding that the impetus for the affiliate transaction rules originated as a regulatory necessity for the evolving telecom industry. It also made practical sense to extend those same protections for ratepayers to both electric and gas utilities as their respective markets evolved and services expanded. Water, in contrast, had historically been a much more local and less complex regulatory service.

Q. What has changed?

A. American Water has changed that narrative.

Q. Please explain.

A. In what has historically been a service dominated by municipal systems or small, local water utilities, American Water Works aggressive acquisitions, system expansion and increasing investment in market-based non-regulated services makes it a textbook example of a utility the Commission's Affiliate Transaction Rules had in mind when they were drafted. Consider

the sheer size and many affiliates under the American Water umbrella as generalized in the Company's "About Us" section of its home webpage:

> Clean, safe, reliable, and affordable water services is our business. Founded in 1886, we (New York Stock Exchange: AWK) are the largest and most geographically diverse, publicly traded U.S. water and wastewater utility company.
>
> With headquarters in Voorhees, New Jersey, we employ 6,700 dedicated professionals who provide regulated and market-based drinking water, wastewater services and other related services to an estimated 15 million people in 47 states and in Ontario, Canada.[2]

Simply put, there is no regulated utility in the United States like the American Water Works and the lack of Commission oversight regarding Missouri American Water and its affiliate transactions is both disconcerting and regrettably long overdue.

Q. Could you provide an illustrative example of concern?

A. Again, from the American Water's homepage under Industry & Homeowner Solutions:

> Homeowner Services >
>
> **<u>Many homeowners are not aware that they are legally responsible for the portion of the water and sewer service lines that extend through their property</u>** and that repair to these lines are typically not covered by homeowners insurance. For over fourteen years American Water Resources (AWR) has offered water utility services by protecting homeowners, just like you, against unexpected home repair costs. Through our affordable Protection Programs, hundreds of thousands of homeowners have peace of mind knowing they will receive prompt, courteous, qualified service from a trusted company. AWR helps protect what most homeowners' insurance policies don't, with the claim forms.[3] (emphasis added)

Figure 1 provides a visual snapshot of the American Water: Water Line Protection Program video currently on its website.

[2] American Water Works Company, Inc. (2017) We Keep Life Flowing: https://amwater.com/corp/
[3] Ibid.

Figure 1: Non-regulated water service line protection program[4]

Additional non-regulated services and products include:

- Sewer Line Protection
- In Home Plumbing Emergency Program
- Electric Line Protection
- Power Surge Protection
- Heating System Repair
- Cooling System Repair

[4] American Water Resources: Avoid costly repairs due to a water line break. (2017) https://awrusa.com/products-services-water-line-protection

Q. Does this type of service pose concerns as it relates to lead service line removal on customer premises?

A. Yes. Service line insurance from a non-regulated affiliate raises yet another concern/question to the growing list of uncertainties surrounding full lead service line replacement.

Q. Does MAWC have a cost allocation manual ("CAM")?

A. Yes, in part. However, it is not a Commission-approved CAM. Because there are no affiliate transaction rules in place for a water utility, MAWC's CAM lacks any enforceable standards and thus provides minimal protection. Regulators and advocates thus operate at a considerable informational disadvantage in ensuring a transparent and appropriate cost allocations.

Q. Can you provide an example of a cost allocation concern that could be alleviated by a Commission-approved CAM?

A. Yes. American Water Works Company's allocation of its BT System costs to its regulated subsidiaries and not to its nonregulated "Market-Based Business" operations provides one illustrative example of potential improper subsidization.

Q. What is your recommendation?

A. OPC recommends that the Commission consider opening a rulemaking to establish affiliate transaction rules for water utilities. The present affiliate transaction rules for both electric and gas utilities serve as an appropriate framework from which to expeditiously be promulgated and submitted. As it relates to this case, OPC recommends that the Commission order MAWC to create a new CAM guided by existing standards for other regulated utilities and informed by stakeholder input. The Commission should order MAWC to file a proposed CAM for Commission approval within six months of the date of its Report and Order in this rate case.

Q. Does this conclude your testimony?

A. Yes.

CASE PARTICPATION OF
GEOFF MARKE, PH.D.

Company Name	Employed Agency	Case Number	Issues
Missouri American Water	Office of Public Counsel (OPC)	WR-2017-0285	**Direct:** Future Test Year/ Cost Allocation Manual and Affiliate Transaction Rules for Large Water Utilities / Lead line replacement
Missouri Gas Energy /Laclede Gas Company aka Spire	OPC	GR-2017-0216 / GR-2017-0215	**Rebuttal:** Decoupling / Rate Design / Customer Confidentiality / Line Extension in Unserved and Underserved Areas / Economic Development Rider & Special Contracts **Surrebuttal:** Pay for performance / Alagasco & EnergySouth Savings / Decoupling / Energy Efficiency / Economic Development Rider: CHP
Indian Hills Utility	OPC	WR-2017-0259	**Direct:** Rate Design
Rule Making	OPC	EW-2018-0078	Comments on cogeneration and net metering
Empire District Electric Company	OPC	EO-2018-0048	Integrated Resource Planning: Special Contemporary Topics Comments
Kansas City Power & Light	OPC	EO-2018-0046	Integrated Resource Planning: Special Contemporary Topics Comments
KCP&L Greater Missouri Operations Company	OPC	EO-2018-0045	Integrated Resource Planning: Special Contemporary Topics Comments
Missouri American Water	OPC	WU-2017-0296	**Direct:** Lead line replacement pilot program **Rebuttal:** Lead line replacement pilot program **Surrebuttal:** 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 / **Presentation**: Missouri Integrated Resource Planning: And the search for the "preferred" plan

Rule Making	OPC	EX-2016-0334	Comments on Missouri Energy Efficiency Investment Act Rule Revisions
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,	OPC	EM-2016-0213	**Rebuttal:** Response to Merger Impact **Surrebuttal:** Resource Portfolio / Transition Plan

Liberty Utilities (Central) Company, Liberty Sub-Corp.			
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 **Surrebuttal:** 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 **Surrebuttal:** 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
2014 Governor's Conference on Economic Development	OPC	Missouri's Energy Future	Presentation: Energy Efficiency: Residential Ratepayers perspective
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
NASUCA – 2017 Winter	OPC	Committee on Accounting	NASUCA – 2017 Winter Presentation: Accounting, Cost Allocation and Acquisition Implications related to Lead-Line Replacement of Water Systems
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

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

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Missouri-American Water Company for an Accounting Order Concerning MAWC's Lead Service Line Replacement Program	)))))	File No. WU-2017-0296

AFFIDAVIT OF GEOFF MARKE

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

Geoff Marke, of lawful age and being first duly sworn, deposes and states:

1. My name is Geoff Marke. I am a Regulatory Economist for the Office of the Public Counsel.

2. Attached hereto and made a part hereof for all purposes is my direct testimony.

3. I hereby swear and affirm that my statements contained in the attached testimony are true and correct to the best of my knowledge and belief.

Geoff Marke
Chief Economist

Subscribed and sworn to me this 1st day of August 2017.

NOTARY PUBLIC NOTARY SEAL STATE OF MISSOURI

JERENE A. BUCKMAN
My Commission Expires
August 23, 2017
Cole County
Commission #13754037

Jerene A. Buckman
Notary Public

My commission expires August 23, 2017.

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DIRECT TESTIMONY

OF

GEOFF MARKE

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
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			Rebuttal: Cycle I Performance Incentive
Kansas City Power & Light	Missouri Public Service Commission Staff	EO-2014-0095	**Rebuttal:** MEEIA Cycle I Application testimony adopted
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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

[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.

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

REBUTTAL TESTIMONY

OF

GEOFF MARKE

Submitted on Behalf of the Office of the Public Counsel

MISSOURI-AMERICAN WATER COMPANY

CASE NO. WU-2017-0296

August 23, 2017

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Missouri-American Water Company for an Accounting Order Concerning MAWC's Lead Service Line Replacement Program	)))))	File No. WU-2017-0296

AFFIDAVIT OF GEOFF MARKE

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

Geoff Marke, of lawful age and being first duly sworn, deposes and states:

1. My name is Geoff Marke. I am a Regulatory Economist for the Office of the Public Counsel.

2. Attached hereto and made a part hereof for all purposes is my rebuttal testimony.

3. I hereby swear and affirm that my statements contained in the attached testimony are true and correct to the best of my knowledge and belief.

Geoff Marke
Chief Economist

Subscribed and sworn to me this 23rd day of August 2017.

NOTARY PUBLIC NOTARY SEAL STATE OF MISSOURI

JERENE A. BUCKMAN
My Commission Expires
August 23, 2017
Cole County
Commission #13754037

Jerene A. Buckman
Notary Public

My commission expires August 23, 2017.

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REBUTTAL TESTIMONY

OF

GEOFF MARKE

MISSOURI-AMERICAN WATER COMPANY

CASE NO. WU-2017-0296

I. INTRODUCTION

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

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

Q. Are you the same Dr. Marke that filed direct testimony in WU-2017-0296?

A. Yes.

Q. What is the purpose of your rebuttal testimony?

A. The purpose of this testimony is to respond to direct testimony regarding:

- Overview of lead and federal lead regulation
  - Missouri American Water Company ("MAWC" or the Company) witness Gary A. Naumick
- MAWC's lead line replacement proposal
  - MAWC witness Bruce W. Aiton, Brian LaGrand and Gary A. Naumick

Q. Please state OPC's position.

A. OPC continues to recommend 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 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.

The issue of lead line replacements cuts across public health, scientific, technical, and legal arenas and should not be viewed as a linear engineering exercise alone. Given the complexities, uncertainties, and costs in ensuring safe drinking water, it is important that necessary planning and dialogue among stakeholders occurs both before and during a program of this kind. OPC recognizes that in this instance, imperfect knowledge should not be an excuse for inaction, but we are also acutely cognizant that eradicating lead within a water distribution system must be grounded in evidence-based research with recognition of the interdependent challenges that are necessarily created. OPC's proposed pilot study from its direct testimony provides the framework to facilitate the substantive research, planning and communication to mitigate known risks and to anticipate and plan for the otherwise unintended consequences that are undoubtedly linked to this complex, decade(s)-long policy reform.

II. OVERVIEW OF LEAD AND FEDERAL LEAD REGULATION

Q. Do you agree with Mr. Naumick's overview of lead hazards?

A. In part. Context matters when considering interventions and informing substantive policy directives; and though I have no reason to doubt his specific factual statements, I do not believe his overview provides the appropriate context for informing the Commission of the likely sources of lead hazards nor of the historical drop in detected blood lead levels ("BLLs") as a result of lead prevention policies to date.

Q. What should the Commission know about lead?

A. In its raw form, lead is one of the softest, most versatile metals found on earth and been utilized in a variety of commercial products and processes. Lead is also a designated

pollutant regulated by many laws administered by EPA, including the Toxic Substances Control Act (TSCA), Residential Lead-Based Paint Hazard Reduction Act of 1992 (Title X), Clean Air Act (CAA), Clean Water Act (CWA), Safe Drinking Water Act (SDWA), Resource Conservation and Recovery Act (RCRA), and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) among others.

There is a voluminous amount of research substantiating the link between the deleterious effects of high BLLs and human health including impairments to brain,[1] kidneys,[2] cardiovascular system,[3] and the blood[4] being some of the most susceptible to breakdown from high dosage or prolonged lead exposure. Children, pregnant mothers, international adoptees and refugees in particular have all been classified as "at-risk" populations by the Centers for Disease Control. ("CDC")[5]

Health-related concerns from lead exposure are not new; there are even documented instances of lead-linked-health-impairments associated with the use of lead service lines that date over two-thousand years ago. For example, the Roman author/architect Marcus Vitruvius Pollio ("Vitruvius") noted in his seminal work, *De architectura* (estimated to be written between 30 and 15 BC) that:

> "Water conducted through earthen pipes is more wholesome than that through lead; indeed that conveyed in lead must be injurious, because from it white lead [PbCO3, lead carbonate] is obtained, and this is said to be injurious to the human system. Hence, if what is generated from it is pernicious, there can be no doubt

[1] Mazumadr. M. et. al (2011) Low-level environmental lead exposure in childhood and adult intellectual function: a follow-up study. *Environmental Health*. 10.24. https://ehjournal.biomedcentral.com/track/pdf/10.1186/1476-069X-10-24?site=ehjournal.biomedcentral.com

[2] Payton, M., Payton, M., Hu, H., Hu, H., Sparrow, D., et al., 1994. Low-level lead exposure and renal function in the normative aging study. *American Journal of Epidemiology*. 140 (9), 821–829. https://academic.oup.com/aje/article-abstract/140/9/821/76785/Low-level-Lead-Exposure-and-Renal-Function-in-the

[3] Hu, H., Aro, A., Payton, M., Korrick, S., Sparrow, D., et al., 1996. The relationship of bone and blood lead to hypertension: the normative aging study. *JAMA* 275 (15): 1171–1176. http://dx.doi.org/10.1001/jama.1996.03530390037031.

[4] Roels, H., Lauwerys, R., 1987. Evaluation of dose-effect and dose-response relationships for lead exposure in different Belgian population groups (fetus, child, adult men and women). *Trace Elements in Medicine*. 4 (2), 80–87. https://dial.uclouvain.be/pr/boreal/object/boreal:53768

[5] CDC (2015) Lead: At-Risk Populations. https://www.cdc.gov/nceh/lead/tips/populations.htm

> that itself cannot be a wholesome body. This may be verified by observing the workers in lead, who are of a pallid colour; for in casting lead, the fumes from it fixing on the different members, and daily burning them, destroy the vigour of the blood; water should therefore on no account be conducted in leaden pipes if we are desirous that it should be wholesome." (VIII.6.10-11)[6]

This sentiment was ultimately abandoned. In fact, as late as 1917, most engineers believed the benefits of using lead mains outweighed the potential costs. The New England Water Works Association argued:

> The most serious objection to the use of lead pipe for services is the possibility that the water may dissolve enough lead from the pipe to cause lead poisoning. It is certain that many cases of lead poisoning have been caused by the use of lead services. On the other hand, lead has always been used for services in most of the large places without any unfavorable effects.[7]

In the United States, by the 1920s, lead was an essential part of the middle-class home. Lead was used in: telephones, ice boxes, vacuums, irons, and washing machines; dolls, painted toys, bean bags, baseballs, and fishing lures. [8] It would be the inclusion of lead in gasoline, paint, and pipes, the building blocks of urbanization and a growing housing stock that would have largest health impact. That legacy remains, in part, with us today. The US Department of Health and Human Services ("HHS") has estimated that

[6] *Vitruvius: Ten Books on Architecture* (2001) edited by Ingrid D. Rowland and Thomas Noble Howe qtd. From Lead Poisoning and Rome. http://penelope.uchicago.edu/~grout/encyclopaedia_romana/wine/leadpoisoning.html

[7] Journal of the New England Water Works Association (1917). 31, 1 March 1917 https://books.google.com/books?id=sGAZAQAAIAAJ&pg=PR1&dqJournal+of+the+New+England+Water+Works+1917+March+Volume+31+%60&hl=en&sa=X&ved=0ahUKEwiZkLT98LPVAhUp2IMKHex_C4IQ6AEIKTAA#v=onepage&q=Journal%20of%20the%20New%20England%20Water%20Works%201917%20March%20Volume%2031%20%60&f=false

[8] Bliss, L. (2016) An American history of lead poisoning. *The Atlantic*. https://www.theatlantic.com/health/archive/2016/02/an-american-history-of-lead-poisoning/462576/

environmental lead levels have increased >1000 fold over the last 300 years due largely to human activities, with the greatest increase occurring between 1950 and 2000.[9]

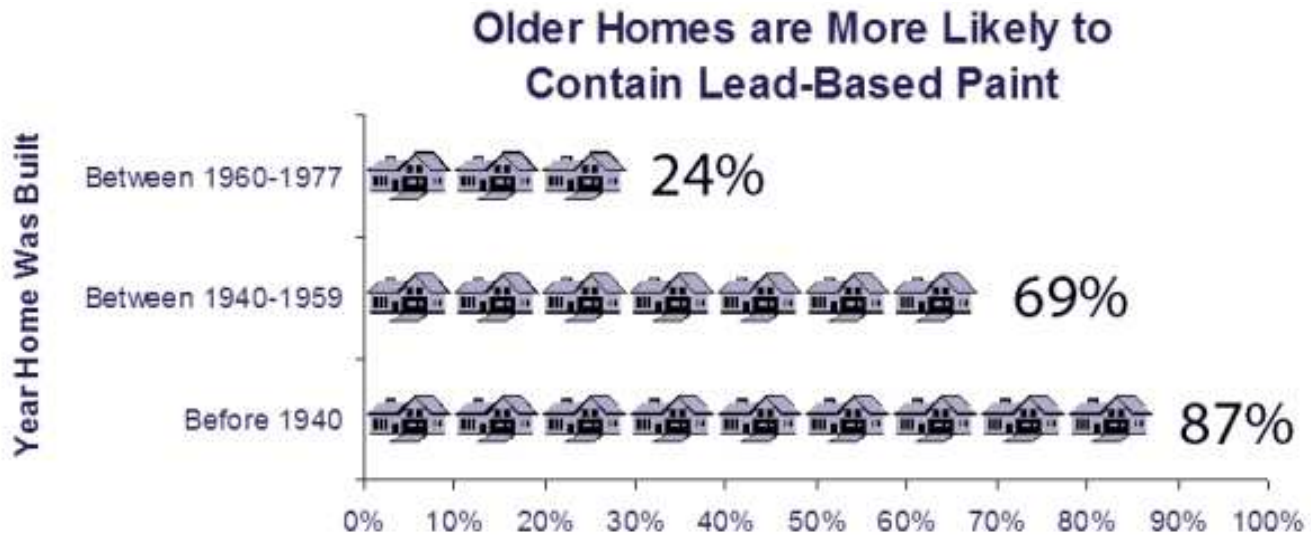
Q. What has been the primary source of lead exposure in the United States?

A. Engine exhaust. Before it was banned, fuel exhaust from the use of tetraethyl lead and tetra methyl lead, as gasoline additives to increase octane rating, resulted in the largest concentrations of lead released into the U.S. environment. In 1979, cars released 94.6 million kilograms (208.1 million pounds) of lead into the air in the United States. In 1989, when the use of lead was limited but not banned, cars released only 2.2 million kg (4.8 million pounds) to the air.[10] Leaded gasoline was phased out in the United States in the 1980s, and lead was banned for use in gasoline for motor vehicles beginning January 1, 1996. However, it is still used in a number of developing countries.[11]

Today, the most common hazardous source of lead exposure for most U.S. citizens is in the form of lead-contaminated dust from deteriorated lead-based paint largely found in older homes as estimated in Figure 2.

[9] United States Agency for Toxic Substances and Disease Registry, (2007). Toxicological Profile for Lead. U.S. Dept. of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Atlanta, Ga Retrieved from: https://www.atsdr.cdc.gov/toxprofiles/tp13.pdf.
[10] Ibid.
[11] Ibid.

Figure 2: EPA estimates of lead-based paint based on year of homes construction[12]



Concern centering on lead-based paint are especially relevant for Missouri citizens. According to the Missouri Department of Health and Senior Services ("MO DHSS"), the primary lead hazard to children in Missouri is deteriorated lead-based paint.[13] Although lead-based paint was banned for residential use nationwide in 1978, according to MO DHSS, more than 21 percent of the current housing stock in Missouri was built before 1950. Not surprisingly, the concentration of old housing stock varies considerably between both zip codes and counties as shown in Figure 3 and Figure 4.

[12] US EPA (2017) Protecting your family from exposures to lead. https://www.epa.gov/lead/protect-your-family-exposures-lead

[13] Missouri Department of Health and Senior Services (2016) Missouri Childhood Lead Poisoning prevention program. Annual Report for Fiscal Year 2015. http://health.mo.gov/living/environment/lead/pdf/AnnualReportFY2015.pdf

Figure 3: Percent of Missouri Pre-1950 Housing by Zip Code[14]

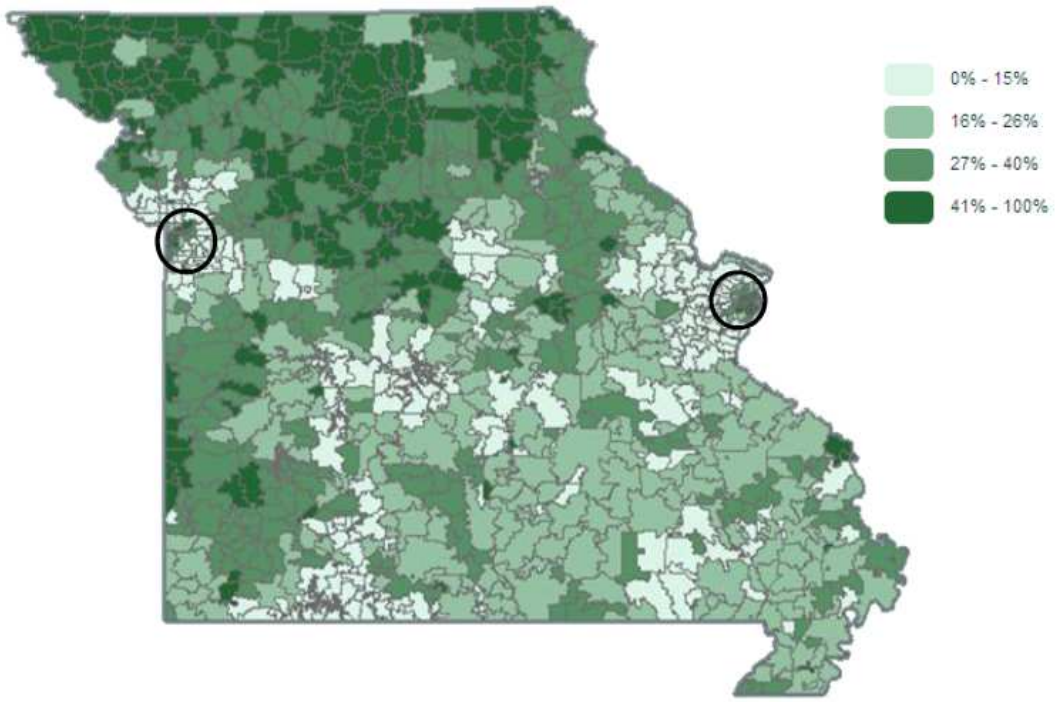
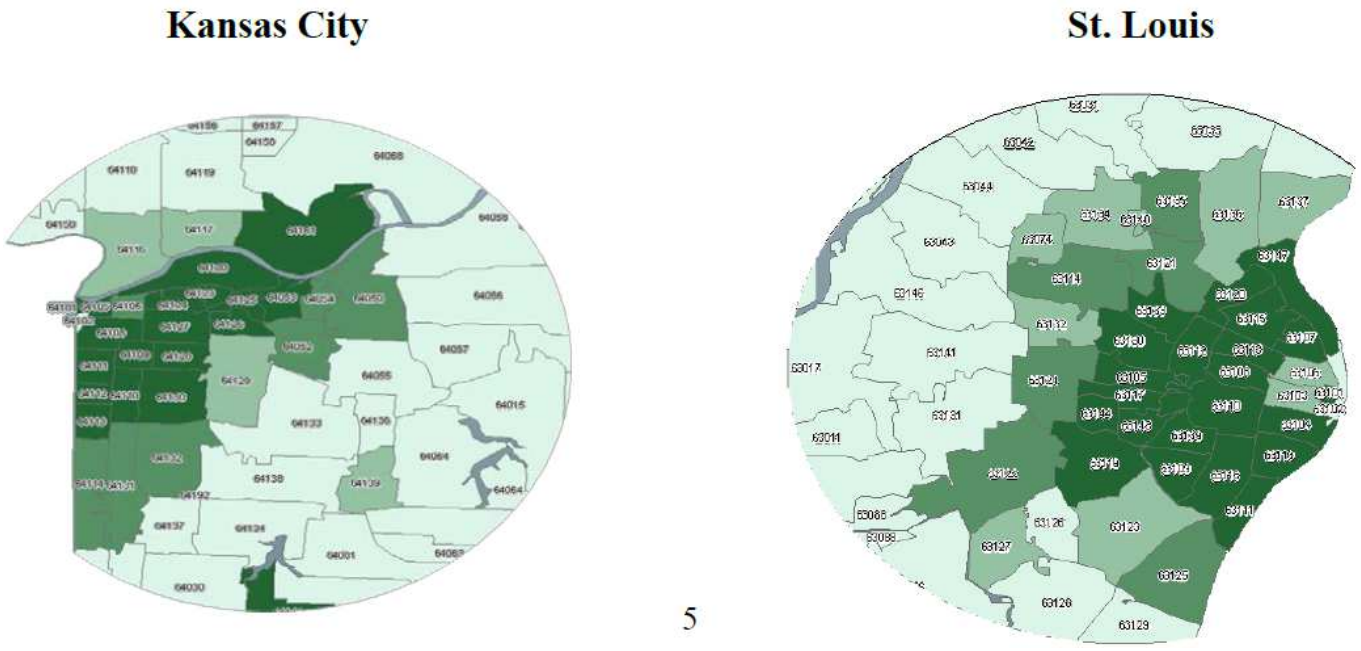


Figure 4: Percent of Missouri Pre-1950 Housing within Kansas City and St. Louis[15]



[14] Ibid.
[15] Ibid.

