ECKERT SEAMANS
ATTORNEYS AT LAW

Eckert Seamans Cherin & Mellott, LLC
213 Market Street
8th Floor
Harrisburg, PA 17101

TEL 717 237 6000
FAX 717 237 6019
www.eckertseamans.com

Daniel Clearfield
717.237.7173
dclearfield@eckertseamans.com

November 7, 2018

Via Electronic Filing
Rosemary Chiavetta, Secretary
PA Public Utility Commission
PO Box 3265
Harrisburg, PA 17105-3265

Re: PA PUC v. Pittsburgh Water and Sewer Authority
Docket Nos. R-2018-3002645 and R-2018-3002647

Dear Secretary Chiavetta:

Enclosed for electronic filing please find the Pittsburgh Water and Sewer Authority's ("PWSA") Motion in Limine to Bar the Admission of Direct Testimony of Israel E. Gray Submitted on Behalf of I&E, Brian Kalcic on Behalf of OSBA, and Mitchell Miller, Gregory Welter and Bruce Lanphear on Behalf of Pittsburgh UNITED with regard to the above-referenced matter. Copies to be served in accordance with the attached Certificate of Service.

Sincerely,

Daniel Clearfield

DC/jls
Enclosure

cc: Hon. Mark Hoyer w/enc.
Hon. Conrad Johnson w/enc.
Certificate of Service w/enc.

CERTIFICATE OF SERVICE

I hereby certify that this day I served a copy of the Pittsburgh Water and Sewer Authority's Motion in Limine, upon the persons listed below in the manner indicated in accordance with the requirements of 52 Pa. Code Section 1.54.

Via Email and/or First Class Mail

Elizabeth Triscari, Esq.
Sharon Webb, Esq.
Office of Small Business Advocate
300 North Second St., Suite 202
Harrisburg, PA 17101
etriscari@pa.gov
swebb@pa.gov

Christine Maloni Hoover, Esq.
Lauren M. Burge, Esq.
Erin L. Gannon, Esq.
Office of Consumer Advocate
555 Walnut St., 5th Fl., Forum Place
Harrisburg, PA 17101-1923
choover@paoca.org
lburge@paoca.org
egannon@paoca.org

Gina L. Miller, Esq.
John M. Coogan, Esq.
Bureau of Investigation & Enforcement
PA Public Utility Commission
P.O. Box 3265
Harrisburg, PA 17105-3265
ginmiller@pa.gov
jcoogan@pa.gov

James Ferlo
1118 N. St. Clair St.
Pittsburgh, PA 15206
senatorferlo@gmail.com

Susan Simms Marsh, Esq.
Pennsylvania-American Water Company
800 West Hersheypark Drive
Hershey, PA 17033
Susan.marsh@amwater.com

Michael A. Gruin, Esq.
Stevens & Lee
17 North Second St., 16th Fl.
Harrisburg, PA 17101
mag@stevenslee.com

Dimple Chaudhary, Esquire
Peter J. DeMarco, Esquire
Cecilia Segal, Esquire
Natural Resources Defense Council
1152 15th Street, NW, Ste. 300
Washington, DC 20005
dchaudhary@nrdc.org
pdemarco@nrdc.org
segal@nrdc.org

Elizabeth R. Marx, Esq.
John Sweet, Esq.
The Pennsylvania Utility Law Project
118 Locust St.
Harrisburg, PA 17101
pulp@palegalaid.net
jsweetpulp@palegalaid.net

Tishekia Williams, Esq.
Michael Zimmerman, Esq.
Emily M. Farah, Esq.
Duquesne Light Company
411 Seventh Avenue, 15th Fl.
Pittsburgh, PA 15219
twilliams@duqlight.com
mzimmerman@duqlight.com
efarah@duqlight.com.

