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Public Counsel

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.



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.

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

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

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

11 However, later he states:

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

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

24 However, the stated cost range is probably not realistic for the St. Louis County
25 service area.⁸

⁶ Rebuttal Testimony of James A. Merciel, Jr., PE p. 6, 12-15.

⁷ Ibid. p. 9, 4-6.

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

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

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

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

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

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

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

20 However, there is no need to delay finding the answers to such questions for two
21 years past the conclusion of a general rate case, or to subject homeowners to potential
22 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

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

9 **OPC's Position**

10 **Q. What is OPC's position?**

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

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

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

1 If this issue was as simple as the 280-word application¹² the EPA would already have
2 explicit rules in place and there would be regulatory uniformity across the states. Neither
3 of those statements is true. MAWC's application does not consider the consequences of its
4 requested action. Consider what would happen if customers began to demand that MAWC
5 disclose its 30,000 "known" lead service lines? More to the point, is MAWC legally (or
6 ethically) obligated to disclose such information?¹³ As it stands, the MAWC estimate is
7 now public knowledge but with no detailed prioritization, disclosure, or education and
8 communication plan. Most, if not all of the secondary literature quoted by the Company
9 and Staff support customer transparency for both lead testing and lead service line
10 locations. Of course it should also be noted that most of that literature is referencing
11 public municipal systems not private, investor-owned systems where disclosure
12 requirements may differ. This, itself, raises additional questions. What information should
13 be disclosed? Will disclosure have an adverse impact on home values? Will it impact
14 businesses? Will disclosure reduce the availability of low-income housing stock?

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

21 As it stands, OPC, nor any party can definitively say yes or no to any of these questions.
22 More troubling is that no party to the case seems to have the answers. This is an unsettling
23 prospect given the universe of potential negative outcomes. OPC's proposal is the only
24 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 research¹⁴ 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

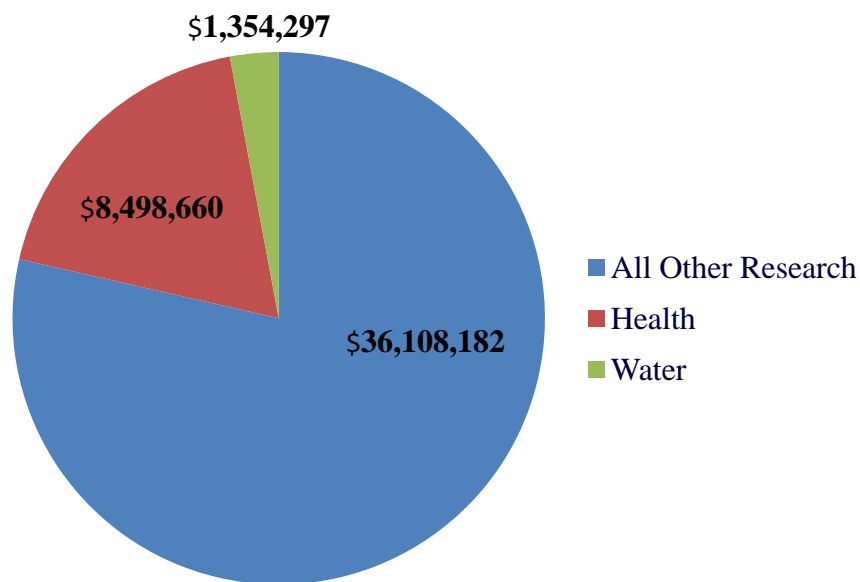
For the period between 2008 and 2016, Federal non-defense spending in the US accounted for \$648.87 billion of which \$343.34 billion was dedicated to health

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-trends-federal-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.

1 **Q. The Company argues that OPC’s proposal is redundant to efforts already taken at**
2 **the national-level by the Lead Service Line Replacement Collaborative (“LSLRC”).**
3 **Please respond.**

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

10 **Getting Started**

11 Local elected officials and community leaders should start by contacting the local
12 water utility to ask whether a proactive initiative for full lead service line (LSL)
13 replacement is underway in the community. A useful first step could also include
14 contacting local experts at nearby consulting engineering firms, neighboring water
15 utilities, and colleges or universities (e.g. in the environmental engineering
16 department) for information about LSL replacement.