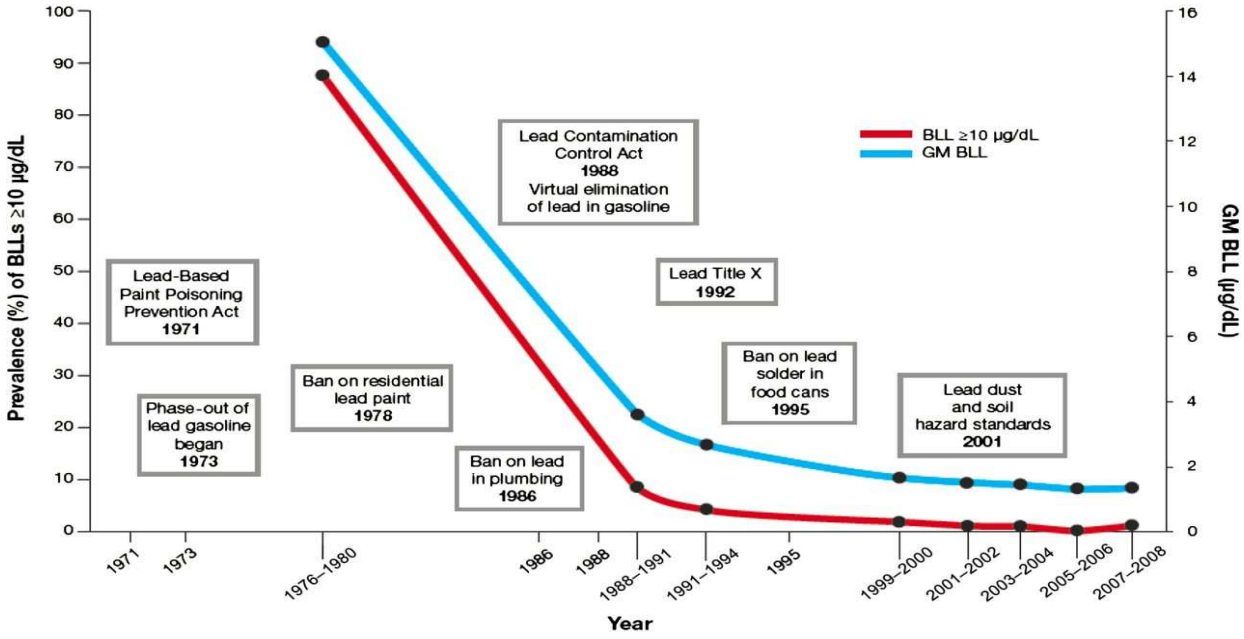
Q. Has exposure to hazardous lead levels decreased?

A. Yes, considerably. In the 1970's, over 70% of children tested nationwide had BLLs over 10 µg/dL;[16] by 2001, it was <1%. For comparison purposes, according to MO DHSS:

> Missouri blood lead testing data for July 1, 2015, through June 30, 2016, there were 600 children under the age of six identified with elevated blood levels of at least 10 µg/dL or 0.69% (0.69 percent of the 86,864 children tested that year).[17]

These decreases, both nationwide and in Missouri (which is the #1 lead producing state in the US[18]), coincide with the phasing out of leaded gasoline and paints.[19] The drop in reported BLLs can be seen Figure 3 along with the relevant passage of U.S. lead prevention policies.

Figure 3: Lead prevention policies and BLLs in children aged 1-5[20]



[16] Mahaffey, K.R., et. al. (1982) National estimates of blood lead levels: United States, 1976–1980: association with selected demographic and socioeconomic factors. *New England Journal of Medicine* 307 (10):573–579. http://dx.doi.org/10.1056/NEJM198209023071001.
[17] See GM-1.
[18] Ibid.
[19] United States Agency for Toxic Substances and Disease Registry (2007) Toxicological Profile for Lead. U.S. Dept. of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Atlanta, Ga Retrieved from: https://www.atsdr.cdc.gov/toxprofiles/tp13.pdf.
[20] Policy Statement from the American Academy of Pediatrics. (2016) Prevention of Childhood Toxicity *Pediatrics* . http://pediatrics.aappublications.org/content/early/2016/06/16/peds.2016-1493

Q. What amount of lead in drinking water poses an urgent health risk—the kind of threat that should cause consumers to immediately stop their home's water for drinking and cooking?

A. It is not clear there is an amount, as this question was posed by reporters at USA TODAY to the EPA with its response as follows:

> At this time, EPA has not provided a broader guidance regarding a lead concentration that would trigger a do-not-drink order.[21]

Today, if a given water system is found to be in violation of the LCR there is no requirement for notification to customers to stop drinking the water, only advice on ways to reduce exposures. Both the EPA and the CDC have said that no amount of lead in water is safe for children, but neither agency supported that statement with a regulatory action. Presently, both the EPA and CDC still recommend that water utilities and public health officials disregard sampling in the homes if one-time tap water sampling results are lower than the EPA 15 ppb ("parts-per-billion") lead action level and there is no known source of lead in the home.[22] Short of a water system being declared a federal emergency (see Flint) it is unclear what the threshold is. This is, in part, because some estimates of complete lead removal from the nation's building and water infrastructure exceed $1 trillion and will likely take decades to complete.[23]

[21] Young. A. (2016) How much lead in water poses an imminent threat? *USA Today*. https://www.usatoday.com/story/news/nation/2016/03/16/what-lead-levels-in-water-mean/81534336/

[22] U.S. Centers for Disease Control and Prevention (CDC). 2002. Managing elevated blood lead levels among young children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention. Atlanta, GA: CDC. Accessed: August 22, 2017, http://www.cdc.gov/nceh/lead/CaseManagement/caseManage_main.htm. In listing "Common Sources of Lead Exposure to Consider in an Environmental Investigation," (Table 2.3), that document recommends only that investigators consider drinking water samples of 15 ppb or higher. See also CDC, Lead Prevention Tips for water, https://www.cdc.gov/nceh/lead/tips/water.htm (accessed August 22, 2017) (stating: "You should begin by asking your water authority these questions: 1. Does my water have lead in it above EPA's action level of 15 parts per billion (ppb)? If the answer is no, no action is needed. . . ."). qtd. from Katner et. al. (2017) Public Comments on EPA's draft report titled "Proposed modeling approaches for a health based benchmark for lead in drinking water. http://www.circleofblue.org/wp-content/uploads/2017/08/Katner_LeadModelingComment.pdf

[23] Bliss, L. (2016) An American history of lead poisoning. *The Atlantic*. https://www.theatlantic.com/health/archive/2016/02/an-american-history-of-lead-poisoning/462576/

Lead and Copper Rule

Q. Do you agree with Mr. Naumick's overview of the issue of lead exposure in water?

A. Again, in part. Although I have no reason to doubt any of his specific factual statements, I do not believe his overview provides the appropriate context for informing the Commission of the uncertainty surrounding compliance, enforcement and future status of the Lead and Copper Rule ("LCR").

Q. Please provide some background regarding the LCR.

A. Promulgated in 1991 to protect public health by minimizing lead and copper levels in drinking water, the LCR was designed to determine the health of a water system, not to identify individual portions of distribution system at high risk.[24] Since lead and copper are generally absent from water as it leaves the treatment facility, the way that lead enters the water in the distribution system is through the corrosion of lead bearing premised plumbing material such as lead service lines, lead solder or leaded brass faucets. Lead particulate can also accumulate on the internal walls of corroded galvanized steel pipes or be lodged within a faucet aerator. The LCR is unique in requiring utilities to collect one liter, first draw water samples at high risk consumers' taps. The rule mandates that only 100 homes in a large city need to be tested in order to be compliant with the LCR, thus resulting in <1 in 1000 homes being tested. Additional breakdown in system size and number of sample sites can be seen in Table 1.

[24] Triantafyllidou, S., Edwards, M., (2012) Lead (Pb) in tap water and in blood: implications for lead exposure in the United States. Critical Review in Environmental Science and Technology. 42 (13), 1297–1352. http://www.tandfonline.com/doi/abs/10.1080/10643389.2011.556556

Table 1: Lead and Copper tap and Water Quality Parameter ("WQP") tap monitoring [25]

Size category	System size	Number of Pb/Cu tap sample sites[a]		Number of WQP tap sample sites[b]	
		Standard	Reduced	Standard	Reduced
Large	>100 K	100	50	25	10
	50,001–100 K	60	30	10	7
Medium	10,001–50 K	60	30	10	7
	3301–10 K	40	20	3	3
Small	501–3300	20	10	2	2
	101–500	10	5	1	1
	≤100	5	5	1	1

The LCR action level of 10 µg/dL applies to the 90th percentile of the sample set, but not to the individual measurements.[26] Inherent sample variability in: water use patterns, the presence or absence of protective coatings in the pipes, the age of the water in the distribution system, water chemistry, mineral types, temperature, and sampling techniques of the LCR at the customer tap pose considerable challenges in accurately assessing the presence of lead-contaminated water. As such, the LCR has been a source of considerable debate within the industry since its inception with the EPA continuing to work on "long-term" revisions for more than a decade now.[27]

Q. What is the current status of the LCR?

A. According to the recently updated US Office of Management and Budget notice:

> Beginning in 2004, EPA conducted a wide-ranging review of the Lead and Copper Rule (LCR) to determine if there is a national problem related to elevated lead levels. EPA's comprehensive review consisted of several elements, including a series of workshops designed to solicit issues, comments, and suggestions from stakeholders

[25] US EPA (2008) Lead and Copper Rule: A quick reference guide. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=60001N8P.txt
[26] Powell, M., (2005) The 1991 Lead/Copper drinking water rule and the 1995 decision not to revise the arsenic drinking water rule: two case studies in EPA's use of science. Discussion Paper 97-05 http://ageconsearch.umn.edu/bitstream/10454/1/dp970005.pdf
[27] Parents for nontoxic alternatives. (2015) Statement of Dissent to the EPA National Drinking Water Advisory Council (NDWAC) https://www.epa.gov/sites/production/files/2015-11/documents/ndwaclcrstatementofdissent.pdf

> on particular issues; a review of the monitoring data to evaluate the effectiveness of the LCR; and a review of the LCR implementation by States and water utilities. As a result of this multi-part review, EPA identified seven targeted rules changes and EPA promulgated a set of short-term regulatory revisions and clarifications on October 10, 2007, to strengthen implementation of the existing Lead and Copper Rule. In developing the short-term revisions, EPA identified several regulatory changes to be considered as part of the identifying more comprehensive changes to the rule. These considerations are longer-term in nature as they require additional data collection, research, analysis, and stakeholder involvement to support decisions.[28]

The EPA now expects a draft rule to be published in January of 2018, or six months later than what was announced a year ago. Assuming no additional setbacks and under the most favorable timeline, the final rules, according to the EPA will not be ready until July 2019.

It is important to note that under this timeline the revised LCR rules would also coincide roughly with the conclusion of OPC's proposed lead service line replacement pilot project. This would position MAWC and ratepayers in the ideal situation for compliance with potential federal regulatory changes.

Q. How are lead service line replacements on the customer-side treated by the LCR?

A. They are the responsibility of the customer not the utility. Initially, the LCR required the replacement of the entire lead pipe, both the utility-owned and privately-owned sections. But requiring water utilities to remove privately-owned lead service lines raised constitutional and legal issues in terms of private property and eminent domain. A 1994 challenge in the DC Circuit Court by the American Water Works Association ("AWWA") limited the EPA's jurisdiction to just the public portion of the service line. The Court opinion stated:

> The AWWA (American Water Works Association) challenges. . . . the EPA's inclusion of water lines owned by others in the definition of distribution facilities

[28] Office of Management and Budget (2017) View Rule: National primary drinking water regulations for lead and copper: regulatory revisions. https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=201704&RIN=2040-AF15

> under the 'control' of a public water system, and thus subject to the lead line replacement regulations. . . . We grant the AWWA's petition because the EPA failed to provide adequate notice that it might adopt a broad definition of control.

As a result the LCR was revised in 2000 to allow for partial service line replacement, although utilities could offer homeowners the option of replacing their portion of the line at the homeowner's cost.

Q. Can you cite to a water system that replaced all of its lead service lines?

A. Yes. Madison, Wisconsin is often held up as a best practice case study. In 1994 Madison Water Utility was faced with a situation where it was in violation of the LCR and its most standard chemical corrosion treatments were ineffective. Seven-years later, there were approximately 6,000 lead service lines on the utility-owned portion and 5,000 on the homeowner side. The state set a goal of replacing all service lines by 2011. In 2000 the city passed an ordinance that prioritized replacements in schools and day care facilities but disagreements regarding cost allocation soon followed. The utility initially attempted to add a surcharge but this was rejected by the Wisconsin Public Service Commission. Ultimately, costs were subsidized in part from an added surcharge from a sewer authority and revenue collected from water tower-based cell antenna fees. The Utility used that money to reimburse individual customers up to $1,000 the cost of the replacement. Madison Water also provided low-income customers a loan with repayment deferred until the property sold.[29]

Q. What should the Commission note from the Madison example?

A. As successful and innovative as Madison's example is, it is worth noting that it took seventeen-years to complete 6,000 lead service lines on the utility-side and 5,000 service lines on the homeowner side. Cost causation principles were also not entirely abandoned by the Madison utility as individual homeowners paid at least half the costs.

[29] Renner. R. (2010). Reaction to the solution: Lead exposure following partial service line replacement. *Environmental Health Perspectives* 118.5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2866705/pdf/ehp-118-a202.pdf

III. MAWC'S LEAD LINE REPLACEMENT PROPOSAL

Estimated Number of Lead Service Lines

Q. Do you agree with Mr. LaGrands 30,000 lead service line replacement estimate?

A. No. In MAWC's initial application two numbers are cited and reprinted here:

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

MAWC's application included a footnote to the 6.1 million estimate that directed readers to the Lead Service Line Replacement Collaborative. Although a review of the website failed to produce a citation for the nationwide estimate, a Google search for "6.1 million lead service lines" immediately cited to a 2016 AWWA journal article titled, "National Survey of Lead Service Line Occurrence."[31]

Table 2 includes the results of that study highlighting the largest estimated number of lead service lines by state, water system size and % of population based on 2016 US Census data.

[30] Missouri American Water (2017) WU-2017-0296. Application and Motion for Waiver. p. 3.
[31] Cornwell, D.A. et al. (2016) National Survey of Lead Service Line Occurrence. Journal of American Water Works Association April. http://media.mlive.com/news_impact/other/jaw201604cornwell_pr.pdf

Table 2: AWWA's top ten estimated states with the most lead service lines as percentage of its total 2016 US Census population

	Water System Size (small, medium, large and total) [32]				% of LSL per population	
	< 10,000	10,000 – 50,000	>50,000	All Systems	Total Population[33]	% of Total Population[34]
1. Illinois	76,000	240,000	410,000	730,000	12,801,539	5.70%
2. Ohio	52,000	170,000	430,000	650,000	11,614,373	5.60%
3. Missouri	**68,000**	**65,000**	**200,000**	**330,000**	**6,093,000**	**5.42%**
4. Minnesota	32,000	83,000	140,000	260,000	5,519,952	4.71%
5. Michigan	52,000	140,000	270,000	460,000	9,928,300	4.63%
6. Indiana	40,000	75,000	180,000	290,000	6,633,053	4.37%
7. Wisconsin	36,000	70,000	130,000	240,000	5,778,708	4.15%
8. New Jersey	1,100	320,000	31,000	350,000	8,944,469	3.91%
9. New York	2,900	280,000	84,000	360,000	19,746,289	1.82%
10. Texas	46,000	210,000	17,000	270,000	27,862,596	0.97%

The Commission should note that Missouri is estimated as having the third highest percentage of lead service lines and the 6th most estimated lead service lines in total in the United States.

MAWC's footprint extends over several of the most populated areas in the state including St. Louis and St. Charles Counties, the City of Joplin, the City of St. Joseph as well as many smaller systems. To be clear, if the Company is to be believed that the two numbers cited in its application are accurate then we should assume that only 9% of all of the estimated lead service lines in Missouri are in a MAWC designated service territory.

Based on the foregoing information it is reasonable to conclude that the Company's estimate for the number of lead service lines in its service territory is likely understated.

[32] Cornwell, D.A. et al. (2016) National Survey of Lead Service Line Occurrence. Journal of American Water Works Association April. http://media.mlive.com/news_impact/other/jaw201604cornwell_pr.pdf
[33] United States Census Bureau (2016) July 2016 Annual Estimates of the Residential population for the United States. https://www.census.gov/data/tables/2016/demo/popest/nation-total.html
[34] Represents a conservative percentage estimates as it assumes one lead service line for 1 person. In reality, one lead service line is likely servicing more than one person within a household.

Q. Can you provide other support to suggest that MAWC's numbers are understated?

A. Yes. Flint, Michigan provides an illustrative example of how company "tap records" and GIS estimates can be grossly inaccurate. In February of 2016 Mayor Karen Weaver of Flint, Michigan publicly estimated that 15,000 lead service lines would need to be replaced. By December of 2016, Mayor Weaver announced that initial estimates were grossly understated, and that an exploratory investigation by the University of Michigan estimated that as many as 29,100 Flint residences have lead or galvanized steel service lines that need to be replaced.[35] In eight-months the estimated number had approximately doubled.

The Company's response to OPC DR-2006 also gives me pause as to the soundness of its lead service line estimates. OPC DR-2006 states:

> Referencing the direct testimony of Bruce W. Aiton p. 3, 12-13, please provide the source/reference to substantiate the following statement:
>
> *Until around 1950, it was common practice for water utilities in Missouri to install lead service lines.*

The Company responded:

> The precise date is not readily available. The use of "around 1950" was pulled from articles related to Flint, MI. "New lead service lines have been banned since the 1950s."
> http://www.freep.com/story/news/local/michigan/flint-water-crisis/2016/02/27/lead-water-lines-lurk-unknown-many-cities/80551724/

To be clear, when asked about specific dates cited in their direct testimony regarding Missouri lead service line installation practices, the Company provided a response from a Detroit newspaper titled, "Where are the lead pipes? In many cities, we just don't know".

[35] City of Flint, Michigan (2016) FAST Start Initiative. https://www.cityofflint.com/fast-start/

With that said, I would agree with sentiments expressed in that headline and apparently MAWC acknowledges this fact as well. Notably, an integral part of OPC's proposed pilot would include a scoping analysis to identify the size and scale of the number of lead service lines.

Costs of Replacing Lead Service Lines

Q. Do you agree with Mr. LaGrand's $3,000 to $5,500 cost per replacement estimate?

A. No. Due primarily to unreliable, opaque and piece-meal records, water utilities often do not know what they will discover in the excavation process. Rarely is it as simple as digging a hole, replacing the line, and filling the hole. Consequently, excavating the ground of an older city may be more akin to performing surgery in the 19th century and this has made the cost of line replacement difficult to accurately estimate. Although still a small sample size, initial spent costs to date have exceeded the Company's estimated range with many individual sites hovering around the $10,000 spend.

Additionally, citing Flint, Michigan again as a reference, the Rowe Professional Services Company Water Service Inventory and Pilot Replacement Report[36] estimated the Flint, Michigan lead line replacement extraction process at $7,500 per household with additional cost considerations including (but not limited to):

- Permits and fees
  - Total about $2,400 per site, or about 25% of the costs of the "average" replacement
- Inspections
- Finished basements
- Garbage days
- Water and sewer service in the same trench
- Fixture repairs
- Large pipe or odd-fittings
- Trees & contaminated soil
- Dust
- Worker identification

[36] Rowe Professional Services Company Water Service Inventory and Pilot Report (2017) City of Flint, Michigan http://docs.house.gov/meetings/IF/IF14/20160413/104765/HHRG-114-IF14-Wstate-CreaghK-20160413-SD006.pdf

Cost estimates will no doubt fluctuate based on what is prioritized. For example, removing 3,000 service lines a year (the Company's proposed estimate) would appear to be an ambitious number under the most favorable of conditions (i.e., perfect weather, perfect information and no confounding variables). It would also be reasonable to assume that these large removal estimates would be married to either increased costs or substandard quality of work. Expeditious removal may be a priority if individually impacted ratepayers want immediate action and the quality of work may be a concern if it is perceived that the contract selection will be based on the "lowest bidder" for what amounts to a highly sensitive excavation process.

There are no doubt other trade-offs that need to be vetted. For example, should lead line service projects prioritize "economically constrained populations," or prioritize work in conjunction with other main replacements that were already scheduled to take place? This question was posed in OPC DR-2017 which stated:

> Referencing the direct testimony of Bruce W. Aiton p. 10, 15-17 which states:
>
> > *Many customers, particularly those in older neighborhoods with populations that face economic constraints that make it difficult or impossible for them to pay for replacement, will have a difficult time replacing their lead service lines on their own.*

- Has MAWC's full lead line replacements to date specifically targeted neighborhoods whose populations face economic constraints? Additionally, Does MAWC plan on targeting neighborhoods whose populations face economic constraints?