William H. Roberts II, Esquire
PNG Companies LLC
375 North Shore Drive
Pittsburgh, PA 15212
william.h.robertsii@peoples-gas.com

David P. Zambito, Esquire
Jonathan P. Nase, Esquire
Cozen O'Connor
17 North Second Street
Suite 1410
Harrisburg, PA 17101
dzambito@cozen.com
jnase@cozen.com

Pamela C. Polacek, Esq.
Adeolu A. Bakare, Esq.
Alessandra L. Hylander, Esq.
McNEES WALLACE & NURICK LLC
100 Pine Street
P.O. Box 1166
Harrisburg, PA 17108-1166
ppolacek@mcneeslaw.com
abakare@mcneeslaw.com
ahylander@mcneeslaw.com

Dated: November 7, 2018

Daniel Clearfield, Esquire

BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Pennsylvania Public Utility Commission, *et al.*	:	
	:	Docket No. R-2018-3002645, *et al.*
v.	:	
	:	
Pittsburgh Water and Sewer Authority - Water	:	
Pennsylvania Public Utility Commission, *et al.*	:	
	:	Docket No. R-2018-3002647, *et al.*
v.	:	
	:	
Pittsburgh Water and Sewer Authority - Wastewater	:	

NOTICE TO PLEAD

To: Pennsylvania Public Utility Commission's Bureau of Investigation and Enforcement, Pennsylvania Office of Small Business Advocate and Pittsburgh UNITED

You are hereby notified to file a response to the enclosed Motion in Limine in the form and manner as directed by the Administrative Law Judges or a judgment may be entered against you.

Respectfully submitted,

Daniel Clearfield, Esq.
(PA Attorney ID No. 26183)
Deanne M. O'Dell, Esq.
(PA Atty I.D. 80614)
Carl R. Shultz, Esq.
(PA Attorney ID No. 70328)

Eckert Seamans Cherin & Mellott, LLC
213 Market Street, 8th Floor
Harrisburg, PA 17101
717.237.6000
717.237.6019 (fax)
dclearfield@eckertseamans.com
dodell@eckertseamans.com
cshultz@eckertseamans.com

Dated: November 7, 2018

Counsel for
The Pittsburgh Water and Sewer Authority

BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Pennsylvania Public Utility Commission, *et al.*	:	
	:	Docket No. R-2018-3002645, *et al.*
v.	:	
	:	
Pittsburgh Water and Sewer Authority - Water	:	
Pennsylvania Public Utility Commission, *et al.*	:	
	:	Docket No. R-2018-3002647, *et al.*
v.	:	
	:	
Pittsburgh Water and Sewer Authority - Wastewater	:	

MOTION IN LIMINE
TO BAR THE ADMISSION OF THE DIRECT TESTIMONY OF ISRAEL E. GRAY SUBMITTED ON BEHALF OF I&E, BRIAN KALCIC ON BEHALF OF OSBA, AND MITCHELL MILLER, GREGORY WELTER AND BRUCE LANPHEAR ON BEHALF OF PITTSBURGH UNITED

To Deputy Chief Administrative Law Judge Mark A. Hoyer and Administrative Law Judge Conrad A. Johnson:

Pursuant to 52 Pa. Code § 5.103, The Pittsburgh Water and Sewer Authority ("PWSA" or "Authority") respectfully submits that the scope of this proceeding should be limited so as to exclude issues that the Public Utility Commission ("Commission" or "PUC") has directed be investigated in PWSA's LTIIP[1] and/or Compliance Plan proceeding,[2] and, accordingly, PWSA moves that the direct testimony regarding PWSA's lead service line replacement program/policies of (1) Israel E. Gray submitted on behalf of the Commissions' Bureau of

---

1 On September 28, 2018, PWSA filed its Long-Term Infrastructure Improvement Plan ("LTIIP") at Docket No. P-2018-3005037. The procedures to investigate the issues in that proceeding are set forth in Chapter 121 of the Commission's Regulations, 52 Pa. Code § 121.1-121.8, and the Secretarial Letter published in the Pennsylvania Bulletin on October 13, 2018. https://www.pabulletin.com/secure/data/vol48/48-41/1605.html.

2 On September 28, 2018, PWSA filed its Compliance Plan at Docket Nos. M-2018-2640802 (water) and M-2018-2640803 (wastewater). Notice of that filing and the procedures to be used to investigate the issues in that proceeding were published in the *Pennsylvania Bulletin* on October 13, 2018. https://www.pabulletin.com/secure/data/vol48/48-41/1605.html.