17 **Water utilities in the process of planning a proactive LSL replacement**
18 **initiative or reviewing ways to accelerate an existing initiative, will find it**
19 **useful to engage local leaders, state agencies, and others early to get their**
20 **perspectives and expertise. Additionally, local elected officials or water**
21 **utilities could form an advisory group to discuss options and/or an internal**
22 **team to help coordinate the planning process.**

23 In getting started, people may not initially agree on whether and/or how to
24 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 Decisions²⁰

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 questions²¹

Elements of a full lead service line replacement plan to consider:

| | |
|--|---|
| How many LSLs exist in our community, and where are they located? | + |
| How do we define full LSL replacement? | + |
| Will participation be mandatory or voluntary? | + |
| How will we prioritize and sequence LSL replacements? | + |
| How can we identify households at risk of disproportionate impact? | + |
| What are the roles and responsibilities for a variety of organizations? | + |
| How will regulations affect LSL replacement? | + |
| How can we ensure public health protection throughout the replacement process? | + |
| What is our timetable? | + |
| What are our metrics of success? | + |

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.

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

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

11 Lead-free water filters have also been historically utilized by the EPA at federally
12 designated Superfund sites found in Missouri's old lead belt (see GM-2). These are areas
13 where the concentration of lead in ground water is known to exceed the EPA action level
14 primarily from historical lead mining extraction and/or smelting operations at sites found
15 in Desloge, Fredericktown and Joplin.²⁴ There are thirty-three EPA Lead Superfund sites
16 in Missouri with sites found in St Louis and St. Charles Counties.²⁵ To the extent OPC's
17 proposal could identify alternative solutions that produce superior public benefits at a
18 fraction of the price, concerns regarding the cost of ratepayers should support OPC
19 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>

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

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

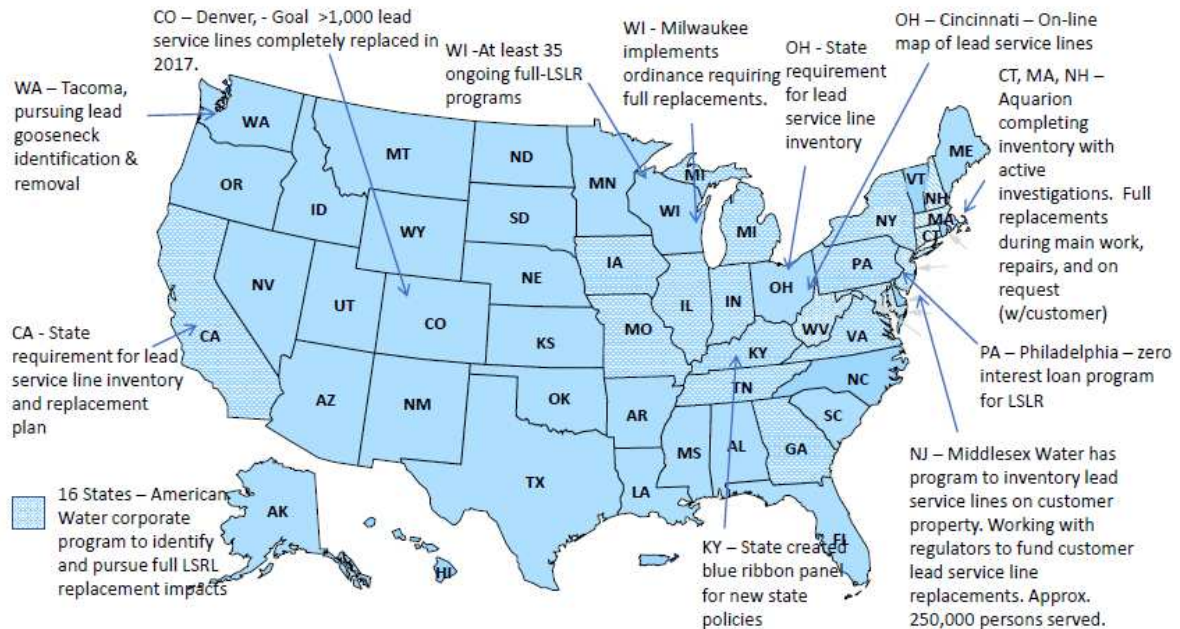
8
9 **V. RESPONSE TO ASSERTIONS REGARDING THE EFFORTS OF**
10 **OTHER UTILITIES**

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

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

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

Local communities are taking steps



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.