The Company responded:

> To date MAWC has replaced lead service lines found on mains that had been prioritized for replacement during our 2016 planning cycle which did not include LSLR in the prioritization. MAWC's approach to replacing lead service lines is to give priority to the lead service lines that exist along the route of water main renewal projects and those found during emergency work.

> The Company is currently updating its prioritization criteria for selecting water mains for renewal. The Company plans to consider the replacement of lead service lines without restriction on home owner economic constraints as part of its prioritization of main renewal projects.

Further discovery responses confirm that the Company does not appear to have been targeting "economically constrained neighborhoods" as the response to OPC DR-2005 includes the zip codes in which water testing samples were taken (see GM-2). I have adapted that table from the Company's response to include the name of the city/county in which the lead service line was excavated. Those results are in Table 3 below:

Table 3: Locations of lead service line replacements to date and flushing sample results

	Zip Code	Sample 1 - Post Flush	Sample 2 - Still	Sample 3 - Post Flush	Sample 4 - Still
Clayton	63105	74	72	8	3
Webster Groves	63119	9	9	2	
Mehlville	63125	1	1		
Spanish Lake	63138	1	1		
Brentwood	63144	3	4	1	
St. Joseph	64501	10	8		
Buchanan County	64503	3	2		
Buchanan County	64504	1	1		
Buchanan County	64505	5	4		
Buchanan County	64506	1	1		
Buchanan County	64507	12	9	1	
	Grand Total	120	112	12	3

A brief review of US Census data shows that the median value of owner-occupied housing units, 2011-2015 in Clayton is listed at $597,700[37] which is contrasted against the Missouri median value of $138,400.[38] Stated differently, homes in Clayton, where the vast majority of lead line replacements have occurred to date, are worth more than four times the median

[37] US Census (2016) QuickFacts: Clayton, Missouri https://www.census.gov/quickfacts/fact/table/claytoncitymissouri/PST045216
[38] US Census (2016) QuickFacts: Missouri https://www.census.gov/quickfacts/MO

average in Missouri. Although a small sample size, these preliminary results raise equity concerns and at the very least call attention to the issue of prioritization.

It is also important to note that the Company's direct testimony omits the total estimated "all-in" costs based on MAWC's numbers to date. For comparative purposes, Table 4 includes the cost estimates referenced in the Company's application broken down by number of estimated service lines and the Company's low/high cost estimate per unit compared a long with AWWA's Missouri-specific estimates with MAWC's low/high cost estimate.

Table 4: Projected Lead Service Line Replacement Costs in Company Application

Source	# of service lines	MAWC low/high Estimated cost	Total costs
MAWC territory estimate	30,000	$3,000 per unit	$90,000,000
MAWC territory estimate	30,000	$5,500 per unit	$165,000,000
AWWA Missouri estimate	330,000	$3,000 per unit	$990,000,000
AWWA Missouri estimate	330,000	$5,500 per unit	$1,815,000,000

Both the $90 million and (especially) the $1.815 billion price tags should give the Commission and other stakeholders pause.

Q. Why should the Commission concern itself with Missouri estimates?

A. First, as explained above, the total Missouri estimates cast doubt on the Company's estimates for its service area. Second, the total Missouri estimates should concern the Commission because MAWC is presently requesting to move to single-tariff pricing and abandon the regulatory principle of cost causation in its entirety. If the Company continues to seek further consolidation and socialization of costs, an incentive is created for water systems with otherwise cost-prohibitive projects (such as lead service line replacement) to sell their system to MAWC and socialize those site-specific costs on to existing MAWC customers. As it relates to lead service line replacement, if the AWWA report is accurate this would represent an enormous cost shifting burden to existing customers. It would also represent an unprecedented regulatory action by a state regulatory Commission.

Putting aside cost allocation issues for a moment to focus on the magnitude of the cost, it bears repeating that even under the most conservative of estimated costs and most conservative of estimated lead services lines in operation—the absolute floor for customers is at $90 million. This is not a trivial amount of money especially when the same Company is currently requesting a 45% rate increase to its quarterly billed St. Louis customers. The Commission should be mindful of the concept of opportunity costs and consider any and all opportunities to minimize excessive costs. OPC's pilot study recognizes this by including a policy track to address ancillary considerations including supplementing future costs from the federal government. As it stands, no such plan is being proposed by the Company.

Q. Do you believe MAWC's communications, testing and prioritization plan is correct?

A. No. There are a number of deficiencies with the company's plan. Many of OPC's concerns have already been raised as questions to explore in the proposed pilot study. These include, but are clearly not limited to the following:

- Which customers should get priority?
- Should work be spread out or concentrated in one area at a time?
- Should vacant or substandard housing be included?
- Will low-income property owners with mass meters pass the costs along to low-income tenants?
- What about inactive accounts?
- Should efforts be focused on mirroring future planned replacement or should previously identified "partial" replacements be the priority?
- How will customers be notified?
- In situations where lead lines have already been identified by the utility, were customers notified? If not, why?
- How should costs be allocated?
- What are the testing parameters and should results be disclosed to the public?
- Should filters be utilized?
- What about lead particulate in the homes internal pipes or faucets?

- When will customers be notified that lead is in contact with their water supply moving forward?

I look forward to other parties' feedback in rebuttal and will expound accordingly on this topic in surrebuttal.

Q. Do you have any concluding statements?

A. Yes. When, and how, to address lead service line replacements are questions with no clear answers at this point. The ever present question of "who pays" further compounds the questions especially as it relate to customer-owned service lines. Ultimately, given the indeterminate size and scope of the Company's proposal, the regulatory uncertainty surrounding the LCR, the public health implications and the potential for public confusion or panic OPC ask the Commission to reject the Company's application and approve OPC's pilot study. Doing so will support the continued course of action (full lead line removal), engage diverse stakeholders in a complex topic, support evidence-based research, and explore ways to mitigate costs. OPC's pilot also allows the Commission and stakeholders the ability to review and determine their positions based on the feedback and results of rigorous pilot study.

Missouri Childhood Lead Poisoning Prevention Program

Annual Report for Fiscal Year 2016

July 1, 2015 – June 30, 2016

Missouri Department of Health and Senior Services

http://health.mo.gov/living/environment/lead/index.php

573-751-6102 or 866-628-9891

Missouri Childhood Lead Poisoning Prevention Program (CLPPP)

Annual Report for Fiscal Year 2016

July 1, 2015 – June 30, 2016

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This report meets the statutory mandate for an annual report per §701.343, RSMo.

About Our Program

PROGRAM MISSION

The Missouri Department of Health and Senior Services (DHSS) Childhood Lead Poisoning Prevention Program's (CLPPP) mission is to assure the children of Missouri a safe and healthy environment through primary prevention and the identification of lead exposures that may cause illness or death.

The DHSS' CLPPP was established in 1993 and continues to assure that health care providers have current information and tools available to screen patients less than six years of age for lead and provide primary prevention education.

The CLPPP is staffed by the following positions: a Program Manager, an Environmental Supervisor, a Research Analyst, two Data Entry Personnel, 6.5 Environmental Specialists, and a Public Health Consultant Nurse. State guidelines describe appropriate follow-up of children with elevated blood lead levels (EBL) of at least 10 micrograms per deciliter (10 µg/dL). Based on the 97.5th percentile of the blood lead level distribution among children one to five years old in the United States, the current Centers for Disease Control and Prevention (CDC) reference level is set at $\geq$ 5 µg/dL. CLPPP has been working to identify ways to provide services based on CDC's reference level. DHSS staff currently notifies all Local Public Health Agencies (LPHAs) and health plans when a blood lead level is received regardless of the level. This ensures LPHAs and health plans are aware of all the children's blood lead level results and can discuss what actions will follow if any.

Follow-up activities and case management are generally provided for children six years and younger with an EBL $\geq$ 10 µg/dL. These activities help the family understand the causes and health effects of childhood lead poisoning. Environmental risk assessments are required per statute to be performed to identify potential sources of lead exposure for children with an EBL $\geq$ 15 µg/dL. While not required by statute, CLPPP also offers environmental risk assessments for children with an EBL $\geq$ 10 µg/dL. These risk assessments provide the family with information about where lead hazards exist in and around their home. A work plan is developed to reduce these hazards and the risks associated with them. By reducing or eliminating exposures to the environmental sources of lead, the child's blood lead level should decrease and repeated elevations should be prevented. A Department of Health and Senior Services produced Lead Fact Sheet and CDC's "Protect Your Family From Lead" booklet are mailed to families of children who have been identified with having a lead level of 5 µg/dL to 9.9 µg/dL to provide information on lead poisoning and prevention.

Lead poisoning prevention educational materials are developed and provided to Missouri citizens at various community venues. DHSS works with LPHAs, the medical community, other state agencies, businesses, schools, and community organizations to prevent childhood lead poisoning. The Missouri CLPPP created a mascot to promote lead poisoning prevention messages. The costume may be loaned to any organization in Missouri wanting to increase lead poisoning prevention education and blood lead testing.

The program currently uses the Missouri Health Strategic Architectures and Information Cooperative (MOHSAIC) database to collect lead-specific data from medical and lead program activities. This database is part of an electronic health records system to provide documentation of medical testing, case management, and environmental risk assessments statewide. The data is

used to provide comprehensive lead case management services and for statistical information. All child and adult lead test information is tracked in MOHSAIC.

Lead Poisoning in Missouri

Lead poisoning is one of the most common and preventable environmental health problems today. Almost a quarter million children in the United States are estimated to have an EBL level of at least a 10 µg/dL. According to Missouri blood lead testing data for July 1, 2015, through June 30, 2016, there were 600 children under the age of six identified with EBL levels of at least 10 µg/dL (0.69 percent of the 86,864 children tested that year).

The primary lead hazard to children in Missouri is deteriorated lead-based paint. Lead-based paint was banned for residential use nationwide in 1978. Any home built before 1978 may contain lead-based paint. The highest risk of lead exposure for children is found in homes built before 1950, when most paint contained a high percentage of lead. More than 21 percent of the housing stock in Missouri was built before 1950 (see page 5).

Lead mining and smelting are an important part of Missouri's history. Lead in Missouri was first discovered along the Meramec River by French explorers in the 1700s while searching for gold and silver. Missouri became the dominant lead-producing state in the nation in 1907. It has remained so ever since. Most early lead production came from the Old Lead Belt district of southeast Missouri in the Park Hills-Bonne Terre area, and in the Tri-State Zinc-Lead district in southwest Missouri around Joplin. Today, all of the state's lead production comes from the New Lead Belt, also known as the Viburnum Trend district. This district is a very narrow, 35-mile-long ore area extending southward from the small town of Viburnum, Iron County, in southeast Missouri. Mining waste products in these areas often end up on driveways, in yards, or even in children's play areas. Dust, air, and soil around mining activity have consistently shown elevated levels of lead contamination.

Lead is a shiny, silver-colored metal found naturally in the earth's crust. Lead has historically been used in a variety of ways including in paints, gasoline, batteries, bullets, keys, and some vinyl products such as mini-blinds. Fine particles of processed or recycled lead and/or lead dust become a health hazard when they are taken into the body through inhalation (breathing) and/or ingestion (swallowing).

Lead affects almost every organ and system in the body. The effects of lead are the same whether it is inhaled or ingested and can damage the brain, central nervous system, kidneys, and immune system. Lead in the human body is most harmful to young children under six years of age, and is especially detrimental to children less than three years of age because their systems are developing rapidly.

A blood test is used to determine lead levels. Lead can be measured in blood drawn from a vein or capillary (finger stick). Blood lead levels are measured and reported as micrograms of lead per deciliter of whole blood (µg/dL).

Legislation passed in 2001 required DHSS to promulgate rules and regulations to establish a statewide screening plan. The rules and regulations define criteria for establishing geographic areas in the state considered to be at higher risk for lead poisoning, outline blood lead testing requirements and protocols, and define lead testing follow-up.

In developing these regulations, CLPPP applied Missouri surveillance and census data to establish criteria for Universal Testing (high risk) and Targeted Testing (non-high risk) areas in Missouri. Based upon those criteria, and as required by state statute, the following activities shall occur in these two areas.

In **Universal Testing Areas**:

- Any child under the age of six living in or visiting for more than 10 hours per week in the Universal Testing or high risk area will be tested annually for lead.
- Childcare facilities located in Universal Testing Areas must record a "proof of lead testing" signed by the health care provider within 30 days of the child's enrollment. The statement must verify that a blood lead test was completed in the previous 12 months. If the parent/guardian does not provide proof or a written statement explaining why they do not want the child tested, the childcare facility is to offer the parent assistance in scheduling a blood lead test.

In **Targeted Testing Areas** the following activities shall occur:

- From six months to six years of age, every child will be screened annually using the Healthy Children and Youth (HCY) Lead Risk Assessment Guide to determine whether the child is at risk for lead poisoning. Responses given during the screening with the Guide may indicate the need for blood lead testing at an earlier age (six months) and/or more frequently.

  *The HCY Lead Risk Assessment Guide can be viewed at: http://health.mo.gov/living/environment/lead/pdf/HCYLeadRiskAssessmentGuide.pdf.

- Every child less than age six found to be at high risk will be blood tested for lead poisoning.
- All MO HealthNet eligible children shall be assessed by the HCY Lead Risk Assessment Guide and/or be blood lead tested at the ages stipulated by the Federal Program Guidelines (12 months of age, 24 months of age, or 12 to 72 months of age).

An updated Missouri Annual Childhood Lead Testing Area Requirements map is published every year and is available at: health.mo.gov/living/environment/lead/maps.php.

Reporting of Blood Lead Testing

Missouri's diseases and conditions reporting rule (19 CSR 20-20.020) requires reporting of all blood lead tests both elevated and non-elevated and clarifies demographic patient information required to be submitted with the report. All blood lead test results are required to be reported to the DHSS regardless of the age of the individual or the reported lead level. The data contributes to Missouri's local, regional, and statewide statistics on blood lead poisoning.

The following information is required:

- Date test was conducted
- Type of specimen (capillary or venous)
- Result of the test
- Name and address of the attending physician
- Name of the disease or condition diagnosed or suspected
- Date the test results were obtained
- Patient's complete name and home address with zip code
- Patient's date of birth
- Patient's sex and race

Health care providers should assure that the laboratory they are using is reporting to DHSS.

LeadCare Analyzers

LeadCare Analyzers are portable and easy-to-use instruments that give results of capillary blood lead samples within minutes. These devices allow the patient to receive a result immediately from the tester. LeadCare Analyzers are very convenient for physicians' offices and local health departments. These devices:

- Prevent the patient from possibly being referred to an entirely different location to have the test done.
- Save time that would be spent waiting on lab results.

The use of these instruments has increased for both providers and local public health agencies.

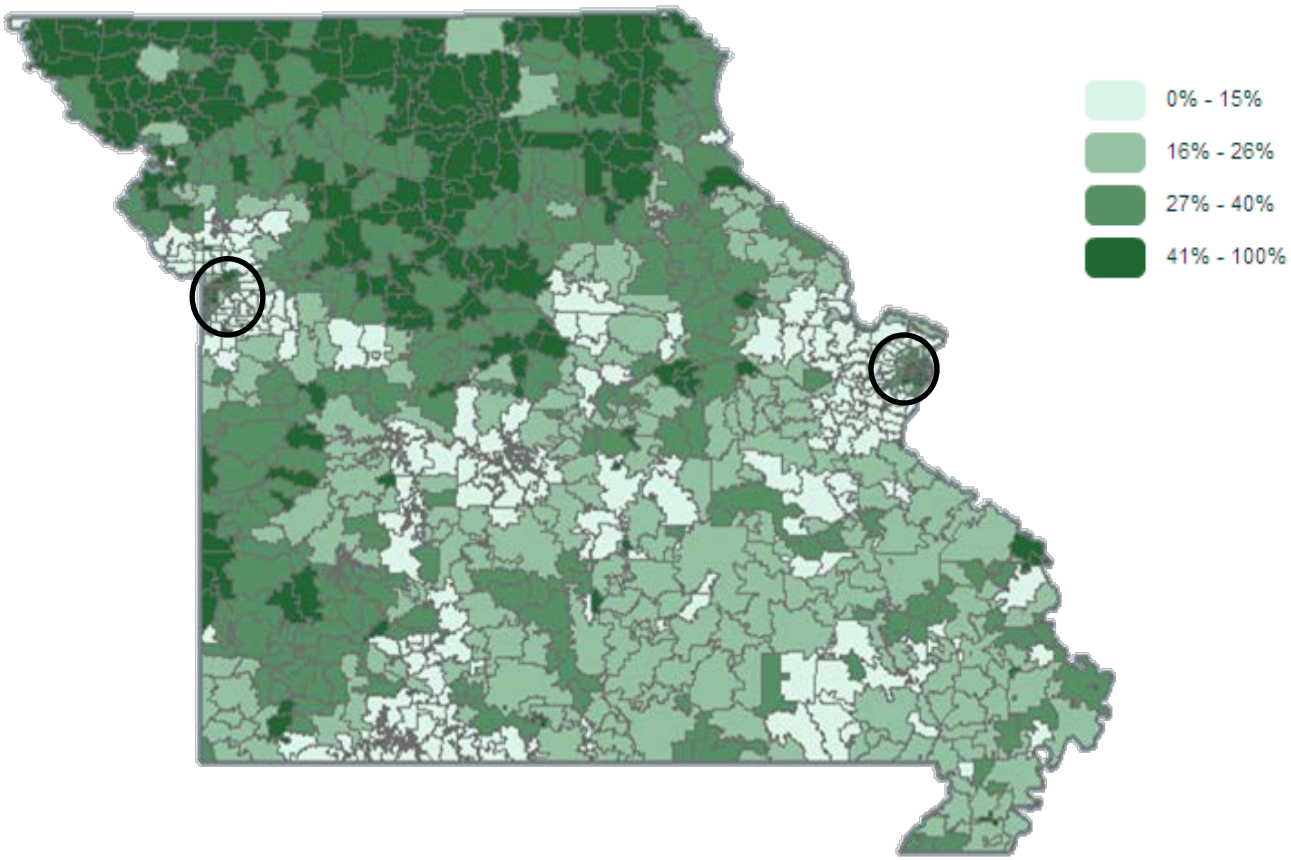
Filter Paper Blood Lead Testing

Filter Paper techniques are acceptable for blood lead testing if health care providers ensure that, as with all blood lead test methods, the chosen laboratory is participating satisfactorily in Clinical Laboratory Improvement Amendments (CLIA) certified proficiency testing (PT) program. Technical assistance is available by contacting the nurse in the DHSS Childhood Lead Poisoning Prevention Program at 573-751-6102.

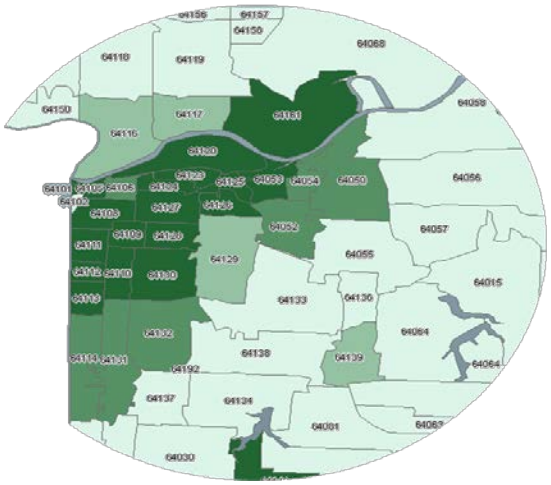
Housing Risks

Nationally, the average percentage of housing built pre-1950 decreased from 22% in 2000 to 19.6 % in 2010. Missouri is above the national average with 21% of housing units built before 1950. The map below lists the percentage of pre-1950 housing by zip code according to the 2000 census data.

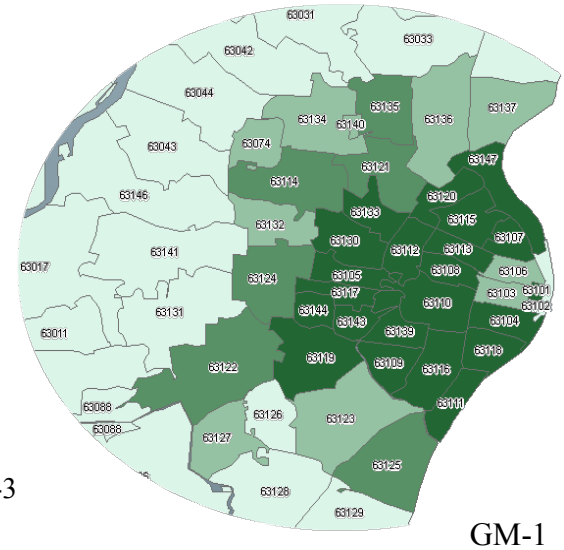
Percent of Missouri Pre-1950 Housing by Zip Code



Kansas City



St. Louis



Testing and Prevalence

The number of Missouri's children less than six years old who have been tested for lead poisoning has increased from 50,362 in 2000 to 86,864 in Fiscal Year 2016. Of the children tested, the percentage found to have elevated blood lead levels (10 µg/dL or greater) has declined from 11.1 percent in 2000 to 0.69 percent in 2016. This decrease mirrors a nationwide decrease in children's blood lead levels. In 2016, of the 86,864 children in Missouri who received a blood lead test, 600 had blood lead levels of 10 µg/dL or greater.

Highlights from the Fiscal Year 2016 testing data

- There were 86,864 children tested for lead during Fiscal Year 2016.
- Of children tested in Missouri, 600 (0.69 percent) had an elevated blood lead level of at least 10 µg/dL.
- The number of children found to have an EBL greater than or equal to 10 µg/dL decreased from 5,588 in 2000 to 600 in 2016.
- Approximately 22.3 percent of children tested resided in a Universal Testing Area in Fiscal Year 2016.
- 2,505 children tested had blood lead levels between 5 and 9.9 µg/dL (2.9 percent of the 86,864 children tested).

A summary of county level blood lead testing data for the period July 1, 2015, through June 30, 2016, is presented on the following pages.