1 For example, Mr. Naumick's map cites to the city of Cincinnati, which is transparently
2 disclosing an on-line map of known lead service lines.³⁵ Now consider this in light of
3 recent American Water announcements to roll-out "customer-friendly" transparent, real-
4 time, infrastructure upgrade project maps in both West Virginia³⁶ and New Jersey.³⁷ Both
5 transparency and disclosure are items an external observer would conclude are reasonably
6 foreseeable obstacles to this application, yet no party has responded or otherwise
7 addressed OPC's concerns in this area.

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

12 The notice states:

13 Despite treatment, lead contamination is still a possibility in New Orleans. . . .
14 Road work can enhance that risk. City lines are often disconnected and
15 reconnected with a homeowner's pipe system. That can dislodge deposits that have
16 prevented lead from leeching into water in the homeowner's pipe. Lead can be
17 released into the water for months after a reconnection is completed.

18 Sarah McLaughlin Porteous, the director of the city's Special Projects & Strategic
19 Engagement Office, said S&WB and the city will be notifying affected property
20 owners and renters of the possibility of elevated lead levels before each road
21 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 details on 2017 system investments. <http://pr.amwater.com/PressReleases/releasedetail.cfm?ReleaseID=1033522>

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

3 Should roadwork merit customer notification of an enhanced risk of lead contamination?³⁹

4 What about consideration for the construction workers?^{40,41,42} **
5
6
7
8
9

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>

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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.

6

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

7

8

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?

9

10

11

12

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

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

8 **Revisions Being Considered**

9 The Lead and Copper Rule Revisions White Paper provides examples of
10 regulatory options to improve the existing rule. The paper highlights key
11 challenges, opportunities, and analytical issues presented by these options.

12 **Options include** lead service line replacement, improving optimal corrosion
13 control treatment requirements, consideration of a health-based benchmark, the
14 potential role of point-of-use filters, clarifications or strengthening of tap sampling
15 requirements, increased transparency, and public education requirements⁴³

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

19 It is important to recognize that LSLR presents substantial economic, legal,
20 technical and environmental justice challenges.⁴⁴

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

⁴³US 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

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

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

- 10 • The appropriate pace of LSLR and the mechanism for implementing and
11 enforcing any LSLR program requirements. Consideration of number of
12 LSLs that can feasibly be replaced on an annual basis will need to be
13 considered as well as water system size.
- 14 • Costs and benefits of LSLR for reducing lead exposures. National costs
15 could range from \$16 to \$80 billion dollars. Benefits will be estimated
16 based upon avoided effects of lead exposure such as IQ loss in developing
17 children. EPA will evaluate how much additional lead exposure reduction
18 can be achieved in removing LSLs from water systems with optimized
19 corrosion control. EPA will also evaluate other measures that can reduce
20 lead exposure to assure that resources are focused on reducing the most
21 significant sources of lead.
- 22 • How to provide for full LSLR where the utility does not own the full line,
23 including an evaluation of whether a potential change to the definition of
24 “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,

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

18 Far from being declarative evidence that “the issue is settled,” or that OPC’s modest
19 proposal is irrational, the EPA’s white paper reinforces OPC’s argument and validates our
20 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

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

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

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

20 **VII. RESPONSE TO COMMENTS REGARDING FLINT, MICHIGAN**

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

23 A. The Flint water crisis became a nation-wide focal event that heightened the dialogue
24 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/>

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

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

8 **Q. Provide some context for Flint, Michigan?**

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

10 The beleaguered history of Flint, Michigan over the last several decades is well
11 known,⁵¹ yet some facts are particularly important to provide context for our
12 findings and recommendations. The City of Flint has suffered dramatic declines in
13 population. From a peak of more than 200,000 in 1960, Flint's population had
14 fallen below 100,000 residents by 2014. Since 2000, Flint has lost over 20 percent
15 of its population.⁵² Of the remaining residents, approximately 57 percent are Black
16 or African American.⁵³

17 Poverty is endemic in Flint, with 41.6 percent of the population living below
18 federal poverty thresholds—2.8 times the national poverty rate. The median value
19 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).