Blood Lead Testing Data by County

For the period July 1, 2015, through June 30, 2016, for Children Less Than Six Years of Age

Jurisdiction	Blood Lead Level Test Results (µg/dL)										Total Count All Tests	2010 Census Population of Children <72 months	Percent of Total Population (<72 months) Tested	Total Elevated Count Tests >= 10	Percent Elevated Total Tested >= 10
	0-2.9	3-4.9	5-9.9	Total Count Tests <10	10-14.9	15-19.9	20-24.9	25-44.9	45-69.9	>69.9					
ADAIR	261	19	9	289	2	0	0	0	0	0	291	1,715	16.97%	2	0.69%
ANDREW	243	13	11	267	0	0	0	0	0	0	267	1,217	21.94%	0	0.00%
ATCHISON	29	17	5	51	2	0	0	0	0	0	53	362	14.64%	2	3.77%
AUDRAIN	359	33	9	401	2	4	0	1	0	0	408	2,063	19.78%	7	1.72%
BARRY	236	31	2	269	1	0	0	0	0	0	270	2,726	9.90%	1	0.37%
BARTON	103	15	1	119	0	1	1	0	0	0	121	997	12.14%	2	1.65%
BATES	157	50	21	228	2	2	1	0	0	0	233	1,369	17.02%	5	2.15%
BENTON	104	8	2	114	1	0	0	0	0	0	115	1,001	11.49%	1	0.87%
BOLLINGER	178	28	5	211	0	0	0	0	0	0	211	907	23.26%	0	0.00%
BOONE	2,347	85	18	2,450	3	0	2	0	0	0	2,455	12,126	20.25%	5	0.20%
BUCHANAN	1,200	146	117	1,463	13	7	5	3	0	0	1,491	7,321	20.37%	28	1.88%
BUTLER	688	138	15	841	1	1	0	0	0	0	843	3,369	25.02%	2	0.24%
CALDWELL	106	16	11	133	0	1	1	0	0	0	135	722	18.70%	2	1.48%
CALLAWAY	466	55	10	531	0	0	0	0	0	0	531	3,169	16.76%	0	0.00%
CAMDEN	239	16	4	259	1	0	0	0	0	0	260	2,610	9.96%	1	0.38%
CAPE GIRARDEAU	636	95	36	767	13	0	1	1	2	0	784	5,638	13.91%	17	2.17%
CARROLL	148	23	11	182	2	0	1	0	0	0	185	634	29.18%	3	1.62%
CARTER	92	8	2	102	1	0	0	0	0	0	103	515	20.00%	1	0.97%
CASS	965	64	7	1,036	4	0	0	0	0	0	1,040	8,174	12.72%	4	0.38%
CEDAR	100	19	7	126	0	0	0	0	0	0	126	1,002	12.57%	0	0.00%
CHARITON	103	16	0	119	0	1	1	0	0	0	121	575	21.04%	2	1.65%
CHRISTIAN	883	56	13	952	1	0	0	0	0	0	953	7,017	13.58%	1	0.10%
CLARK	70	14	12	96	1	0	0	0	0	0	97	577	16.81%	1	1.03%
CLAY	2,663	145	21	2,829	0	1	0	0	0	0	2,830	19,570	14.46%	1	0.04%
CLINTON	220	19	3	242	0	0	1	0	1	0	244	1,569	15.55%	2	0.82%
COLE	772	103	34	909	1	1	2	0	0	0	913	6,099	14.97%	4	0.44%
COOPER	189	31	10	230	1	0	0	0	0	0	231	1,291	17.89%	1	0.43%
CRAWFORD	335	29	10	374	2	0	0	0	0	0	376	2,000	18.80%	2	0.53%
DADE	74	22	2	98	3	0	0	0	0	0	101	494	20.45%	3	2.97%
DALLAS	147	21	4	172	1	0	0	0	0	0	173	1,368	12.65%	1	0.58%

Jurisdiction	Blood Lead Level Test Results (µg/dL)										Total Count All Tests	2010 Census Population of Children <72 months	Percent of Total Population (<72 months) Tested	Total Elevated Count Tests >= 10	Percent Elevated Total Tested >= 10
	0-2.9	3-4.9	5-9.9	Total Count Tests <10	10-14.9	15-19.9	20-24.9	25-44.9	45-69.9	>69.9					
DAVIESS	106	17	4	127	0	0	0	0	0	0	127	757	16.78%	0	0.00%
DEKALB	112	6	4	122	0	0	0	0	0	0	122	706	17.28%	0	0.00%
DENT	190	45	7	242	0	0	0	0	0	0	242	1,145	21.14%	0	0.00%
DOUGLAS	258	18	3	279	1	0	0	0	0	0	280	983	28.48%	1	0.36%
DUNKLIN	390	60	7	457	0	0	0	0	0	0	457	2,640	17.31%	0	0.00%
FRANKLIN	818	24	14	856	2	1	0	0	0	0	859	7,862	10.93%	3	0.35%
GASCONADE	172	15	7	194	3	0	0	0	0	0	197	1,009	19.52%	3	1.52%
GENTRY	117	15	5	137	0	2	0	0	0	0	139	542	25.65%	2	1.44%
GREENE	2,747	269	45	3,061	13	3	0	1	1	0	3,079	20,451	15.06%	18	0.58%
GRUNDY	134	38	11	183	3	0	3	0	0	0	189	853	22.16%	6	3.17%
HARRISON	82	10	5	97	2	0	0	0	0	0	99	781	12.68%	2	2.02%
HENRY	238	19	5	262	0	0	0	0	0	0	262	1,583	16.55%	0	0.00%
HICKORY	85	22	4	111	0	0	0	0	0	0	111	535	20.75%	0	0.00%
HOLT	77	12	1	90	2	0	0	0	0	0	92	336	27.38%	2	2.17%
HOWARD	143	7	2	152	2	0	0	0	0	0	154	732	21.04%	2	1.30%
HOWELL	293	62	4	359	0	0	0	0	0	0	359	3,389	10.59%	0	0.00%
IRON	186	48	44	278	1	0	0	0	0	0	279	742	37.60%	1	0.36%
JACKSON	8,315	3,503	261	12,079	49	14	6	7	1	0	12,156	57,177	21.26%	77	0.63%
JASPER	1,713	268	96	2,077	5	3	0	2	0	0	2,087	10,727	19.46%	10	0.48%
JEFFERSON	1,511	128	19	1,658	3	0	0	0	0	0	1,661	18,009	9.22%	3	0.18%
JOHNSON	299	46	12	357	2	3	0	0	0	0	362	4,267	8.48%	5	1.38%
KANSAS CITY	7,664	972	246	8,882	43	11	4	7	1	0	8,948	40,849	21.91%	66	0.74%
KNOX	50	8	2	60	1	0	0	0	0	0	61	323	18.89%	1	1.64%
LACLEDE	374	79	7	460	0	0	0	0	0	0	460	3,029	15.19%	0	0.00%
LAFAYETTE	180	277	0	457	1	0	0	0	0	0	458	2,511	18.24%	1	0.22%
LAWRENCE	353	55	12	420	1	0	0	0	0	0	421	3,220	13.07%	1	0.24%
LEWIS	132	8	5	145	2	0	0	0	0	0	147	762	19.29%	2	1.36%
LINCOLN	604	19	5	628	0	0	0	0	0	0	628	4,892	12.84%	0	0.00%
LINN	120	26	5	151	2	0	0	0	0	0	153	1,009	15.16%	2	1.31%
LIVINGSTON	223	15	8	246	1	0	0	0	0	0	247	1,127	21.92%	1	0.40%
MACON	174	25	10	209	2	0	0	0	0	0	211	1,266	16.67%	2	0.95%
MADISON	282	31	20	333	7	0	0	0	0	0	340	956	35.56%	7	2.06%

Jurisdiction	Blood Lead Level Test Results (µg/dL)										Total Count All Tests	2010 Census Population of Children <72 months	Percent of Total Population (<72 months) Tested	Total Elevated Count Tests >= 10	Percent Elevated Total Tested >= 10
	0-2.9	3-4.9	5-9.9	Total Count Tests <10	10-14.9	15-19.9	20-24.9	25-44.9	45-69.9	>69.9					
MARIES	63	10	0	73	0	0	0	0	0	0	73	680	10.74%	0	0.00%
MARION	419	65	32	516	5	4	0	0	0	0	525	2,373	22.12%	9	1.71%
MCDONALD	197	19	6	222	0	0	0	0	0	0	222	2,022	10.98%	0	0.00%
MERCER	23	4	3	30	0	0	0	0	0	0	30	314	9.55%	0	0.00%
MILLER	254	19	3	276	2	0	0	0	0	0	278	1,932	14.39%	2	0.72%
MISSISSIPPI	332	49	10	391	0	0	0	0	0	0	391	1,084	36.07%	0	0.00%
MONITEAU	165	17	6	188	0	0	0	0	0	0	188	1,306	14.40%	0	0.00%
MONROE	79	7	4	90	0	0	0	0	0	0	90	658	13.68%	0	0.00%
MONTGOMERY	202	36	11	249	0	0	0	0	0	0	249	920	27.07%	0	0.00%
MORGAN	160	18	2	180	1	1	0	1	0	0	183	1,503	12.18%	3	1.64%
NEW MADRID	330	57	6	393	0	1	0	0	0	0	394	1,507	26.14%	1	0.25%
NEWTON	675	92	31	798	1	1	0	0	0	0	800	4,638	17.25%	2	0.25%
NODAWAY	275	30	13	318	1	0	0	1	0	0	320	1,479	21.64%	2	0.63%
OREGON	180	38	1	219	1	0	0	0	0	0	220	736	29.89%	1	0.45%
OSAGE	138	18	8	164	0	0	0	0	0	0	164	1,095	14.98%	0	0.00%
OZARK	94	11	3	108	0	0	0	0	0	0	108	601	17.97%	0	0.00%
PEMISCOT	167	21	0	188	0	0	0	0	0	0	188	1,674	11.23%	0	0.00%
PERRY	140	4	1	145	1	0	0	0	0	0	146	1,533	9.52%	1	0.68%
PETTIS	498	64	38	600	8	3	0	0	1	0	612	3,739	16.37%	12	1.96%
PHELPS	556	73	5	634	1	1	0	0	0	0	636	3,326	19.12%	2	0.31%
PIKE	193	30	8	231	1	0	0	1	0	0	233	1,349	17.27%	2	0.86%
PLATTE	926	43	7	976	1	0	0	0	0	0	977	6,855	14.25%	1	0.10%
POLK	385	33	13	431	1	1	0	1	0	0	434	2,402	18.07%	3	0.69%
PULASKI	272	21	3	296	1	0	0	0	0	0	297	4,660	6.37%	1	0.34%
PUTNAM	46	2	0	48	0	0	0	0	0	0	48	371	12.94%	0	0.00%
RALLS	123	10	5	138	1	1	0	0	0	0	140	768	18.23%	2	1.43%
RANDOLPH	308	46	14	368	2	0	1	0	0	0	371	1,921	19.31%	3	0.81%
RAY	310	41	2	353	0	1	0	1	0	0	355	1,735	20.46%	2	0.56%
REYNOLDS	47	19	4	70	1	0	0	0	0	0	71	476	14.92%	1	1.41%
RIPLEY	201	22	6	229	1	0	1	0	0	0	231	991	23.31%	2	0.87%
SALINE	355	61	22	438	6	1	0	0	0	0	445	1,781	24.99%	7	1.57%
SCHUYLER	42	3	2	47	1	0	0	0	0	0	48	344	13.95%	1	2.08%

Jurisdiction	Blood Lead Level Test Results (µg/dL)										Total Count All Tests	2010 Census Population of Children <72 months	Percent of Total Population (<72 months) Tested	Total Elevated Count Tests >= 10	Percent Elevated Total Tested >= 10
	0-2.9	3-4.9	5-9.9	Total Count Tests <10	10-14.9	15-19.9	20-24.9	25-44.9	45-69.9	>69.9					
SCOTLAND	21	8	1	30	0	0	0	0	0	0	30	470	6.38%	0	0.00%
SCOTT	702	68	14	784	0	0	1	1	0	0	786	3,304	23.79%	2	0.25%
SHANNON	43	4	0	47	0	0	0	0	0	0	47	638	7.37%	0	0.00%
SHELBY	130	23	5	158	0	0	1	0	0	0	159	519	30.64%	1	0.63%
ST CHARLES	2,265	48	13	2,326	2	0	0	0	0	0	2,328	29,474	7.90%	2	0.09%
ST CLAIR	47	6	4	57	0	0	0	0	0	0	57	585	9.74%	0	0.00%
ST FRANCOIS	628	122	39	789	10	0	0	0	0	0	799	4,811	16.61%	10	1.25%
ST LOUIS CO	14,553	969	268	15,790	27	17	5	5	1	0	15,845	70,993	22.32%	55	0.35%
ST LOUIS CITY	8,876	1,660	758	11,294	125	36	17	17	4	0	11,493	24,645	46.63%	199	1.73%
STE GENEVIEVE	202	22	11	235	1	0	0	0	0	0	236	1,239	19.05%	1	0.42%
STODDARD	462	26	7	495	1	0	0	0	0	0	496	2,171	22.85%	1	0.20%
STONE	157	17	4	178	0	0	0	0	0	0	178	1,694	10.51%	0	0.00%
SULLIVAN	201	18	13	232	2	0	0	0	0	0	234	528	44.32%	2	0.85%
TANEY	332	10	0	342	2	0	0	0	0	0	344	3,754	9.16%	2	0.58%
TEXAS	185	19	7	211	0	0	0	0	0	0	211	1,911	11.04%	0	0.00%
VERNON	167	31	10	208	2	2	0	0	0	0	212	1,754	12.09%	4	1.89%
WARREN	410	22	1	433	0	0	0	0	0	0	433	2,746	15.77%	0	0.00%
WASHINGTON	195	39	11	245	3	1	0	0	0	0	249	1,967	12.66%	4	1.61%
WAYNE	125	15	3	143	0	0	0	0	0	0	143	858	16.67%	0	0.00%
WEBSTER	308	64	10	382	3	0	0	0	0	0	385	3,219	11.96%	3	0.78%
WORTH	30	7	2	39	0	0	0	0	0	0	39	124	31.45%	0	0.00%
WRIGHT	262	21	9	292	0	1	0	0	0	0	293	1,569	18.67%	1	0.34%
Grand Total	**73,047**	**10,712**	**2,505**	**86,264**	**378**	**117**	**51**	**43**	**11**	**0**	**86,864**	**468,264**	**18.55%**	**600**	**0.69%**

Data Notes:

-Kansas City tests are reflected in both the Kansas City row and the rows for their respective counties. These tests are counted only once in the grand totals.

Lead Poisoning Prevention Education

CLPPP develops an educational campaign and distributes materials to advocates statewide each year. The campaign goal is to provide stakeholders with the tools necessary to promote lead poisoning prevention. Themes, fact sheets, posters, and public service announcements are examples of campaign materials. The materials are used during lead poisoning prevention month to intensify the statewide effort.

Several educational brochures and fact sheets that focus on specific lead related issues such as *Pregnancy and Lead Poisoning* and *A Health Care Provider's Guide to Lead Screening and Testing Requirements* are also available and can be ordered for community-wide use.

Educational materials are also available and displayed at health fairs, home shows, blood lead testing events, and other public events when possible. Display boards provide visitors with lead poisoning prevention posters, signs, facts, and other educational materials. The display boards are helpful to capture people's attention and draw them in to learn about other healthy homes topics such as radon and mold.

Lead Poisoning Prevention Week (observed in October) campaign information, newsletters, fact sheets, booklets, and other publications are all available to the public on the CLPPP webpage. The webpage also features: upcoming events, lead testing guidelines, Missouri Annual Childhood Lead Testing Area Requirements maps, product recalls, data and statistical reports, laws, regulations, and manuals. CLPPP personnel worked with St. Joseph, St. Francois, Johnson, Audrain, and Gentry Tri-Counties testing for blood lead levels on children less than 72 months during their monthly Women, Infant, and Children (WIC) events. The team also attended a Lead Poisoning Prevention Webinar.

Collaborations

Case Management Services

Case management of children with EBL levels involves coordinating, providing, and overseeing the services required to help reduce the child's blood lead level. During fiscal year 2016, case managers strived to reduce EBL levels to less than 10 µg/dL. It is based on the efforts of an organized team and is child, physician, and family centered. Lead case management services may be provided by the child's primary care physician, LPHA, or a MO HealthNet Managed Care health plan. At times, other disciplines, such as behavioral health, are part of the case management system. In some cases, interpretive services may be indicated and these individuals will also interact with lead case managers. DHSS Childhood Lead Poisoning Prevention staff, along with MO HealthNet and LPHA staff, monitors case management for children identified with a blood lead level greater than or equal to 10 µg/dL. The MOHSAIC system is used to provide a centralized documented record of communications, results, case management interventions, and updated demographic information. This promotes the sharing of the findings and promoting unified support of suggested interventions made by the risk assessors following environmental investigation results.

Environmental Services

The CLPPP provides lead risk assessment services to detect hazardous sources of lead exposure in children's homes. This service is provided for children age six and younger who have a confirmed venous blood lead level of 15 µg/dL or greater and is offered at 10 µg/dL.

A risk assessment is conducted by a professional, trained and licensed by the DHSS Lead Licensing Program. The assessor consults with the child's family to determine areas of the home where the child may come into contact with lead. X-ray Fluorescence Analyzers (XRFs) are used to analyze painted surfaces and household objects. Dust, soil, and water samples are collected to determine if and where lead hazards exist. Upon completing the assessment and receiving the lab analysis, the risk assessor provides the property owner and/or occupant (if other than the owner) with recommendations for reducing lead hazards. The risk assessor revisits the home at an agreed-upon time to assure lead hazard reduction has been accomplished. The risk assessor collaborates with the child's parent or legal guardian, property owner, LPHA or MO HealthNet lead case manager, DHSS CLPPP staff, and the child's physician as indicated, as part of their role in case management of the elevated child. Risk assessment reports are also accessible to team members if a risk assessment was conducted on a child with a blood lead level of 10 µg/dL or greater.

Healthy Homes

Since the beginning of the "Is Your Home Healthy?" exhibit in 2007, the exhibit has been adapted for use at a variety of events throughout the state. The main exhibit focuses on the Healthy Indoor Environments unit in the Bureau of Environmental Epidemiology. The primary programs highlighted are the Childhood Lead Poisoning Prevention Program and the Indoor Air/Radon Program. Information is available on a variety of topics including lead poisoning prevention, radon and mold remediation, the fish consumption advisory, asbestos-containing vermiculite insulation, carbon monoxide poisoning prevention, heat and cold illness prevention, mercury handling and disposal, and other environmental health topics as appropriate for the event and audience. Coloring and activity books, magnets, and stickers are available to capture the interest of guardians and children. Employees from various DHSS programs work the exhibit and are available to answer questions about environmental health concerns from citizens. The exhibit also features hand washing information from the Bureau of Communicable Disease Control and Prevention along with tick and mosquito repellant information from the Vector Borne Disease Program.

Between July 1, 2015, and June 30, 2016, "Is Your Home Healthy?" was displayed at 40 different venues across the state and provided 11,898 handouts. These included the new Local Public Health Administrators training; St. Louis, Kansas City, and Jefferson City Home Builders Association Home Shows; Missouri School Nurse Conference; Missouri Environmental Educator Conference; and school and community health fairs.

The "Is Your Home Healthy?" exhibit is an ongoing collaborative effort between the Bureau of Environmental Epidemiology programs, the Bureau of Communicable Disease Control and Prevention, the Vector Borne Disease Program, and the local health departments. This outreach effort continues to help build partnerships with outside organizations such as Parents as Teachers, child advocates, school nurses, contractors, environmental health professionals, senior citizen groups, and parents. At the same time, it provides valuable information to and helps educate the citizens of Missouri about environmental hazards in their homes.

Agency for Toxic Substance and Disease Registry (ATSDR)/Environmental Protection Agency (EPA)/Missouri Department of Natural Resources (MDNR)

Lead mining, milling, and smelting have occurred throughout the lower half of Missouri. Missouri ranks as the top lead-producing state in the nation. Across the state, there are 60 counties that are potentially impacted by lead mining-related activities.

Historical lead mining, milling, and processing have resulted in innumerable tons and acres of waste products, such as tailings and chat. Over time, tailings and chat have migrated into the surrounding communities. The migration has been caused by wind or water erosion, as well as human activities, such as using the lead waste as fill material in yards, driveways, and sandboxes or using the chat for traction along roads in winter. Because of the lead mine waste and the resulting contamination into nearby communities, Missouri has many sites placed on the Environmental Protection Agency (EPA) National Priorities List (NPL) for remediation. In St. Francois County, six large mine tailings and chat piles from past mining and milling operations are located near residential areas. Other major lead mining sites that have been placed on the NPL due to residential contamination include Madison and Jefferson counties; sites in Newton, Jasper, and Iron counties; and four sites in Washington County. The active lead smelter in Herculaneum, Missouri, ceased operation on December 31, 2013. The smelter processed lead concentrate from active mining and milling operations in nearby counties into lead ingots for use in consumer products like batteries and computers. Lead contamination resulting from the smelter operations is also being addressed in the community of Herculaneum.

DHSS, along with other state, local and federal agencies (including ATSDR, EPA, and MDNR), is addressing these sites to protect public health. Multiple actions have been taken to reduce human exposure and prevent lead poisoning, especially to children less than six years old. Some of the actions taken by partnering agencies at the various sites to reduce exposure include monitoring of air, sampling of soil, water, and dust, stabilization of the tailings piles, yard soil removals, street cleanings, interior home cleaning, reduction in smelter air emissions, and special blood lead testing events. Additional activities conducted by DHSS include health studies, health consultations, public health assessments, and ongoing educational activities.

Brownfield Project

Vast areas of Missouri may have high levels of lead in soil and/or groundwater due to naturally occurring lead deposits and from past and present lead mining and production. Given the recent rapid expansion of urban sprawl, many previously undeveloped properties are now being looked at by developers for residential housing and other types of increased land use. Development of this nature on mining-impacted lands potentially exposes new populations to lead and other heavy metal contaminants.

Under a grant from ATSDR, DHSS acted to increase testing for lead in drinking water by working with the State Public Health Laboratory to add lead to its list of analytes included in the New Well Series for private drinking water supplies and by recommending actions that local public health agencies can take to increase testing. DHSS also developed health education materials to promote water testing for lead. To assist in responding to homeowner concerns for those identified with lead impacts to their drinking water system, a lead in drinking water fact sheet was developed that can be provided along with test results with recommendations for reducing exposure. These health education materials can be found at the following DHSS web site: http://health.mo.gov/living/environment/lead/publications.php#gov.

DHSS Lead Licensing Program

The Lead Licensing Program is responsible for licensing individuals to conduct lead abatement, inspections, and risk assessments. Employees of this section may make unannounced site visits to check that all individuals have the proper current license and that lead abatement is being conducted correctly and safely. This is to ensure the safety of the residents who may not know the harmful effects of improper lead abatement work practices. Like CLPPP, the Lead Licensing Program plays an important role in keeping people healthy and safe from lead poisoning. All risk assessors that are a part of CLPPP are licensed and overseen by the Lead Licensing Program.

Missouri Department of Social Services (MDSS), MO HealthNet Division (MHD)

Poverty is one major risk factor for lead poisoning. DHSS and MHD have had a cooperative agreement in place since 1998. This agreement outlines the agencies' mutual objectives regarding childhood lead poisoning to: 1) assure that MO HealthNet eligible children are screened/tested according to the Statewide Lead Testing Plan; and 2) assure that medically necessary services are provided for MO HealthNet eligible children whether by a MO HealthNet enrolled provider or a MO HealthNet Managed Care health plan for the correction or amelioration of lead poisoning related conditions identified through a full or partial Early Periodic Screening Diagnosis and Treatment. During FY2016, MO HealthNet staff assessed the current MO HealthNet status of all Missouri children with confirmed blood lead levels 10 µg/dL or greater. MO HealthNet staff generates a health plan specific report of elevated health plan members that is forwarded to each health plan lead case manager for case management of the elevation. Lead case management activities for these elevated health plan children are documented by the health plan lead case managers, directly into the MOHSAIC Lead Case Management Application. This documentation helps to facilitate greater and timelier communication regarding follow-up of elevated children among the MO HealthNet Managed Care health plans, MHD, DHSS, and the LPHAs. DHSS staff representation on the Central Area Headstart Advisory Committee provides opportunities for education and outreach regarding lead poisoning awareness and prevention activities in the community.

Women, Infant, and Children (WIC) Program

High blood lead levels that affect intelligence, behavior, and the development of children less than six years of age disproportionately affect minority and poor children. The Special Supplemental Nutrition Program for WIC is an important partner in efforts to combat the health risks of lead poisoning. By identifying high-risk children through a screening process during WIC clinic visits, referring children to their primary care provider for testing, or making blood lead testing available on-site, the likelihood that more children will be blood lead tested is improved. This practice also helps to identify elevated children, as well as initiate timely and appropriate follow-up care.

Missouri Department of Economic Development (DED)

The Missouri Department of Economic Development FY 2013-2017 Consolidated Plan produced by DED includes Targeted and Universal Testing Area maps, blood lead testing data by county, and percentage of pre-1950 housing data for the state. The document also contains the Missouri Housing Development Commission's lead-based paint policies and procedures and the HOME Repair (HERO) Program's and HOME Rental Production Program's lead-based paint reference guide.

Missouri Local Public Health Agencies (LPHAs)

Many LPHAs offer blood lead testing within their counties. Some agencies offer free blood lead testing or referrals to providers that offer testing. Most of these agencies have a nurse that assists with case management for children who have elevated lead levels; however, this nurse works in collaboration with the child's primary care physician, parent or guardian, managed health care plan, if the child is enrolled, and environmental risk assessors. DHSS' CLPPP staff collaborates with LPHA staff on elevated lead cases to provide initial and ongoing technical assistance regarding lead case management activities, as well as environmental risk assessment. Lead poisoning education and outreach is often offered at the LPHA level at health fairs, through physician offices, childcare facilities, and upon request. LPHAs utilize lead poisoning prevention campaigns to assist in raising community awareness regarding lead poisoning and its health effects. LPHAs are often a primary contact for parents of children attending childcare facilities where proof of lead testing is required. This is typically a convenient access point for lead testing and opportunity for provision of educational lead information to families. The Childhood Lead Poisoning Prevention Program also provides these agencies with educational materials and technical assistance for other related issues such as the use of the MOHSAIC application, lead case management training, and current program and regulatory requirements. The support and ongoing efforts of the LPHAs regarding childhood lead poisoning and its prevention play a key role in the primary goal to eliminate childhood lead poisoning.

St. Louis City, St. Louis County, and Kansas City are Missouri's three largest metropolitan areas. According to 2016 surveillance data, these three areas combined contain 53 percent of Missouri's children with elevated blood lead levels (320 of 600). These three areas along with Jasper County, Greene County, and Jefferson County have lead poisoning prevention programs that are managed by the LPHAs. To decrease the prevalence of EBLs in these areas, DHSS collaborates with these LPHAs, who provide lead poisoning prevention educational activities, assure case management, and environmental risk assessments.

DHSS collaboration efforts include loaning department-owned XRFs to three LPHAs for lead-related work activities. Jefferson County and Jasper County each have lead poisoning prevention programs where the XRFs are utilized. Madison County has an ongoing project using the XRF to measure lead levels in soil. The department was able to loan an XRF to each of these counties, as they were not able to purchase their own XRFs for their programs. The loaning of the XRFs to these lead programs provides a fast, accurate alternative for those programs to identify lead hazards and promote the remediation of those hazards.

For more information on lead poisoning prevention contact:

Missouri Department of Health and Senior Services
Bureau of Environmental Epidemiology
930 Wildwood Drive
Jefferson City, MO 65109
Phone: (573) 751-6102 or (866) 628-9891

Or visit our website at:
http://health.mo.gov/living/environment/lead/index.php

DATA INFORMATION REQUEST
Missouri-American Water Company
WU-2017-0296

Requested From: Tim Luft
Date Requested: 8/9/17

Information Requested:

Referencing OPC DR-2001, please provide the zip codes for each and every 189 samples and indicate whether or not the line was connected to a residential, commercial, industrial or other unit.

Requested By: Geoff Marke – Office of Public Counsel – geoff.marke@ded.mo.gov

Information Provided:

The samples were taken at premises of residential customers.

Zip Code	Sample 1 - Post Flush	Sample 2 - Still	Sample 3 - Post Flush	Sample 4 - Still
63105	74	72	8	3
63119	9	9	2	
63125	1	1		
63138	1	1		
63144	3	4	1	
64501	10	8		
64503	3	2		
64504	1	1		
64505	5	4		
64506	1	1		
64507	12	9	1	
Grand Total	**120**	**112**	**12**	**3**

Responsible witness: Bruce Aiton

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

SURREBUTTAL TESTIMONY

OF

GEOFF MARKE

Submitted on Behalf of the Office of the Public Counsel

MISSOURI-AMERICAN WATER COMPANY

CASE NO. WU-2017-0296

****** ******

Denotes Confidential Information
that has been Redacted

September 14, 2017

Public

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Missouri-American Water Company for an Accounting Order Concerning MAWC's Lead Service Line Replacement Program	)))))	File No. WU-2017-0296

AFFIDAVIT OF GEOFF MARKE

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

Geoff Marke, of lawful age and being first duly sworn, deposes and states:

1. My name is Geoff Marke. I am a Regulatory Economist for the Office of the Public Counsel.

2. Attached hereto and made a part hereof for all purposes is my surrebuttal testimony.

3. I hereby swear and affirm that my statements contained in the attached testimony are true and correct to the best of my knowledge and belief.

Geoff Marke
Chief Economist

Subscribed and sworn to me this 14th day of September 2017.

NOTARY PUBLIC NOTARY SEAL STATE OF MISSOURI

JERENE A. BUCKMAN
My Commission Expires
August 23, 2021
Cole County
Commission #13754037

Jerene A. Buckman
Notary Public

My commission expires August 23, 2021.

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SURREBUTTAL TESTIMONY

OF

GEOFF MARKE

MISSOURI-AMERICAN WATER COMPANY

CASE NO. WU-2017-0296

I. INTRODUCTION

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

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

Q. Are you the same Dr. Marke that filed direct and rebuttal testimony in WU-2017-0296?

A. Yes.

Q. What is the purpose of your surrebuttal testimony?

A. The purpose of this testimony is to respond to rebuttal testimony of:

- Missouri American Water Company ("MAWC") witnesses:
  - Gary A. Naumick and Bruce W. Aiton
- Missouri Public Service Commission ("Staff") witnesses:
  - James A. Merciel, Jr., PE and Jonathan Dallas
- Missouri Department of Economic Development, Division of Energy ("DED" or "DE") witness:
  - Martin R. Hyman

Executive Summary:

Q. Summarize OPC's position.

A. OPC continues to recommend 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 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.

Q. Why is OPC's proposed pilot study the best path forward?

A. As I noted in my prior testimony. The issue of lead line replacements cuts across public health, scientific, technical, and legal arenas and should not be viewed as a linear engineering exercise alone. The Company's proposal falls short in addressing the multitude of issues presented by a plan to remove customer-owned lead service lines. Importantly, OPC's proposed pilot program presents a path forward to address the issues while permitting the Company to continue replacing lead service lines as the pilot is conducted. OPC's proposed pilot study from its direct testimony provides the framework to facilitate the substantive research, planning and communication to mitigate known risks and to anticipate and plan for the otherwise unintended consequences that are undoubtedly linked to this complex, decade(s)-long policy reform.

Summary of Policy Objections Offered by Other Parties

Q. Please summarize MAWC's policy response to OPC's pilot proposal.

A. Without replying to any specific action items or explicit objectives raised in OPC's direct testimony, the Company dismisses OPC's proposal as unnecessary and redundant. Mr. Naumick cites four general objections:

1. It is redundant to the voluminous amount of research already conducted across the country.

2. It would impose unnecessary costs on Missouri-American Water Company's ("MAWC", Missouri-American" or "Company") customers;

3. It contains proposed tasks that are beyond the scope and purview of any water utility; and

4. It would delay the important public health benefit to Missouri-American's customers that implementation of the Company's lead service line proposal ("LSLR") program will provide.[1]

Referencing secondary support of his argument, Mr. Naumick cites to the EPA's Lead and Copper Rule (LCR) Revisions white paper (Oct. 2016) and believes that OPC's study would be duplicative of national efforts, specifically those undertaken by the Lead Service Line Replacement Collaborative ("LSLRC").[2]

MAWC's second policy witness, Mr. Aiton, admits that both the estimated number of lead service lines and the estimated costs are subject to change and that "we will adjust this estimate as additional information is gained."[3]

Mr. Aiton also takes the position that no further analysis is necessary as "the case for full lead service line replacement has been established by EPA and public health experts"[4] and that MAWC "will incorporate input from local public health agencies for potential identification and prioritization of premises and areas in which to focus our efforts. . ."[5] presumably, on a going-forward basis.

Q. Please summarize Staff's policy response to OPC's pilot proposal.

A. Staff policy witnesses Merciel and Dallas also do not reply to any specific action items or explicit objectives from OPC's direct testimony with the exception of a singular "concern"

[1] Rebuttal Testimony of Gary A. Naumick, p. 1, 22-23 & p. 2, 1-5.
[2] Ibid. p. 8, 18-19.
[3] Rebuttal Testimony of Bruce W. Aiton p. 3, 5.
[4] Ibid, p. 4, 1-3.
[5] Ibid. p. 4, 4-6.

raised by Mr. Merciel requesting guidance from the Commission on any future workgroups that are charged solely with discussing the issue of lead in drinking water.

Staff supports the Company's request; however, Mr. Merciel's testimony unintentionally highlights the ambiguity of the application and inconsistency within Staff's position. At one point, Mr. Merciel emphasizes that:

> MAWC is not proposing a comprehensive program to replace all LSLs. MAWC's proposed program in this AAO case is a limited LSL replacement program to take advantage of accessibility during water main excavation, and is designed to eliminate a potential source of lead contamination with limited service disruption to the customer.[6]

However, later he states:

> **Staff firmly believes that the public benefit of removing any lead-based water service lines outweighs the estimated costs associated with these removals**. (emphasis added)[7]

Taken together, Staff's position appears to support both a narrowly focused lead-line replacement program (i.e., limit replacement to lead service lines in combination with future main replacements) and an all-in abatement position in which the public benefits outweigh the costs of *any* lead service lines. The latter declarative statement is void of context as Staff is certainly aware that partial lead service lines have been passed over during main replacements. Further questions remain about Staff's position. Does Staff support *any* lead service line removal at *any* cost? Does Staff support removal not in combination with main replacement? Has Staff performed a cost-benefit analysis? Regarding costs, Mr. Merciel does opine that the Company's estimates for St. Louis County's are likely understated.

> However, the stated cost range is probably not realistic for the St. Louis County service area.[8]

[6] Rebuttal Testimony of James A. Merciel, Jr., PE p. 6, 12-15.
[7] Ibid. p. 9, 4-6.

In support of Staff's position, Mr. Merciel also includes select press releases from of lead service line replacement "programs" undertaken in other water systems as well as a copy of the US EPA's Science Advisory Board's ("SAB") literature review on partial lead service line replacements. On the latter example, he notes that the SAB review explicitly states that minimal or inadequate data exists regarding studies of partial LSL replacements.

Staff witness Dallas recounts a site visit of a MAWC lead service line replacement and explains MAWC's lead service line identification practice.

Finally, both witnesses reference Flint, Michigan (water crisis) and the EPA's Lead and Copper Rule (LCR) Revisions white paper (Oct. 2016) as additional secondary support for Staff's policy position.

Q. Please summarize the Missouri Department of Economic Development, Division of Energy's position.

A. DED witness Hyman supports the Company's position and rejects OPC's position on the basis that it would delay public health actions. Mr. Hyman's argument appears to rest largely on concerns of affordability for low income households; although he does deviate from the other two parties position for a brief moment to acknowledge there is some merit to OPC's concerns, stating:

> Dr. Marke's question as to real estate and legal ramifications is worth exploring.[9]

This passing reference is short lived, as Mr. Hyman states:

> However, there is no need to delay finding the answers to such questions for two years past the conclusion of a general rate case, or to subject homeowners to potential health hazards for that length of time in order to answer such concerns.[10]

[8] Ibid. p. 7, 21.
[9] Rebuttal Testimony of Martin R. Hyman p. 10, 5-6.
[10] Ibid. p. 10, 6-9.

Q. Do the other parties accurately portray OPC's position?

A. No. To be clear, OPC is not saying no to full lead service line replacements. Instead, we are saying "we don't know." In fact, OPC's pilot proposal is designed to permit the Company to continue replacing lead service lines while other policy questions are examined. This is a crucial distinction. The Commission should be contemplative and hesitant to endorse the Company's overly simple solution to complex problem(s) and be skeptical of Staff and DED's blanket support without foundation or necessary scrutiny.

Consider the insufficient timing and detail surrounding MAWC's proposal. MAWC's application, submitted 125 days ago, contained a total of 280 words informing the Commission of the "Presence of Lead Service Lines" and requesting approval of the Company's "Lead Service Line Replacement Program."[11]

The Company filed direct testimony only 45 days ago. Contrast the brevity of support for the filing and the limited opportunity for review with the magnitude of costs, the uncertainty of public benefits, and the potential for negative unintended consequences in an unprecedented regulatory decision.

Q. Should MAWC's proposal be given regulatory approval even though the costs and benefits are so uncertain and the application is silent on so many questions?

A. No. It would be difficult, and certainly not appropriate, to make competent, informed decisions absent adequate information and proper subject-matter expert feedback. The absence of the agencies charged with representing relevant interests in this case should give the Commission pause.

The testimony of Mr. Hyman, rather than supporting the Company as he intended, inadvertently bolsters OPC's position that a pilot program is necessary. Mr. Hyman, an

[11] According to Word Counter: "For those who need a general rule of thumb, a typical page which has 1-inch margins is typed in 12 point font with standard spacing elements will be approximately 500 words when typed single spaced. For assignments that require double spacing, it would take approximately 250 words to fill the page. https://wordcounter.net/blog/2015/09/18/10655_how-many-pages-is-2000-words.html

employee of the Missouri Department of Economic Development, Division of Energy offers his opinion on low-income public health outcomes for a water utility's construction program. His testimony should be seen in contrast with the absence of the Missouri Department of Natural Resources (the department charged with enforcing the Lead and Copper Rule), the Missouri Department of Health and Human Services (the department charged with collecting and monitoring the blood lead levels ("BLLs") in Missouri, and the Missouri Department of Social Services (the department charged with advocating for low-income families and low-income children).

OPC's Position

Q. What is OPC's position?

A. Based on OPC's exploratory research and communication with outside experts on this topic (see GM-1) it is abundantly clear that both the expedited schedule and the confined regulatory procedure are inappropriate for the complexity and magnitude of this case.

OPC has put forward a reasonable alternative for all parties and the public interest by drafting a pilot project that incorporates absent expertise and includes explicit deliverables. Importantly, OPC's pilot study specifically includes full replacement of lead service line pipes (both the utility and customer-side) but marries it with evidence-based research. Additionally, our proposed annual budget is double what MAWC is projected to expend in 2017.

The pilot project also asks difficult questions without easy answers and recognizes that the decision to move forward with proactive customer-side premise replacement based on public health concerns is not made in a vacuum—other parties should and need to be present and the ultimate decision may extend beyond the Commissions purview. As it stands, the Company's application and the supporting testimony is deficient and void of appropriate analysis and will likely result in adverse secondary and potentially tertiary impacts on ratepayers.

If this issue was as simple as the 280-word application[12] the EPA would already have explicit rules in place and there would be regulatory uniformity across the states. Neither of those statements is true. MAWC's application does not consider the consequences of its requested action. Consider what would happen if customers began to demand that MAWC disclose its 30,000 "known" lead service lines? More to the point, is MAWC legally (or ethically) obligated to disclose such information?[13] As it stands, the MAWC estimate is now public knowledge but with no detailed prioritization, disclosure, or education and communication plan. Most, if not all of the secondary literature quoted by the Company and Staff support customer transparency for both lead testing and lead service line locations. Of course it should also be noted that most of that literature is referencing public municipal systems not private, investor-owned systems where disclosure requirements may differ. This, itself, raises additional questions. What information should be disclosed? Will disclosure have an adverse impact on home values? Will it impact businesses? Will disclosure reduce the availability of low-income housing stock?

Beyond the impact of disclosure, the replacing of lead service lines raises additional questions. Will removing the full lead line increase lead exposure? Will ratepayers be given a false sense of security if the lead service line is removed but premise plumbing remains? Would a temporary filter be more cost-effective? Should schools, daycares, children and pregnant women be prioritized? Do the public benefits outweigh the public costs?

As it stands, OPC, nor any party can definitively say yes or no to any of these questions. More troubling is that no party to the case seems to have the answers. This is an unsettling prospect given the universe of potential negative outcomes. OPC's proposal is the only plan put forward to mitigate that uncertainty and provide a measured proactive response.

[12] The amount of words devoted specifically explaining the context and plan of the application.
[13] In this respect, the recent experience from Flint, Michigan can provide some insight and will be explored in greater detail later in this surrebuttal.

The Commission should reject the Company's application and encourage the parties to pursue OPC's proposed pilot program.

II. RESPONSE TO MAWC'S CLAIM OF REDUNDANT RESEARCH AND DUPLICATIVE COLLABORATION

Q. The Company believes that no additional research is warranted. Please respond.

A. This argument is without merit. The Lead Service Line Replacement Collaborative itself recognizes the need for additional research[14] Staff witness Mr. Merciel's rebuttal testimony also cited the scientific uncertainty surrounding the short and long-term exposure of lead from partial replacements according to the EPA's Scientific Advisory Board. The Commission should also consider that no independent research has been put forward by American Water based on its pilot studies of full and partial lead line replacement in New Jersey and Illinois. In fact, not one specific study (American Water sponsored or otherwise) is put forward as proof that this issue is settled. Instead, Mr. Naumick footnotes a Water Research Foundation ("WRF") literature review of completed and ongoing projects on the issue of lead and copper corrosion and the Lead and Copper Rule. A review of the WRF paper lists 47 studies over a twenty-seven-year period of which only three explicitly examine partial or full lead service line replacement. The most recent of which was published in 2013. The reality is that research into the topic of partial and full lead line replacement is still limited. In fact, according to Rosen et al (2017):[15]

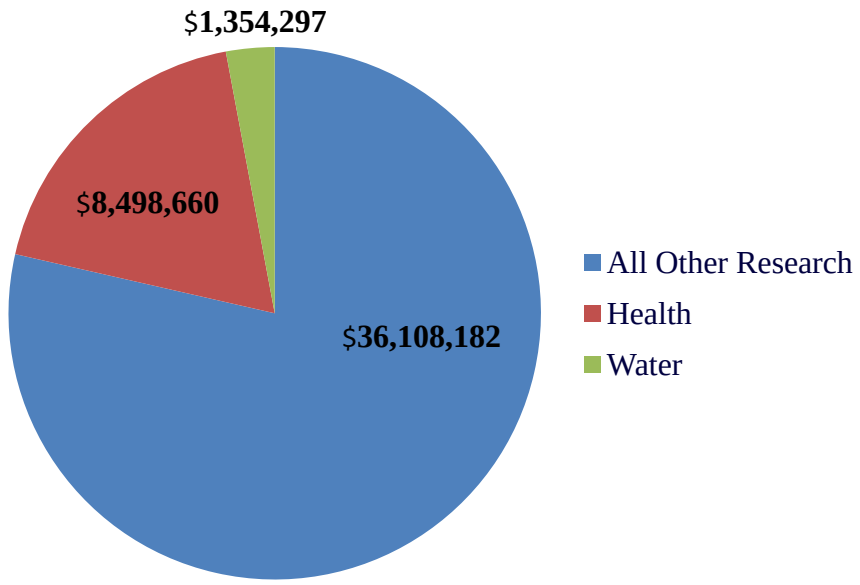
> For the period between 2008 and 2016, Federal non-defense spending in the US accounted for $648.87 billion of which $343.34 billion was dedicated to health

[14] Lead Service Line Collaborative (2017) Filling information gaps through research http://www.lslr-collaborative.org/research-needs.html

[15] Rosen et al. (2017) A discussion about the public health, lead and Legionella pneumophila in drinking water supplies in the United States. *Science of the Total Environment*. https://www.researchgate.net/profile/Lok_Pokhrel2/publication/313842318_A_Discussion_about_Public_Health_Lead_and_Legionella_pneumophila_in_Drinking_Water_Supplies_in_the_United_States/links/592847100f7e9b9979a35976/A-Discussion-about-Public-Health-Lead-and-Legionella-pneumophila-in-Drinking-Water-Supplies-in-the-United-States.pdf

research.[16] However, in this same time frame of Federal research or research and development (R&D), a total of $45.96 million was spent on grants where the driving focus was Pb [lead] related.[17] Once this value is parsed further, we can see in Fig. 4B [reprinted below as Figure 1] how these Federal R&D expenditures are spent. The category All Other Research has research projects such as advanced batteries and other technology development. What is quite startling is the lack of water Pb research. In total from 2008 to 2016 (years for which data are readily available to the public), only $1,354,297 was spent on projects researching Pb in water, whether being related to health or not.

Figure 1: Reprint of Rosen et al (2017), US Federal research expenditures related to Pb (Lead) for the period of 2008-2016.[18]



[16] American Association for the Advancement of Science (2016) Historical Trends in Federal R&D. https://www.aaas.org/page/historical-trendsfederal-rd. qtd in. Rosen et al. (2017)
[17] USA Spending (2016) https://www.usaspending.gov/Pages/Default.aspx. qtd in. Rosen et al. (2017)
[18] Ibid.

Q. The Company argues that OPC's proposal is redundant to efforts already taken at the national-level by the Lead Service Line Replacement Collaborative ("LSLRC"). Please respond.