1 average.^{54,55} Crime plagues the community; for 2013, Flint's crime index was 811
2 as compared to a national average of 295.⁵⁶

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

10 **Q. What took place in Flint, Michigan?**

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

12 We now understand the Flint Water Crisis as a disaster with many facets:
13 environmental, socio-economic, political, and infrastructural, among others. The dire
14 problems affecting the city's water started in April 2013 when, as a short-term cost-
15 saving measure, city officials opted to switch the water supply from Lake Huron to
16 the Flint River. Not long after the switch, residents began to notice an unpleasant
17 odor and discoloration in the water flowing from their taps. While water testing data
18 reported by state government officials passed regulations from the U.S.
19 Environmental Protection Agency (EPA), data collected by outside academics from
20 Virginia Tech suggested otherwise. This independent academic work found water
21 lead levels dramatically higher than the threshold allowed by the EPA's Lead and
22 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/genesee/county/outcomes/overall/snapshot

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

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

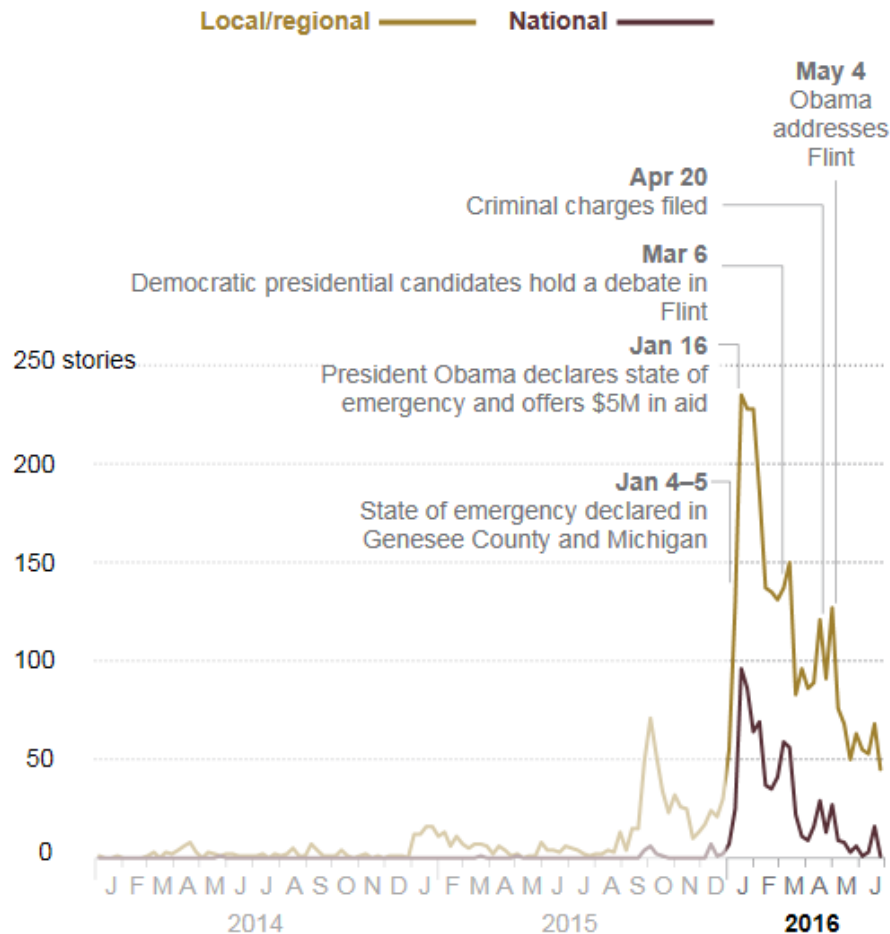
16 **Q. Did the "Flint Water Crisis" receive a large amount of news coverage?**