A. This argument is also without merit. OPC designed its pilot project largely off of the suggestions and "roadmap" provided by the LSLRC. Missouri is a home-ruled state with many individual laws in place regarding zoning and disclosure.[19] To dismiss, out-of-hand, the idea that a localized collaborative of diverse stakeholders would provide no service is contrary to what is actually espoused by the LSLRC. To illustrate this I have included the entirety of the "Getting Started" introduction of the LSLRC Roadmap below:

> **Getting Started**
>
> Local elected officials and community leaders should start by contacting the local water utility to ask whether a proactive initiative for full lead service line (LSL) replacement is underway in the community. A useful first step could also include contacting local experts at nearby consulting engineering firms, neighboring water utilities, and colleges or universities (e.g. in the environmental engineering department) for information about LSL replacement.
>
> **Water utilities in the process of planning a proactive LSL replacement initiative or reviewing ways to accelerate an existing initiative, will find it useful to engage local leaders, state agencies, and others early to get their perspectives and expertise. Additionally, local elected officials or water utilities could form an advisory group to discuss options and/or an internal team to help coordinate the planning process.**
>
> In getting started, people may not initially agree on whether and/or how to implement a full LSL replacement initiative. Some community members or public

[19] Mo. Const. Art. VI, Sec. 19(a); See also Home rule in the United States (2017) https://en.wikipedia.org/wiki/Home_rule_in_the_United_States

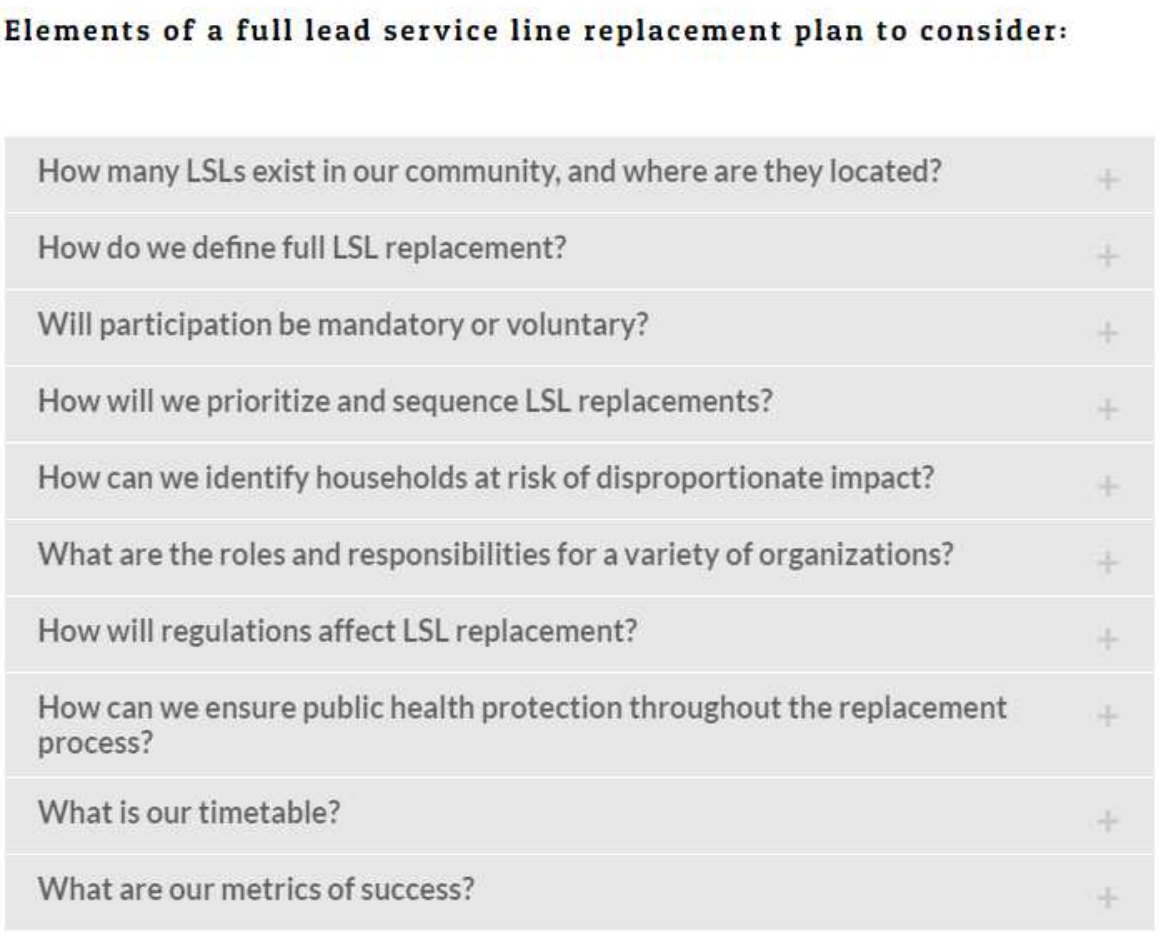
officials may place a priority on moving ahead aggressively, whereas others will have questions or concerns. **A collaborative process that engages all voices in the community with respect for different perspectives will help to ensure everyone is on the same page and working together towards a common goal.**

1. Scoping
2. Identifying Partners
3. Building Consensus
4. Making Decisions[20]

Mr. Naumick's argument is categorically incorrect. To further support this, Figure 2 contains a webpage snapshot from the LSLRC's "Plan Development" section highlighting the necessary questions to consider.

[20] LSLR Collaborative (2017) Roadmap: Getting Started http://www.lslr-collaborative.org/getting-started.html

Figure 2: Example of LSLRC's plan development questions[21]



OPC would concur with the questions and sentiments espoused by the Lead Service Line Collaborative as it pertains to the questions that need to be considered and have echoed similar sentiments throughout this filing.

[21] Lead Service Line Replacement Collaborative (2017) Roadmap: Plan Development http://www.lslr-collaborative.org/plan-development.html

III. RESPONSE TO MAWC'S CLAIM OF UNNECESSARY COSTS

Q. Mr. Naumick contends that OPC's pilot project would impose unnecessary costs on MAWC's customers. Please respond.

A. It seems inappropriate to criticize OPC's budgetary proposal when the Company has not been forthright with its own cost estimate. Be that as it may, OPC reaffirms its proposed costs as both prudent and necessary, in part, because the Company's own estimates are so uncertain. As stated in my rebuttal testimony, and reprinted here in table 1, the range of projected lead service line replacement costs in the Company's application are both extreme and critically uncertain.

Table 1: Projected Lead Service Line Replacement Costs in Company Application.

Source	# of Service Lines	MAWC low/high Estimated Cost	Total Cost
MAWC territory estimate	30,000	$3,000 per unit	$90,000,000
MAWC territory estimate	30,000	$5,500 per unit	$165,000,000
AWWA territory estimate	330,000	$3,000 per unit	$990,000,000
AWWA territory estimate	330,000	$5,500 per unit	$1,815,000,000

These large costs underscore the importance of the need to perform a cost-benefit analysis and explore all available options. For example, a thorough review of cost mitigation strategies would consider alternatives such as "point-of-use" lead-free water filters. Today, an NSF lead-free water filter can be obtained for under $50.00.[22] If the argument is that a partial lead line replacement potentially elevates lead exposure in the short-term would an NSF water filter represent a reasonable cost-effective alternative?

According to the EPA's Flint, MI Filter Challenge Assessment (2016) which examined the efficacy of Brita and Pur Brand filters to remove lead at homes with known lead service

[22] Email discussion with the EPA places the purchase price in Flint at approximately $30 with replacement cartridges at $10/per. A filter is designed to handle 100 gallons of water. When using water for non-drinking purposes (i.e., washing), there is a by-pass valve to use unfiltered water.

lines, confirmed at-risk populations, and/or Flint homes with the highest concentration of tested lead:

> Lead levels in filtered water averaged less than 0.3 µg/L and all sample results were well below EPA's action level. . . . the Brita and Pur filters distributed in Flint are effective in consistently reducing the lead in tap water, in most cases to undetectable levels, and in all cases to levels that would not result in a significant increase in overall lead exposure. ATSDR also reported that the filter test data supports the conclusion that the use of filtered water would protect all populations, including pregnant women and children, from exposure to lead-contaminated water.[23]

Lead-free water filters have also been historically utilized by the EPA at federally designated Superfund sites found in Missouri's old lead belt (see GM-2). These are areas where the concentration of lead in ground water is known to exceed the EPA action level primarily from historical lead mining extraction and/or smelting operations at sites found in Desloge, Fredericktown and Joplin.[24] There are thirty-three EPA Lead Superfund sites in Missouri with sites found in St Louis and St. Charles Counties.[25] To the extent OPC's proposal could identify alternative solutions that produce superior public benefits at a fraction of the price, concerns regarding the cost of ratepayers should support OPC proposal.

[23] US EPA (2016) Flint, MI filter challenge assessment. https://www.epa.gov/sites/production/files/2016-06/documents/filter_challenge_assesment_field_report_-_epa_v5.pdf
[24] US EPA (2017) Lead at Superfund Sites https://www.epa.gov/superfund/lead-superfund-sites
[25] US EPA (2017) National Priorities List (NPL) Sites-by State Missouri. https://www.epa.gov/superfund/national-priorities-list-npl-sites-state#MO

IV. RESPONSE TO COMMENTS REGARDING DELAYED HEALTH BENEFITS

Q. Both the Company and DED reject OPC's proposal, in part, because it would delay public health benefits. Please respond.

A. This is not true. To highlight a few key points for consideration:

1. OPC's proposal explicitly includes the provision for full lead service line replacements at a budget that was double what the Company projects to spend this year;[26]
2. MAWC is currently in compliance with the Lead and Copper Rule. There is no immediate system-wide health hazard;[27]
3. Any time lead-based premise plumbing is disturbed there is an increased chance for lead contamination whether it is partial or full;[28]
4. The mere removal of the full lead service line is no guarantee that a premise is free of potential lead exposure. Absent proper education and communication of potential lead hazards; ratepayers may be given a false sense of security. For example, high lead levels were found in a number of water samples four years after all of the lead service line pipes were replaced in Madison, Wisconsin;[29]
5. While no amount of lead is safe, the same amount can have different impacts on different populations. For example, the negative effects of lead exposure are

[26] Direct Testimony of Geoff Marke, p. 5, 10-17 & p. 6, 1-4.
[27] See GM-2 in the Direct Testimony of Geoff Marke
[28] American Water Works Association (2014) Communicating about lead service lines: A guide for water systems addressing service line repair and replacement. https://www.awwa.org/portals/0/files/resources/publicaffairs/pdfs/finaleadservicelinecommguide.pdf
[29] Cantor E. (2006) Diagnosing corrosion problems through differentiation of metal fractions. *Journal of the American Water Works Association*; 98 (1): 117. https://www.awwa.org/publications/journal-awwa/abstract/articleid/15379.aspx

heightened for children under six and pregnant women. For this reason, some states have prioritized lead testing at schools;[30]

6. Excavation or extraction of lead-based products requires additional remedial precautions (per OSHA and EPA rules) for workers at the site, and in the lead disposal to ensure there is no continued contamination—e.g., soil around the house; [31]
7. Hazardous lead exposure is far more likely to come from sources separate and aside from the water distribution system (e.g., paint and soil). Focusing on a single-source leads to a boutique approach to research and mitigation. The spectrum of realistic exposures, hazards and risks needs to be understood to properly ensure public health and safety;[32]
8. A NSF Standard 53 certified lead-free water filter, properly installed will provide safe tap water;[33]
9. It is not clear what "delay" means. Based on the Company's estimate, the best case-scenario is that its proposal would take ten years to complete. This estimate is based on removing 3,000 lead service lines each year or a little more than 8 successful excavations a day for the next 3,650 days. Clearly, this will not be a quick process.[34] Whether these numbers are feasible or should be adjusted up or down for cost and benefit is a reasonable and necessary consideration for the Commission; and

[30] Governor of New York State (2016) Governor Cuomo signs landmark legislation to test drinking water in New York schools for lead contamination. https://www.governor.ny.gov/news/governor-cuomo-signs-landmark-legislation-test-drinking-water-new-york-schools-lead
[31] EPA (1993) Lead Abatement for workers. https://www.epa.gov/sites/production/files/documents/wkrch3_stu_eng.pdf
[32] National Center for Healthy Housing. (2008) What we do: Lead. http://www.nchh.org/What-We-Do/Health-Hazards--Prevention--and-Solutions/Lead.aspx
[33] US EPA (2016) Flint, MI filter challenge assessment. https://www.epa.gov/sites/production/files/2016-06/documents/filter_challenge_assesment_field_report_-_epa_v5.pdf
[34] Dupnack, J. (2017) Pipe replacements delayed after vandals destroy contractor's equipment. ABC 12 http://www.abc12.com/content/news/Vandals-delay-pipe-replacements-in-Flint-422102343.html

10. What are the public health benefits of individual lead service line replacements in a water system that is in compliance with the Lead and Copper Rule? Of the universe of items in which to direct limited funds, is this best option? Will the Company's scarce proposal produce the greatest ratepayer or societal benefit for the range of estimated costs requested?

Far from delaying any public health benefit, OPC's proposal is designed to help minimize public health threats and provide proper context for appropriate action.

V. RESPONSE TO ASSERTIONS REGARDING THE EFFORTS OF OTHER UTILITIES

Q. Both Staff and the Company cite to other utilities that are proactively removing lead service lines in other states as support for their position. Please respond.

A. There is no suitable comparable utility effort that I am aware of. If there was, parties would no doubt be citing to it directly and relying on its actions to further justify their position. Consider the map of examples Mr. Naumick's provides in his attachment and reprinted here on Figure 3.

Figure 3: Mr. Naumick's examples of lead service line efforts in local communities

The examples listed above can be broken down as:

- Specific local municipal efforts that are pursuing "some" element related to lead service line removal (see WA-Tacoma, CO-Denver, OH- Cincinnati, PA-Philadelphia and WI-Milwaukee);
- States which are exploring legislative policy changes or undergoing studies to determine the size of the problem (see CA, OH, and KY); or
- Are investor-owned utilities that are conducting inventories (Aquarion and Middlesex) and/or exploring regulatory approval (American Water, Aquarion and Middlesex).

All of these examples are devoid of context and not one of them has been cited explicitly as an example to emulate. All this map does is further reinforce the complexity and uncertainty of this problem and suggest that further discussion is warranted.

For example, Mr. Naumick's map cites to the city of Cincinnati, which is transparently disclosing an on-line map of known lead service lines.[35] Now consider this in light of recent American Water announcements to roll-out "customer-friendly" transparent, real-time, infrastructure upgrade project maps in both West Virginia[36] and New Jersey.[37] Both transparency and disclosure are items an external observer would conclude are reasonably foreseeable obstacles to this application, yet no party has responded or otherwise addressed OPC's concerns in this area.

Taking this example a step further, the Commission should consider this information in light of the first example Mr. Merciel provides in support of his testimony: the customer notification from the New Orleans, Louisiana municipal water utility with the stated headline "New Orleans road work could raise lead levels in your water, officials warn." The notice states:

> Despite treatment, lead contamination is still a possibility in New Orleans. . . . Road work can enhance that risk. City lines are often disconnected and reconnected with a homeowner's pipe system. That can dislodge deposits that have prevented lead from leeching into water in the homeowner's pipe. Lead can be released into the water for months after a reconnection is completed.
>
> Sarah McLaughlin Porteous, the director of the city's Special Projects & Strategic Engagement Office, said S&WB and the city will be notifying affected property owners and renters of the possibility of elevated lead levels before each road project begins, through the city's RoadWork NOLA email newsletter, inserts in

[35] Greater Cincinnati Water Works (2017) Lead Awareness. http://cincinnati-oh.gov/water/lead-information/
[36] American Water (2017) West Virginia American Water launches customer-friendly infrastructure upgrade project map. https://amwater.com/wvaw/news-community/news/id/445
[37] American Water (2017) What a million dollars a day looks like: New Jersey American Water's online infrastructure map provides detailes on 2017 system investments. http://pr.amwater.com/PressReleases/releasedetail.cfm?ReleaseID=1033522

water bills, and during community meetings, which will be held at the start of each project.[38]

Should roadwork merit customer notification of an enhanced risk of lead contamination?[39] What about consideration for the construction workers?[40,41,42] **

[38] See the Rebuttal Testimony of James A. Merciel, Schedule JAM-r5
[39] New Orleans Office of Inspector General (2017) Lead exposure and infrastructure reconstruction. http://files.constantcontact.com/1b8199d3201/c5bc5ad0-0389-4401-afb4-ecaccce8005f.pdf?ver=1500394246000
[40] Phillips, B. (2011) Lead exposure in road construction. Occupational health and Safety. https://ohsonline.com/Articles/2011/03/01/Lead-Exposure-in-Road-Construction.aspx
[41] Reagn, M.H. (1998) Soil is an important pathway to human lead exposure. Environmental Health Perspectives, 106. https://www.ehp.niehs.nih.gov/wp-content/uploads/106/Suppl%201/ehp.98106s1217.pdf
[42] Lead Service Line Collaborative (2017) Disturbing lead service lines. http://www.lslr-collaborative.org/disturbing-lead-service-lines.html

**

OPC's pilot proposal would allow this question (and others) to be explored with relevant actors who are currently absent from the process and without the restrictions or burden of a confined regulatory proceeding that minimizes necessary dialogue.

VI. RESPONSE TO THE ASSERTIONS REGARDING THE EPA LEAD AND COPPER RULE REVISIONS WHITE PAPER (2016)

Q. Both Company and Staff witnesses cite the EPA's Lead and Copper Rule Revisions White Paper (2016) as evidence that full lead service line replacement is a settled issue. Do you agree?

A. No. The sixteen-page white paper takes no new formal position on revisions to the LCR. It merely presents information that may be considered moving forward. Publishing a white

paper acknowledging that the current LCR rules could be clearer or more prescriptive is far different than submitting a budget request to the US Congress or securing appropriations for a specific abatement strategy. The white paper's focus is centered on potential revisions to the twenty-six-year-old rule and it does not articulate the EPA's official scientific or policy position on full or partial lead service line replacement. This can be surmised by reading the abstract on the EPA's website which merely lists lead service line replacement (not partial, not full) as an option being considered:

> **Revisions Being Considered**
>
> The Lead and Copper Rule Revisions White Paper provides examples of regulatory options to improve the existing rule. The paper highlights key challenges, opportunities, and analytical issues presented by these options. **Options include** lead service line replacement, improving optimal corrosion control treatment requirements, consideration of a health-based benchmark, the potential role of point-of-use filters, clarifications or strengthening of tap sampling requirements, increased transparency, and public education requirements[43]

What *is* worth noting about the EPA's white paper is how similar it is to OPC's policy position. Regarding the subject of full lead service line replacement, the white paper explicitly acknowledges the complexity of the problem:

> It is important to recognize that LSLR presents substantial economic, legal, technical and environmental justice challenges.[44]

The paper also discusses the need for a health-based cost-benefit analysis that is informed by evolving evidence-based empirical data. The white paper states:

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

[44] US EPA (2016) Lead and Copper Rule Revisions White Paper. https://www.epa.gov/sites/production/files/2016-10/documents/508_lcr_revisions_white_paper_final_10.26.16.pdf

> In addition, the EPA must prepare a Health Risk Reduction Cost Analysis **to evaluate if the benefits justify the costs of the rule.** EPA is committed to using the best available science. **As knowledge about lead contamination in drinking water evolves**, we will continue to engage with stakeholders and consider their viewpoints and relevant science in developing revisions to the LCR. (emphasis added)[45]

Notably, many (if not most) of the questions and issues OPC has raised in this docket and hopes to explore within the pilot program are the same questions and issues that the EPA acknowledges need to be evaluated moving forward, including:

- The appropriate pace of LSLR and the mechanism for implementing and enforcing any LSLR program requirements. Consideration of number of LSLs that can feasibly be replaced on an annual basis will need to be considered as well as water system size.
- Costs and benefits of LSLR for reducing lead exposures. National costs could range from $16 to $80 billion dollars. Benefits will be estimated based upon avoided effects of lead exposure such as IQ loss in developing children. EPA will evaluate how much additional lead exposure reduction can be achieved in removing LSLs from water systems with optimized corrosion control. EPA will also evaluate other measures that can reduce lead exposure to assure that resources are focused on reducing the most significant sources of lead.
- How to provide for full LSLR where the utility does not own the full line, including an evaluation of whether a potential change to the definition of "control" under the SDWA would facilitate full LSLR.[46]

[45] Ibid.
[46] The Safe Drinking Water Act defines the term public water system as "…a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals. Such term includes (i) any collection,

- Requiring drinking water utilities to update their distribution system materials inventory to identify the number and location of LSLs in their system.
- How to address potential equity concerns with LSLR requirements and consumers ability to pay for replacement of their portion of the LSL. Identifying and evaluating incentive and creative funding mechanisms are critical as is encouraging use of Drinking Water State Revolving Fund to the extent possible.
- How to address LSLR in rental properties, particularly where low income residents do not control the property or have the ability to contribute to the cost of LSLR.
- Whether to prohibit or otherwise limit partial LSLR, and how to address concerns related to potential disturbance of LSLs during emergency repairs to water mains that are connected to LSLs.
- How to address the short term increases in lead levels that can follow LSLRs (i.e., requiring water systems to provide filters when lines, or enhanced household flushing recommendations). [47]

Far from being declarative evidence that "the issue is settled," or that OPC's modest proposal is irrational, the EPA's white paper reinforces OPC's argument and validates our concerns and questions.

treatment, storage, and distribution facilities under the control of the operator of such system and used primarily in connection with such system, and any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system." Qtd. in Ibid.

[47] Ibid

Q. Staff witness Merciel claims that the EPA Lead and Copper Rule Revisions White Paper (2016) concluded that the full LSL replacement, not partial should be the standard. Do you agree?

A. No. First, it is important to note again, that the EPA has taken no formal position and definitely did not institute any "standard" as expressed as an enforceable requirement. Second, it appears as though Mr. Merciel has mistaken EPA advisory groups. He cites the EPA's Science Advisory Board ("SAB") while the white paper cites the National Drinking Water Advisory Committee ("NDWAC"). Regardless of the specific "advisory group" neither have regulatory power. It should be noted that far from a firm stance, the NDWAC's position on full lead service line replacement has been criticized as lacking accountability, oversight and enforcement.[48] Perhaps most importantly, and as stated in my rebuttal testimony, there is considerable uncertainty surrounding potential revisions to the LCR as the EPA now expects a draft rule to be published in January of 2018, or six months later than what was announced a year ago. Assuming no additional setbacks and under the most favorable timeline, the final rules, according to the EPA will not be ready until July 2019.

This timelines would also coincide roughly with the conclusion of OPC's proposed lead service line replacement pilot project and place MAWC, its ratepayers, and potentially the rest of Missouri in an ideal situation for compliance with any federal regulatory changes.

VII. RESPONSE TO COMMENTS REGARDING FLINT, MICHIGAN

Q. Both the Company and Staff have referenced the Flint, Michigan water crisis as justification for the Company's proposal. Please respond.

A. The Flint water crisis became a nation-wide focal event that heightened the dialogue surrounding the public health risk of lead contaminated water. The crisis has been roundly

[48] Walton, B. (2016) Strength of new EPA lead rule depends on accountability. *Circle of Blue.* http://www.circleofblue.org/2016/world/strength-of-new-epa-lead-rule-depends-on-accountability/

labeled as a example of an environmental injustice with a breakdown in local, state and federal government institutions in response to basic needs for predominately low-income and minority communities.[49]

Any serious discussion about the issue of lead line replacements needs to acknowledge the circumstances and outcome(s) of that event. Simply put, much of the heightened anxiety surrounding the removal of lead service lines is based on the recent events surrounding Flint's water crisis.

Q. Provide some context for Flint, Michigan?

A. According to the Flint Water Advisory Task Force, Final Report (March 2016):[50]

> The beleaguered history of Flint, Michigan over the last several decades is well known,[51] yet some facts are particularly important to provide context for our findings and recommendations. The City of Flint has suffered dramatic declines in population. From a peak of more than 200,000 in 1960, Flint's population had fallen below 100,000 residents by 2014. Since 2000, Flint has lost over 20 percent of its population.[52] Of the remaining residents, approximately 57 percent are Black or African American.[53]
>
> Poverty is endemic in Flint, with 41.6 percent of the population living below federal poverty thresholds—2.8 times the national poverty rate. The median value of owner-occupied housing is $36,700, roughly one-fifth of the national

[49] Rosner, D. (2016) Flint Michigan: A century of environmental injustice. American Journal of Public Health 106(2); https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4815825/
[50] Davis, et al (2016). Flint Water Advisory Task Force—Final Report: March 2016. https://www.michigan.gov/documents/snyder/FWATF_FINAL_REPORT_21March2016_517805_7.pdf
[51] See also, Scorsone, E. & N. Bateson (2011) "Long-Term Crisis and Systemic Failure: Tasking the Fiscal Stress of America's Older Cities Seriously: Case Study, Flint Michigan," Michigan State University. https://www.cityofflint.com/wp-content/uploads/Reports/MSUE_FlintStudy2011.pdf qtd. in Davis et al (2016).
[52] BiggestUSCities.com, www.biggestuscities.com/city/flint-michigan qtd. in Davis et al (2016).
[53] U.S. Census, Quickfacts for Flint, Michigan and the United States, www.census.gov/quickfacts/table/PST045215/00 qtd. in Davis et al (2016).

average.[54,55] Crime plagues the community; for 2013, Flint's crime index was 811 as compared to a national average of 295.[56]

Even before the Flint water crisis, Genesee County (in which Flint is the largest population center) exhibited poor health statistics. In a 2015 study, the county ranked 81st out of 82 Michigan counties in health outcomes. It ranked 78th in length of life, 81st in quality of life, 77th in health behaviors, 78th in social and economics factors, and 75th in physical environment measures. Only the quality of clinical care, for which the county ranked 22nd, is not a cause of acute community concern.[57]

Q. What took place in Flint, Michigan?

A. According to University of Michigan researchers, Abernethy et al. (2017):

> We now understand the Flint Water Crisis as a disaster with many facets: environmental, socio-economic, political, and infrastructural, among others. The dire problems affecting the city's water started in April 2013 when, as a short-term cost-saving measure, city officials opted to switch the water supply from Lake Huron to the Flint River. Not long after the switch, residents began to notice an unpleasant odor and discoloration in the water flowing from their taps. While water testing data reported by state government officials passed regulations from the U.S. Environmental Protection Agency (EPA), data collected by outside academics from Virginia Tech suggested otherwise. This independent academic work found water lead levels dramatically higher than the threshold allowed by the EPA's Lead and Copper Rule. It was not until September 2015, following a report by a pediatrician

[54] Ibid
[55] The Advisory Task Force utilized 2014 data for this estimate (the most recently available at the time). Since then, the median property value has dropped 11% to $32,600 with 2015's revised numbers. https://datausa.io/profile/geo/flint-mi/#economy
[56] City-Data.com, www.citydata.com/crime/crime-Flint-Michigan.html qtd. in Davis et al (2016).
[57] Qtd. in Davis et al (2016). County Health Rankings, www.countyhealthrankings.org/app/michigan/2015/ranking/genessee/county/outcomes/overall/snapshot

observing a dramatic rise in lead levels in blood of Flint children, that the water crisis began to receive serious attention from government officials. In December 2015, Flint's mayor declared a state of emergency, and agents from both the Michigan Department of Environmental Quality (DEQ) and the EPA embarked on thorough investigations. By late 2015 and early 2016, the media had elevated the Flint Water Crisis into a major national and international news story.

Eventually, the immediate cause was understood: the water from the Flint River was significantly more corrosive than local officials had thought. This, and other governmental failures, resulted in improper water treatment. Central to the problem was that, like many U.S. cities, Flint's water infrastructure contains tens of thousands of lead pipes. These pipes typically are treated with beneficial chemicals to develop thick layers of deposits, which protect water against contamination from heavy metals. Treated incorrectly, however, Flint's corrosive water began to erode these protective layers and ultimately, lead particles leeched from the pipes into the city's drinking water.[58]

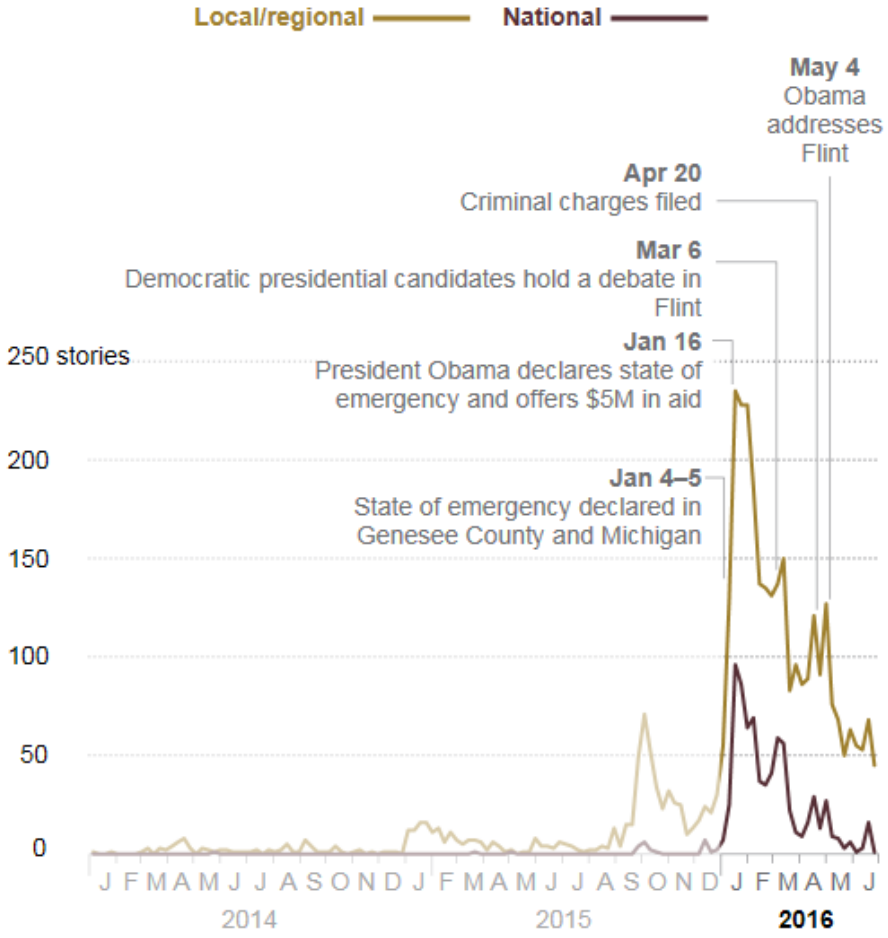
Q. Did the "Flint Water Crisis" receive a large amount of news coverage?

A. Yes. Pew Research analyzed Google search data (approximately 2,700 unique keywords) from January 5th, 2014 through July 2, 2016 to examine the kind of searches most prevalent as a proxy for public interest, concerns and intentions at local, state and national level. Pew's data showed how a local issue became national news. It also highlighted how Flint residents utilized Google for answers about the quality of their water before the local government had issued alerts and that questions about personal health consistently saw the largest share of activity across the two years. Figure 6 shows the number of Flint water crisis-related sorties identified in the local/regional and national news outlets studied. [59,60]

[58] Abernethy et al. (2017) A data science approach to understanding residential water contamination in Flint. https://arxiv.org/pdf/1707.01591.pdf

[59] Matsa K.E. et al. (2017) Searching for News: The Flint Water Crisis. Pew Research Center: Journalism and Media http://www.journalism.org/essay/searching-for-news/

Figure 6: Pew Research analysis of Google Trend Data related to the Flint, Michigan Water Crisis[61]



Water Lead Levels

Q. What were the water lead levels in Flint, Michigan?

A. This is a difficult question to answer for many reasons as water is a universal solvent, so any foreign substance is potentially a contaminant, which could then affect the physical

[60] Craven, J. and T. Tynes (2016) The racist roots of Flint's water crisis. Huffington Post. http://www.huffingtonpost.com/entry/racist-roots-of-flints-water-crisis_us_56b12953e4b04f9b57d7b118

[61] Data represents stories identified in local, regional and national news media and were retrieved from LexisNexis and ProQuest News & Newspapers databases. Local and regional news media include daily, weekly and alt-weekly newspapers in Flint and Detroit regions, as well as the digital outlet MLive.com. National news media include national newspapers and TV network evening programming. See also: http://www.journalism.org/2017/04/27/google-flint-methodology/

properties of the water. Measuring water lead contamination is a highly difficult process, and even repeated measurements at the same source produce highly variable results.[62] Lead water measurements are time and place specific with many potential confounding variables (weather, location, pressure, method, etc…).[63] For regulatory purposes, 15 ppb ("parts-per-billion")[64] at the 90th percentile of lead readings is the system-wide threshold for EPA action per the Led and Copper Rule ("LCR").[65]

Regarding Flint-specific lead water test result levels, beginning in late 2015, more than 25,000 tap water sample tests at 15,000 unique Flint locations were collected (primarily by residents) and analyzed by the State of Michigan and made publically available.[66] In addition to that large sample set, the Michigan Department of Environmental Quality ("MDEQ") initiated a "sentinel program" in which over 400 homes considered to be especially at risk of lead contamination (many of which were known to have a led service line) were selected to be tested multiple times over many months. According to Abernethy et al. (2017):

> It is important to note that despite what one may infer from headlines, nearly half of all homes had no detectable lead, and around 80% of measurements from the residential testing program were below 5 ppb. . . . [and that] the observed distribution of lead levels in water [is] fat tailed and highly skewed: the 95th percentile of Flint's

[62] See Masters, et al. (2016) Inherent variability in lead and copper collected during standardized sampling. *Environmental Monitoring and Assessment*. 188.177. https://link.springer.com/article/10.1007%2Fs10661-016-5182-x

[63] An example of a confounding variable is as follows: if you are researching whether the presence of lead service lines leads to lead contaminated water, the presence of lead pipes is the independent variable and increased lead in water is the dependent variable. A confounding variable is any other variable that also has an effect on your dependent variable (e.g., other sources of lead within the system, temperature of water, source of water, corrosion treatment, flowing or stagnant water draw, etc…).

[64] A ppb is equal to microgram per liter (µg/L) or 1 ppb = 1 µg.L = 1/1 billion = 0.000000001. Analogous references would be: one silver dollar in a roll stretching from Detroit to Salt Lake City; one sheet in a roll of toilet paper stretching from New York to London, one second in nearly 32 years or one pinch of salt in 10 tons of potato chips. Qtd. from Satterfiled, Z (2004) What does ppm or ppb mean?. http://www.nesc.wvu.edu/ndwc/articles/ot/fa04/q&a.pdf

[65] One of the challenges with determining lead contamination levels is determining which homes to test. The EPA requires water systems to select homes that are at greater risk of elevated lead in their tap water, according to the Lead and Copper Rule, but this leaves much to the discretion of officials who seek data points.

[66] See http://www.michigan.gov/flintwater/

> lead readings is 28 ppb, the 99th percentile is 180 ppb, and the 99.9th percentile is over 2,100 ppb. . . . We identified features which are strong predictors of high lead levels and found that a number of factors, not just the composition of service lines, are important to consider in addressing the crisis.[67]

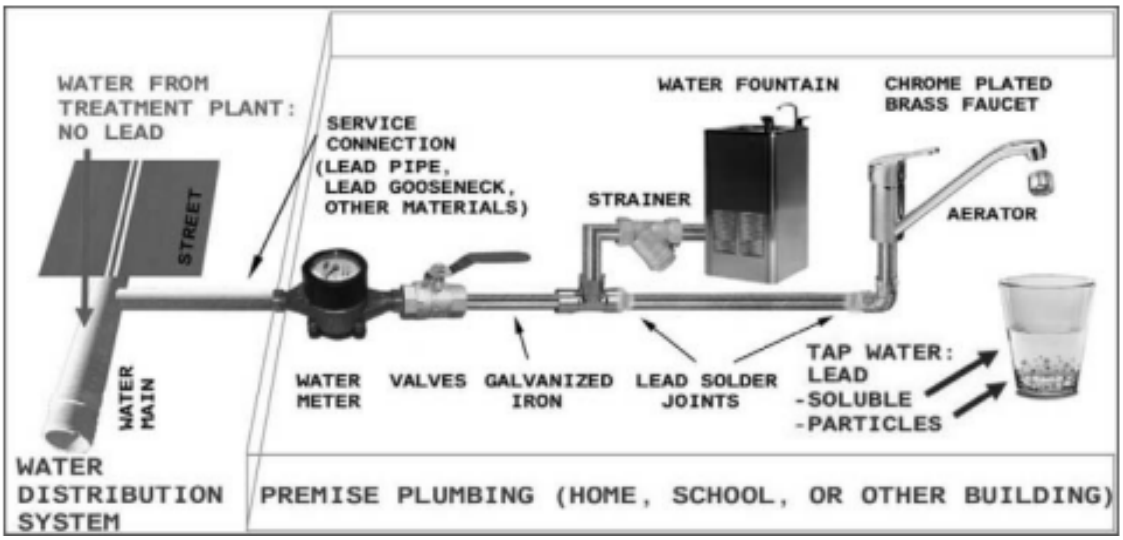
Restated, it appears as though the concentration of elevated water lead levels in Flint, Michigan[68] followed a power law distribution where a small number of locations accounted for a disproportionate amount of the elevated lead levels.[69] Whether or not Flint, Michigan ever exceeded the EPA action-level of 15 ppb at the 90th percentile is not clear.[70] Importantly, the cause of that increased lead exposure in water samples, in some cases, may be attributable to lead-based premised plumbing and/or fixtures not necessarily (or just) lead service lines. That is, elevated concentrations of lead were found at sites without lead service lines, most likely from lead-based premise plumbing and/or other internal fixtures that contained lead.[71]

Q. What do you mean by lead-based premise plumbing and fixtures?

A. Water pipes and faucets within a customer's home or building. Figure 7 provides a graphical illustration of all of the potential sources in which water flows through in a given distribution system to the customer's taps that could possibly induce lead contamination.

[67] Abernethy et al. (2017) A data science approach to understanding residential water contamination in Flint. https://arxiv.org/pdf/1707.01591.pdf
[68] That is, the water lead levels measurements after the source was changed back to Lake Huron.
[69] Power law distribution occurs when one quantity varies as a power of another. Normal distributions are often graphed as "bell-curve" while power law distributions resemble a graphical "hockey stick." See also, Taleb, N. (2007) *The black swan: The impact of the highly improbable*. New York: Random House.
[70] I was unable to locate test results from any authorized agency in which Flint's water system exceeded the LCR EPA action level of 15 ppb at the 90th percentile. However, independent Virginia Tech research Marc Edwards conducted a survey of 300 homes in which the results showed an excessive action-level of 25 ppb. It should be noted that both Edwards' data (which included 48 missing samples) and the Michigan Department of Environmental Quality's sample selections have been challenged. See also Davis, et al (2016). Flint Water Advisory Task Force—Final Report: March 2016. https://www.michigan.gov/documents/snyder/FWATF_FINAL_REPORT_21March2016_517805_7.pdf
[71] Abernethy et al. (2017) A data science approach to understanding residential water contamination in Flint. https://arxiv.org/pdf/1707.01591.pdf

Figure 7: Potential sources of lead contamination in tap water of homes, schools and other buildings[72]



A useful analogy to consider is to visualize the path water takes from the treatment plant to the tap as one elaborate extended piece of chalk. Lead could be present at any point along that path (the service line, the meter, the valve, the faucet, etc…) and disturbance or removal of any point within that path could temporarily induce a release of lead (i.e., just like breaking a piece of chalk releases particles and dust into the air).

The argument for full lead service line replacement as opposed to partial lead service line replacement rests, in part, on this premise. That is, if we only remove half the service line, the utility will be elevating the potential for risk-exposure from lead from its disturbance in the short-term.

[72] Triantafyllidou, S. & M. Edwards. (2011) Lead (Pb) in U.S. drinking water: school case studies, detection challenges and public health considerations. *Critical Reviews in Environmenteal Science and Techology.* http://www.yaleseas.com/watersymposium/pdfs/EdwardsLeadPaper.pdf

Q. Do you agree with the premise that full lead line replacement is better than partial lead line replacement?

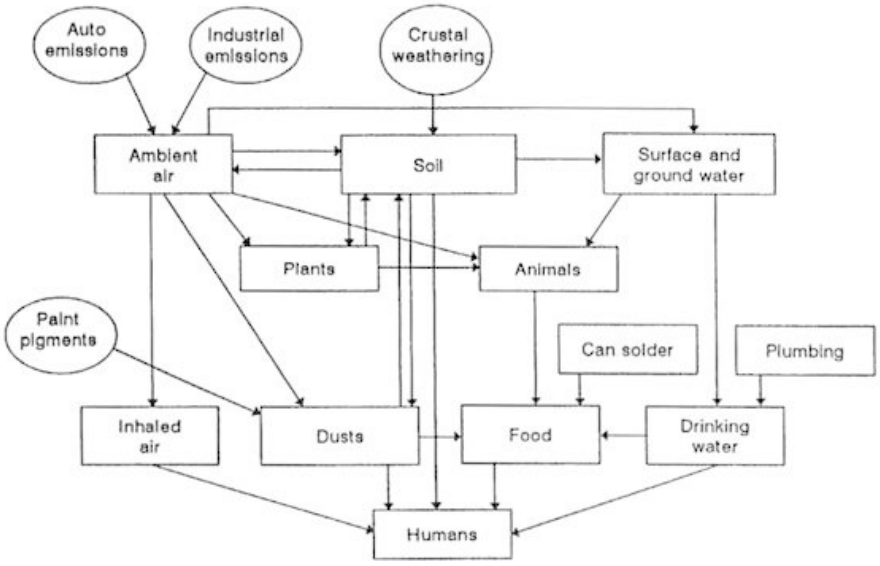
A. Intuitively it would seem to make sense, but more research is necessary to substantiate the impact.[73]For example, this line of argument (that elevated risk exposure would occur from lead service line replacement) would still be present if the full lead service line was replaced as well, at least in the short-term. That is, any significant disturbance at any point in the path increases the risk for lead disruption. Whether you remove the lead line partially or fully it is still being "broken" and thus subject to the potential for elevated levels of lead exposure.

Blood Lead Levels

Q. What were the blood lead level ("BLL") results from Flint, Michigan?

A. This is also a difficult but important question to attempt to answer. Therefore, appropriate context is imperative. First, it is important to note that high BLLs are the result of exposure to lead through air, water, soil or food as seen in Figure 8:

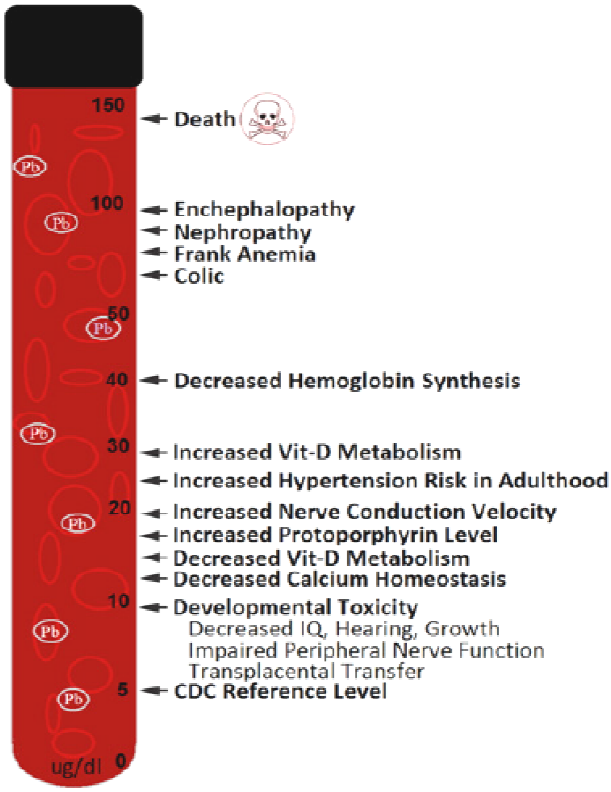
Figure 8: Sources and pathways of lead from environment to humans[74]



[73] As stated in the direct testimony of Geoff Marke, p. 5, footnote 6
[74] US National Research Council Committee on measuring lead in critical populations. (1993) Measuring lead exposure in infants, children and other sensitive populations. National Academies Press. https://www.ncbi.nlm.nih.gov/books/NBK236466/

Second, larger amounts of concentrated BLLs will produce progressively worse health outcomes with extreme intoxication even resulting in death as shown in Figure 9.

Figure 9: Expected impacts of different blood lead levels on human health[75]



Third, it is important to note that historically, and as stated in my rebuttal testimony, in the 1970's, over 70% of children tested nationwide had BLLs over 10 µg/dL, by 2001, nationwide, it was <1% as seen in Figure 10. In part, this was the result of progressively aggressive lead prevention policies and subsequent lower "reference levels" by the CDC as depicted in Figure 11.