17 **A.** Yes. Pew Research analyzed Google search data (approximately 2,700 unique keywords)
18 from January 5th, 2014 through July 2, 2016 to examine the kind of searches most prevalent
19 as a proxy for public interest, concerns and intentions at local, state and national level. Pew's
20 data showed how a local issue became national news. It also highlighted how Flint residents
21 utilized Google for answers about the quality of their water before the local government had
22 issued alerts and that questions about personal health consistently saw the largest share of
23 activity across the two years. Figure 6 shows the number of Flint water crisis-related sorties
24 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 Crisis⁶¹



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 Lead 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 lead 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-](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 Satterfield, 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/>

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

5 Restated, it appears as though the concentration of elevated water lead levels in Flint,
6 Michigan⁶⁸ followed a power law distribution where a small number of locations accounted
7 for a disproportionate amount of the elevated lead levels.⁶⁹ Whether or not Flint, Michigan
8 ever exceeded the EPA action-level of 15 ppb at the 90th percentile is not clear.⁷⁰ Importantly,
9 the cause of that increased lead exposure in water samples, in some cases, may be attributable
10 to lead-based premised plumbing and/or fixtures not necessarily (or just) lead service lines.
11 That is, elevated concentrations of lead were found at sites without lead service lines, most
12 likely from lead-based premise plumbing and/or other internal fixtures that contained lead.⁷¹

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

14 A. Water pipes and faucets within a customer's home or building. Figure 7 provides a graphical
15 illustration of all of the potential sources in which water flows through in a given distribution
16 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.

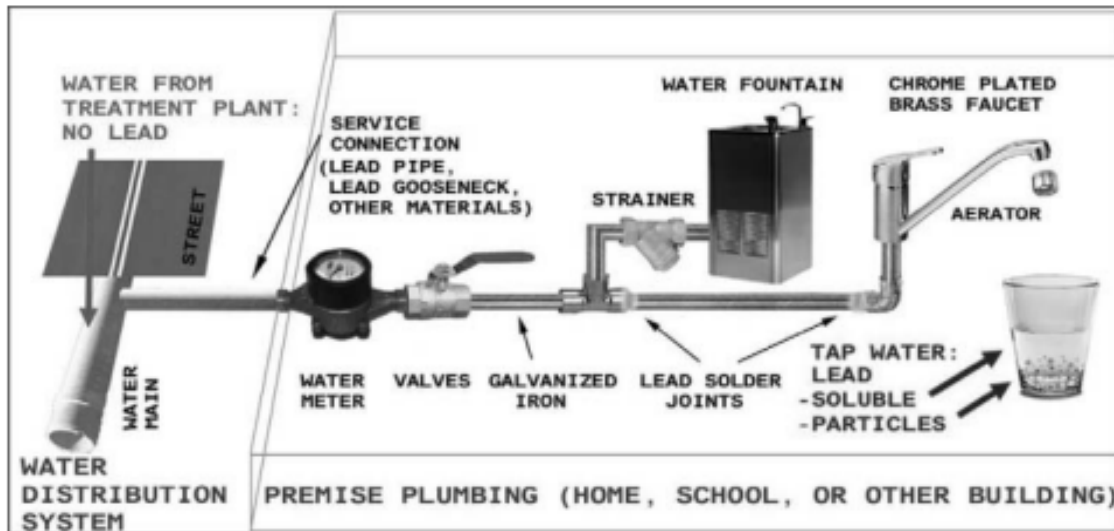
⁶⁹ Power law distribution occurs when one quantity varies as a power of another. Normal distributions are often graphed as "bell-curve" while power law distributions resemble a graphical "hockey stick." See also, Taleb, N. (2007) *The black swan: The impact of the highly improbable*. New York: Random 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 buildings⁷²



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 Environmental Science and Technology*. <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?

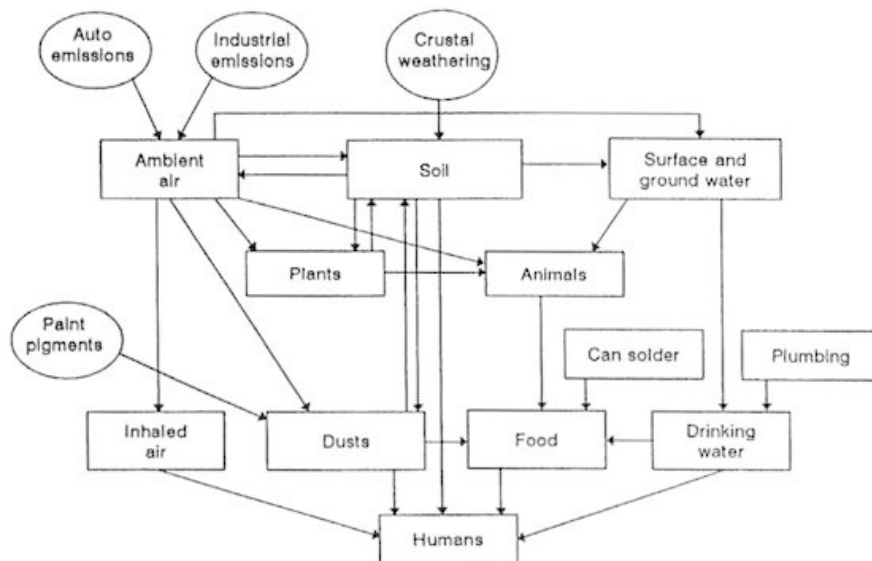
A. Intuitively it would seem to make sense, but more research is necessary to substantiate the impact.⁷³ For example, this line of argument (that elevated risk exposure would occur from lead service line replacement) would still be present if the full lead service line was replaced as well, at least 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 humans⁷⁴



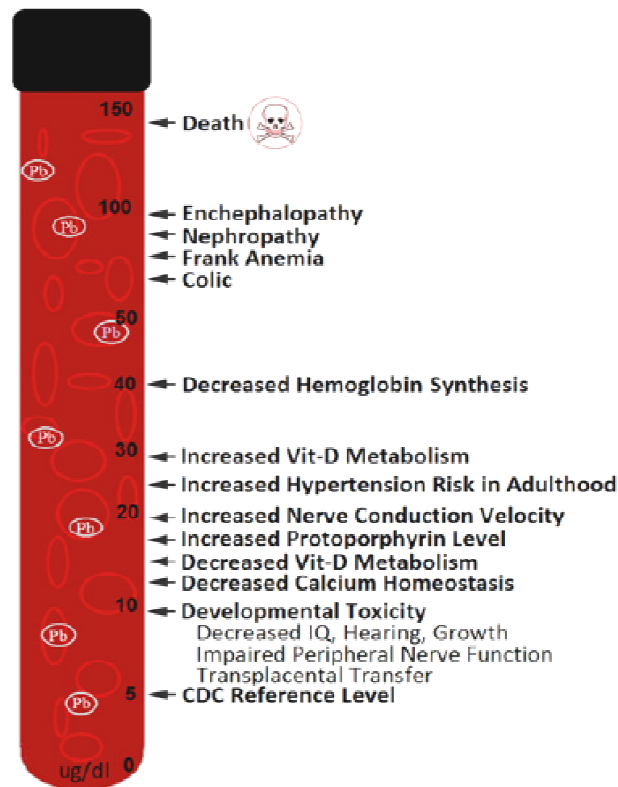
⁷³ As stated in the direct testimony of Geoff Marke, p. 5, footnote 6

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 health⁷⁵



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 $\mu\text{g}/\text{dL}$, 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 time⁷⁶