[75] US Health And Human Services, Agency for Toxic Substances and Disease Registry (2007) Toxicological profile for lead. https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=96&tid=22

Figure 10: BLL "reference levels" considered harmful by CDC over time[76]

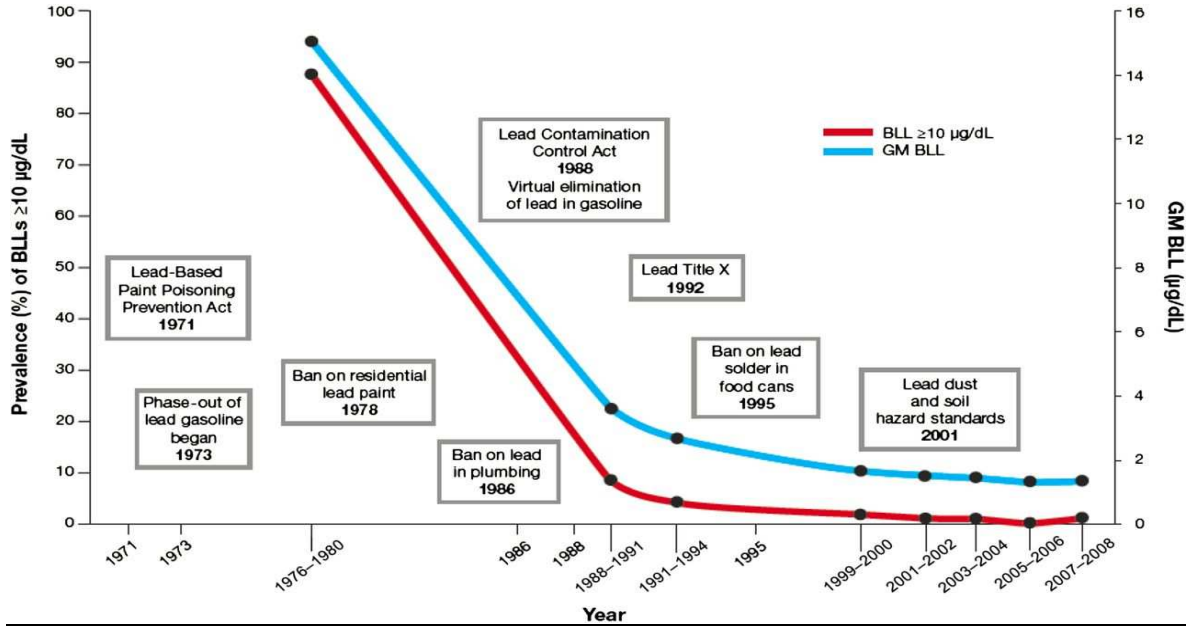
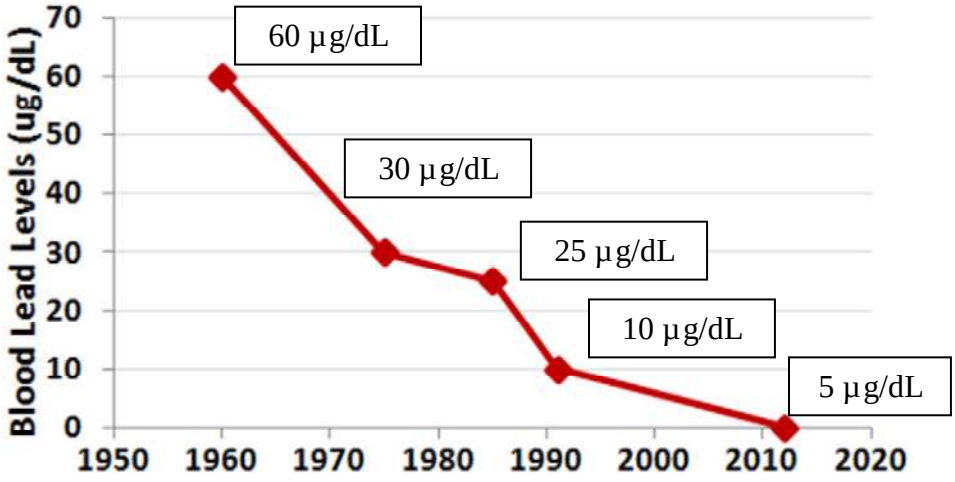


Figure 11: BLL "reference levels" considered harmful by CDC over time[77]



[76] Mahaffey, K.R., et. al. (1982) National estimates of blood lead levels: United States, 1976–1980: association with selected demographic and socioeconomic factors. *New England Journal of Medicine* 307 (10):573–579. http://dx.doi.org/10.1056/NEJM198209023071001.

[77] Adapted from, Rosen et al. (2017) A discussion about the public health, lead and Legionella pneumophila in drinking water supplies in the United States. *Science of the Total Environment*. https://www.researchgate.net/profile/Lok_Pokhrel2/publication/313842318_A_Discussion_about_Public_Health_Lead_and_Legionella_pneumophila_in_Drinking_Water_Supplies_in_the_United_States/links/592847100f7e9b9979a35976/A-Discussion-about-Public-Health-Lead-and-Legionella-pneumophila-in-Drinking-Water-Supplies-in-the-United-States.pdf

Prior to 1975 the reference BLL for lead was at 60 µg/dL, which was later revised to 30 µg/dL in 1975 and lowered to 25 µg/dL in 1985 by the CDC. From 1990 through 2012, the reference BLL was further decreased to 10 µg/dL. In 2012, the CDC lowered the reference level further to 5 µg/dL. Historical records for children with BLL's below 5 µg/dL is sporadic across state and local public health authorities

Fourth, the CDC recommends different medical actions for children (under six) based on the BLL test results. This can be seen in Table 2 below.

Table 2: CDC Recommended actions based on confirmed blood lead levels of children [78]

Blood Lead Level (BLL)	Recommendations
<5µg/dL	Routine assessment of nutritional and developmental milestones. Anticipatory guidance about common sources of lead exposure. Follow-up blood lead testing at recommended intervals based on child's age.
5-9 µg/dL	Previous recommendations + nutritional counseling related to calcium and iron intake.
10-19 µg/dL	Previous recommendations + consider lab work to assess iron status
20-44 µg/dL	Previous recommendations + lab work (iron status and hemoglobin or hematocrit) + abdominal X-ray (with bowel decontamination if indicated) + neurodevelopment assessment
45-69 µg/dL	Previous recommendations + complete neurological exam + oral chelation therapy; consider hospitalization, if lead-safe environment cannot be assured
≥ 70µg/dL	Hospitalize and commence chelation therapy in conjunction with consultation with a medical toxicologist or a pediatric environmental health specialty unit.

[78] CDC (2017) Recommended Actions Based on Blood Lead Level: Summary of recommendations for follow-up and case management of children based on confirmed blood lead levels. https://www.cdc.gov/nceh/lead/acclpp/actions_blls.html

Fifth, according to the Flint Water Advisory Task Force, Final Report (March 2016) the following "time-line" events were singled out pertaining to blood lead level tests as show in Figure 12:

Figure 12: All time-line events listed in the Flint Water Advisory Task Force, Final Report pertaining to blood lead levels[79,80]

50. July 28, 2015: MDHHS epidemiologist Cristin Larder finds that children's blood lead tests conducted in summer 2014 "lie outside the control limit" compared with prior years and that this finding "does warrant further investigation." On the same day, CLPPP data manager Robert Scott analyzes the data over a 5-year period and concludes that "water was not a major factor." Later that day, CLPPP manager Nancy Peeler concludes that the lack of persistently elevated blood lead levels in children in Flint beyond the summer months indicates no connection to the change in water in Flint in 2014. Larder then receives email communication from Peeler: Peeler has concluded from CLPPP data and communicated with MDHHS leadership that there is no problem with children's lead levels in Flint.

56. September 22, 2015: Dr. Mona Hanna-Attisha, director of the pediatric residency program at Hurley Medical Center, contacts Robert Scott/MDHHS to request access to the state's childhood lead testing records. This is a similar request to one filed by Professor Edwards several weeks before, to which the state had yet to respond. No data are shared.

57. September 23, 2015: Nancy Peeler/MDHHS, director of the state's Childhood Lead Poisoning Prevention Program (CLPPP), e-mails Robert Scott/MDHHS to consider re-running the analysis that had been conducted in July, and asks for formal epidemiologic help. Later that day, Mikelle Robinson/MDHHS writes to colleagues that the Governor's office briefing maintains that Flint water does not represent an "imminent public health problem."

[79] Davis, et al (2016). Flint Water Advisory Task Force—Final Report: March 2016. https://www.michigan.gov/documents/snyder/FWATF_FINAL_REPORT_21March2016_517805_7.pdf

[80] Items 51-55 included time-line events pertaining to water lead testing and government communication and were therefore omitted.

58. September 24, 2015: Dr. Hanna-Attisha presents her findings about children tested for lead in a press conference at Hurley Medical Center, reporting that the proportion of children with elevated blood lead levels has increased since the switch to the Flint River water source in April 2014. MDHHS issues comments emphasizing differences between the Hurley analysis and preceding internal analyses by MDHHS that were not shared publicly. That same day, Robert Scott/MDHHS writes in an internal memo that he sees patterns in blood lead levels similar to what Dr. Hanna-Attisha has reported.

59. September 28, 2015: MDHHS Director Nick Lyon calls for analysis of the blood lead levels in order to "make a strong statement with a demonstration of proof that the blood lead levels seen are not out of the ordinary." No such analysis is ever provided. Later that day, Governor Snyder is briefed by staff that the Flint water system is in compliance.

60. September 29, 2015: The *Detroit Free Press* publishes an analysis of Flint blood lead tests, concluding that Dr. Hanna-Attisha's analysis is correct. GCHD issues a health advisory regarding the water quality. Governor Snyder's office contacts Director Wyant and Director Lyon to consider emergency responses.

61. October 1, 2015: MDHHS issues a statement confirming Dr. Hanna-Attisha's analysis.

The report does not provide specific BLL metrics regarding any population cohort within Flint. That is, it is not clear from reading the report how "bad" things got.

On July 1, 2016 the CDC published its Morbidity and Mortality Weekly Report which included an article titled, "Blood Lead Levels among Children Aged <6 Years — Flint, Michigan, 2013–2016." The report includes a breakdown of BLL's for children under 6 in Flint pre- and post-water source change and is reprinted in here in table 3.

Table 3: BLL's of children <6 in Flint, Michigan from April 25, 2013 to March 16, 2016 [81]

Date and number of BLL tests	Before switch to Flint River 04/25/13 to 04/24/14 (2,408 tests)	After switch to Flint River (early) 04/25/14 to 01/02/15 (1,694 tests)	After switch to Flint River (late) 01/03/15 to 10/15/15 (1,990 tests)	After switch back to Detroit Water System 10/16/15 to 03/16/16 (3,330 tests)
≥5µg/dL overall	74 (3.1)	84 (5.0)	78 (3.9)	48 (1.4)
5 – 9	59 (2.5)	71 (4.2)	68 (3.4)	37 (1.1)
10-14	9 (0.4)	10 (0.6)	6 (0.3)	4 (0.1)
15-19	2 (0.1)	2 (0.1)	0 (0)	4 (0.1)
20-39	4 (0.2)	1 (0.1)	4 (0.2)	2 (0.1)

Q. What should the Commission note?

A. It would be difficult to draw strong conclusions one way or the other based on this table alone. Among the many variables one would need to consider are the dates of the testing and the number of children being tested. Clearly, a rise in elevated BLL's would be expected to coincide with prolonged exposure to untreated corrosive water, but the expected "spike" that would be expected in relative BLLs as the Flint press coverage would have the public believe is more of an isolated bump at the lowest threshold level of concern. To confirm this outcome, BLL test results were examined based on historical records from the Michigan Department of Health and Human Services (MDHHS) which I have included in GM-3 in its entirety.

Q. What did you find in the MDHHS results?

A. I have included a snapshot of the data in table 4 which shows the incidence of elevated blood lead levels (≥5 mcg/dL) among children less than 6 years of age in Flint, Genesee County (where Flint is located) and Michigan, across three different time spans as presented in the data.

[81] Kennedy, C. (2016) Blood lead levels among children aged <6 years—Flint, Michigan, 2013-2106. https://www.cdc.gov/mmwr/volumes/65/wr/mm6525e1.htm

Table 4: Reprint of incidence of elevated blood levels (≥5 µg/dL) among children less than 6 years of age in Michigan, Genesee County and the city of Flint[82]

		Michigan	Genesee County	Flint
10/1/2015 to 01/20/2017	Total tested for lead*	186,112	13,333	7,482
	Number of test results ≥5 mcg/dL	6,647	239	191
	Percent of test results ≥5 mcg/dL	3.6%	1.8%	2.6%
4/1/2014 to 01/20/2017	Total tested for lead*	332,797	18,783	9,288
	Number of test results ≥5 mcg/dL	12,331	411	294
	Percent of test results ≥5 mcg/dL	3.7%	2.2%	3.2%
1/1/2016 to 01/20/2017	Total tested for lead*	157,175	11,708	6,637
	Number of test results ≥5 mcg/dL	5,722	212	172
	Percent of test results ≥5 mcg/dL	3.6%	1.8%	2.6%

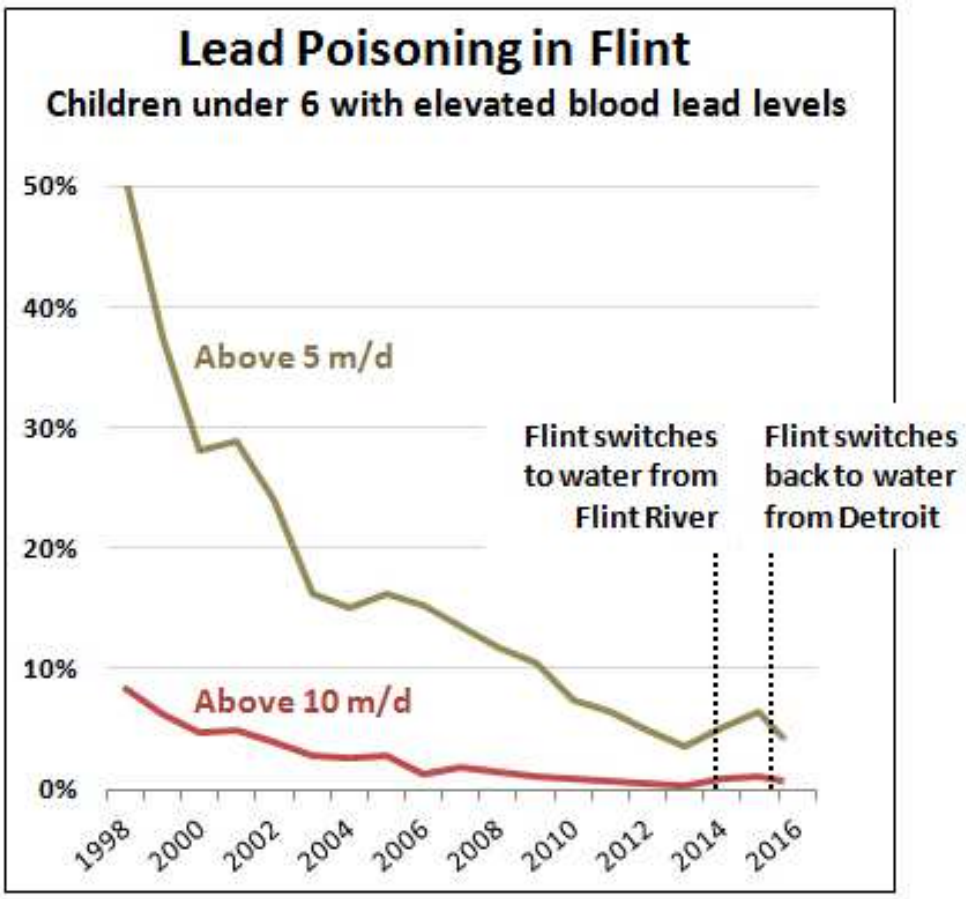
The Commission should note that the percentage of children with elevated BLL's in the city of Flint is far less than the state of Michigan as a whole during the water crisis. This is also true for BLL's at other cohort level including children 6 – 18 and adults (see GM-3).[83]

GM-4 contains a breakdown of the CDC's National Surveillance Data of tested and confirmed BLL above ≥5 µg/dL by state, year (2010-2015) for children over 3 years of age for comparative purposes to illustrate that Flint's numbers are not out of line with averages seen in other states across the country. Figure 13 provides another historical perspective on Flint's blood lead levels.

[82]Michigan Department of Health and Human Services. (2017) Blood lead level test results for selected Flint zip codes, Genesee County, and the State of Michigan Summary as of January 20, 2017. http://www.michigan.gov/documents/flintwater/Weekly_Executive_Report_-_Flint_Blood_Testing_1_20_17_557764_7.pdf

[83] With the exception of 2011 for children under

Figure 13: BLL's above 5 and 10 µg/dL in Flint 1998-2016[84]



Based on OPC's examination of MDHSS and CDC historical BLL results it would appear as though the public health impact as it relates to lead as a result of the Flint water crisis has been overstated.[85] If one were to take the reports from the media at face value, one would expect the graphical lines to show spikes of elevated BLLs in children in 2015 like what was at least seen in 1998. No such spike exists.

It is important to note that the CDC recommended medical action for children with test results of BLLs between 5-9 µg/dL is "nutritional counseling related to calcium and iron

[84] Drum, K. (2016) Raw data: lead poisoning of kids in Flint. Mother Jones. http://www.motherjones.com/kevin-drum/2016/01/raw-data-lead-poisoning-kids-flint/ website site contains work papers for results.
[85] See Hanna-Attisha, M. (2017) Flint's fight for America's children. *TED MD* http://www.tedmed.com/talks/show?id=627338

intake." That is, there are no specific medical actions recommended. The Commission should also note that heightened BLL's are strongly correlated with warm temperature. A review of MDHSS data shows that increased BLL's followed a pattern of isolated increases during the third quarter of every year (e.g., July, August and September). That is, children are more likely to be outside and thus exposed to greater lead hazards (primarily from soil-sourced lead risks) than they otherwise would be if they were inside during colder months where BLLs levels decreased. This correlation would also be consistent with Laidlaw, et al.'s (2016) examination of the Flint, Michigan crisis which concludes that:

> Based upon previous findings in Detroit and other North American cities we infer that resuspension to the air of lead in the form of dust from lead contaminated soils in Flint appears to be a persistent contribution to lead exposure of Flint children even before the change in the water supply from Lake Huron to the Flint River.[86]

Q. Were there any other adverse public health outcomes as a result of the Flint, Michigan crisis?

A. Yes. In a one-year period that seemingly coincided with the Flint Water Crisis, there were 87 documented Legionnaires' disease cases (including twelve deaths), where in an average year there are 6 to 13 cases.[87] The same Virginia Tech researchers who independently tested Flint homes for elevated lead concentrations and produced results that showed Flint's water system was operating in excess of the Lead and Copper Rule believe that the outbreak of Legionnaires Disease in 2015 is linked to Flint's failure to properly treat its water.[88]

[86] Laidlaw, M.A.S. et al. (2016) Children's blood lead seasonality in Flint, Michigan (USA), and soil-sourced lead hazard risks. *International Journal of Environmental Research and Public Health.* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4847020/

[87] Schumaker, E. (2016) Flint's Legionnaires' outbreak may be tied to its contaminated water. When will Flint catch a break? *Huffington Post, Healthy Living*. http://www.huffingtonpost.com/entry/flint-water-legionnaires-lead-crisis_us_569d09d6e4b0ce4964252c33

[88] Schwake,D.et al. (2017) Legionella DNA markers in tap water coincident with a spike in Legionnaires' disease in Flint, MI. *Environmental Science and Technology* 3(9) 311-315. http://pubs.acs.org/doi/ipdf/10.1021/acs.estlett.6b00192

Specifically, Flint's untreated water elevated levels of iron from corroded iron water service lines in two hospitals where incidents increased. Schwake et al. (2017) state:

> Our field results support the overarching hypothesis that interrupted distribution system corrosion control can lead to high Legionella numbers in premise plumbing, though further research is necessary to confirm the specific mechanisms involved.[89]

It is important to note that that the Legionella outbreak has not been causally liked to Flint's water system. For example, not all of the Legionella victims were residents of Flint and further epidemiological research is necessary.[90]

Q. What should the Commission take from your information on the Flint, Michigan water crisis?

A. The public health impact of the Flint water crisis as it relates to lead is far from definitive. These claims of impact become a little less credible when scrutinized in conjunction with the water and blood lead data on its citizens. Yet, despite the uncertainty of the impact of the lead service lines on public health, the impact of the incident has been far reaching. No doubt, Flint's economy, already struggling, was further deteriorated. [91, 92] Flint's real estate market clearly suffered as homes were categorically devalued[93, 94] and mortgage firms

[89] Ibid.
[90] Rosen et al. (2017) A discussion about the public health, lead and Legionella pneumophila in drinking water supplies in the United States. *Science of the Total Environment.* https://www.researchgate.net/profile/Lok_Pokhrel2/publication/313842318_A_Discussion_about_Public_Health_Lead_and_Legionella_pneumophila_in_Drinking_Water_Supplies_in_the_United_States/links/592847100f7e9b9979a35976/A-Discussion-about-Public-Health-Lead-and-Legionella-pneumophila-in-Drinking-Water-Supplies-in-the-United-States.pdf
[91] Snider, A. (2016) Flint's other water crisis: money. *Politico: Energy & Environment.* http://www.politico.com/story/2016/03/flint-lead-water-contamination-money-220391
[92] Carpenter. Z (2016) Lead poisoning in Flint is more than a health crisis: it's also an economic disaster. *The Nation.* https://www.thenation.com/article/flint-wealth/
[93] Goldstein, D. (2016) Lead poisoning crisis sends Flint real-estate market tumbling. *Market Watch.* http://www.marketwatch.com/story/lead-poisoning-crisis-sends-flint-real-estate-market-tumbling-2016-02-17
[94] Vasel, K. (2016) You can buy a house in Flint for $14,000. *CNN.Money.* http://money.cnn.com/2016/03/04/real_estate/flint-housing-water-crisis/index.html

began requiring proof of safe water before loan approval.[95] In July of 2016, six state employees were criminally charged in connection with the case.[96]

The events surrounding Flint, Michigan are complex and interrelated without easy answers. In fact, we would welcome alternative perspectives on our findings—ideally, through the proposed pilot program as articulated in our direct testimony. Ultimately, critical feedback, evidence-based research and cooperative dialogue will call attention to faulty assumptions and identify appropriate paths forward. Flint is an obvious selection for a case study in attempting to evaluate the "worst case" scenario as there is no doubt many lessons still to learn.

VIII. RESPONSE TO COMMENTS REGARDING ISSUES BEYOND THE SCOPE OF THE COMMISSION

Q. Both the Company and Staff dismiss OPC's pilot proposal, in part, because the topics extend beyond the Commission's control. Please respond.

A. Pilot programs are not beyond the scope of the Commission. In fact, the Commission routinely endorses and authorizes pilot programs to explore issues that may not cover traditional utility regulation (e.g., on-bill financing, low-income rate customer charge reduction, etc…). Certainly there is a logical connection to a pilot to examine in part the safety of the water provided. Pilot programs are put forward to understand the feasibility and appropriateness of replicating program at a large-scale.

OPC's pilot program proposal is especially appropriate considering that the Company's request arguably extends beyond the Commission's control. MAWC is acting in conflict

[95] Light, J. (2016) New Trouble Knocks Flint as Mortgage Firms Require Proof of Safe Water. *The Wall Street Journal*. https://www.wsj.com/articles/new-trouble-knocks-flint-as-mortgage-firms-require-proof-of-safe-water-1454544966?cb=logged0.10463099810294807

[96] Damron, G. (2016) A look at the 6 state employees charged in Flint water crisis. *Detroit Free Press.* http://www.freep.com/story/news/local/michigan/flint-water-crisis/2016/07/29/look-6-state-employees-charged-flint-water-crisis/87708870/

with their existing tariff and replacing customer-owned property. The Company, at some level, recognizes this as evidence by its efforts to pass legislation authorizing its actions in the most recent General Assembly. Again, OPC's pilot program provides a reasonable and measured compromise.

For our part, OPC has been forthright from the beginning that the scale and scope of this problem necessitates engagement with stakeholders and interest groups that have traditionally been absent from utility regulatory proceedings. The pilot study can serve as a bridge to engage these stakeholders expertise and facilitate measurable deliverables for future consideration. If, as a result of the study and the collaborative effort, it is determined that the very issue of lead service line replacement (as Staff suggests) has ramifications for all of Missouri, than the pilot study can inform appropriate legislative and executive actions.

Finally, and as noted throughout my testimony, the pilot study and its supportive framework mirrors best practice literature and recommendations ranging from the EPA to the Lead Service Line Replacement Collaborative. It is OPC's hope that the pilot study will help fill existing gaps in research and potentially position the Company and Missouri for supplemental funding from either the federal government or other outside institutions.

Q. Does this conclude your testimony?

A. Yes.