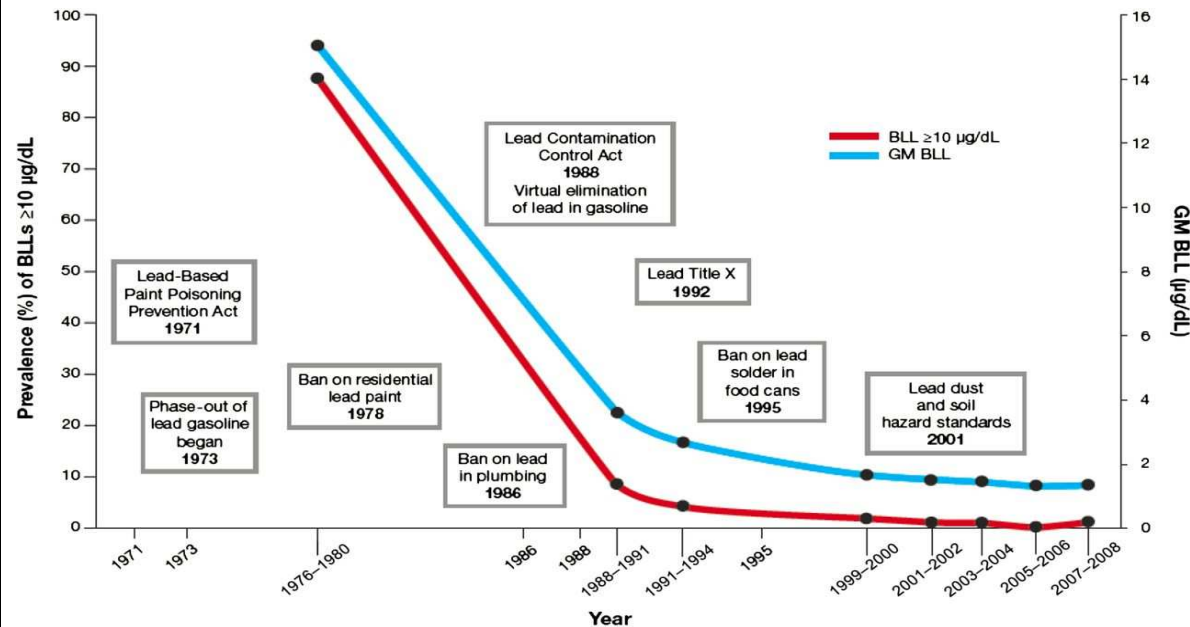
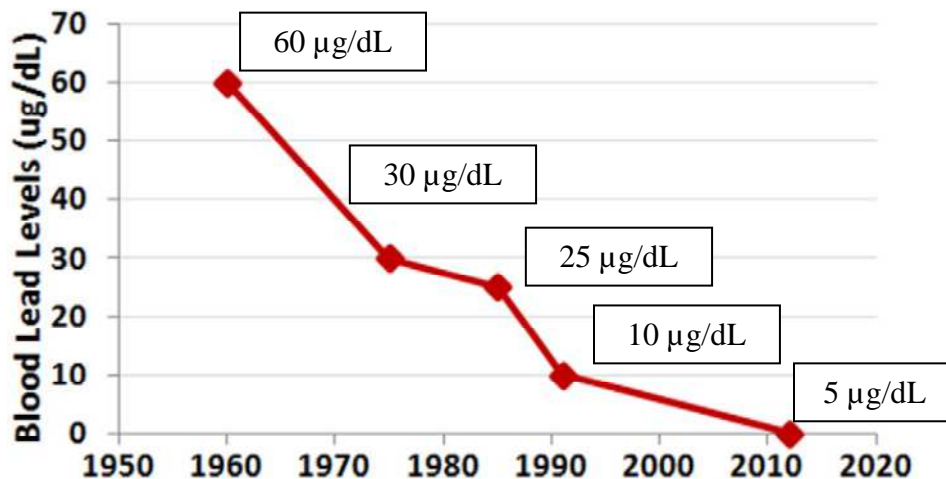


Figure 11: BLL “reference levels” considered harmful by CDC over time⁷⁷



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 children⁷⁸

| 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

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

4 Figure 12: All time-line events listed in the Flint Water Advisory Task Force, Final Report pertaining
5 to blood lead levels^{79,80}

6 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.

7 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.

8 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.

1 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.

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

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

5 On July 1, 2016 the CDC published its Morbidity and Mortality Weekly Report which
6 included an article titled, “Blood Lead Levels among Children Aged <6 Years — Flint,
7 Michigan, 2013–2016.” The report includes a breakdown of BLL’s for children under 6 in
8 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, 2016⁸¹

| 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 $\mu\text{g/dL}$) among children less than 6 years of age in Michigan, Genesee County and the city of Flint⁸²

| | | 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

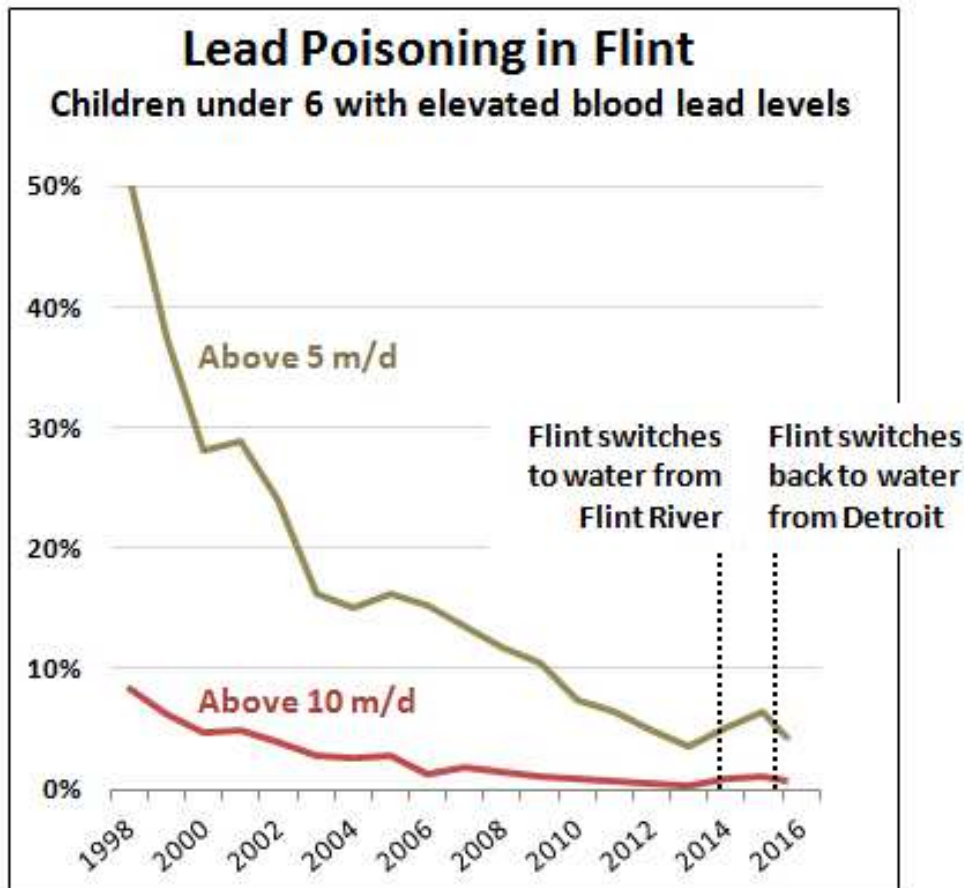
GM-4 contains a breakdown of the CDC's National Surveillance Data of tested and confirmed BLL above ≥ 5 $\mu\text{g/dL}$ by state, year (2010-2015) for children over 3 years of age for comparative purposes to illustrate that Flint's numbers are not out of line with averages seen in other states across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

⁸²Michigan 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 $\mu\text{g}/\text{dL}$ in Flint 1998-2016⁸⁴



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 $\mu\text{g}/\text{dL}$ 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 linked 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

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

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

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

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

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

20 OPC’s pilot program proposal is especially appropriate considering that the Company’s
21 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/>

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

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

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

18 **Q. Does this conclude your testimony?**

19 **A.** Yes.