Investigation and Enforcement ("I&E") (2) Brian Kalcic submitted on behalf of the Office of Small Business Advocate ("OSBA") and (3) Gregory Welter and Bruce Lanphear submitted on behalf of Pittsburgh UNITED should be barred from admission as being irrelevant to PWSA's 2018 Base Rate Case.[3] In addition, certain pages regarding PWSA's lead service line replacement program/policies of the direct testimony of Mitchell Miller on behalf of Pittsburgh UNITED should also be should be barred from admission for the same reason.[4] In support hereof, PWSA states as follows:

1. On July 2, 2018, PWSA[5] filed Tariff Water – Pa. P.U.C. No. 1 and Tariff Wastewater – Pa. P.U.C. No. 1 to become effective August 31, 2018 with the Commission (collectively, the "2018 Base Rate Case"). Through the 2018 Base Rate Case, PWSA requests that the Commission approve its proposed rates[6] and tariffs pursuant to Chapter 32.

2. On September 25, 2018, I&E submitted the direct testimony of Israel E. Gray (I&E Statement No. 4). Mr. Gray's direct testimony is primarily devoted to PWSA's lead service line replacement program/policies.[7]

3. On September 25, 2018, OSBA submitted the direct testimony of Brian Kalcic (OSBA Statement No. 1). Portions of Mr. Kalcic's direct testimony are related to PWSA's lead service line replacement program/policies.[8]

---

3 See Attachments 1, 2, 4-5 to this Motion.

4 See Attachment 3 to this Motion.

5 PWSA's water and wastewater operations became subject to regulation by the Pennsylvania Public Utility Commission on April 1, 2018, pursuant to Act 65 of 2017, 66 Pa.C.S. § 3201 *et seq.* ("Act 65" or "Chapter 32"). *See Implementation of Chapter 32 of the Public Utility Code; RE: Pittsburgh Water And Sewer Authority*, Docket Nos. M-2018-2640802 and M-2018-2640803, Final Implementation Order entered March 15, 2018 ("FIO").

6 PWSA proposes increases to water and wastewater total annual operating revenues of approximately $27.0 million per year or 17.1% on a total revenue basis over the amount of annual revenues at present rates.

7 I&E Statement No. 4 at 1-7.

8 OSBA Statement No. 1 at 9-10.

4. The Petition to Intervene filed by Pittsburgh UNITED was granted.[9] On September 25, 2018, Pittsburgh UNITED submitted the direct testimony of Mitchell Miller (Pittsburgh UNITED St. No. 2), Gregory Welter (Pittsburgh UNITED St. No. 4), Bruce Lanphear (Pittsburgh UNITED St. No. 5), and others. Mr. Welter's direct testimony is devoted entirely to PWSA's lead service line replacement program/policies.[10] Mr. Lanphear's direct testimony is also devoted entirely to PWSA's lead service line replacement program/policies.[11] In addition, pages 64-65 and 83-88 of Mr. Miller's testimony discuss PWSA's lead service line replacement program/policies.[12]

5. On October 26, 2018, PWSA filed its rebuttal testimony. As a precautionary measure, PWSA provided rebuttal to the testimony regarding PWSA's lead service line replacement program/policies.[13] However, as explained in greater detail herein, the direct testimony on said issues should be barred from admission and be disregarded in the disposition of PWSA's 2018 Base Rate Case.

6. Section 5.403(a) of the Commission's regulations authorizes presiding officers to control the receipt of evidence, including ruling on the admissibility of evidence, confining the evidence to the issues in the proceeding and limiting the scope of direct testimony and cross-examination.[14]

---

9 Prehearing Order dated July 20, 2018, which is available at: http://www.puc.pa.gov/pcdocs/1577805.doc.

10 Pittsburgh UNITED St. No. 4.

11 Pittsburgh UNITED St. No. 5.

12 Pittsburgh UNITED St. No. 2 at 64-65, 83-88.

13 PWSA recognizes that if this Motion is granted, portions of PWSA's rebuttal testimony will be moot. PWSA will be prepared at the hearing to submit appropriately revised rebuttal testimony. In addition, portions of the rebuttal testimony of others may also be moot. *See, e.g.,* OCA Statement 2R at p. 1-4.

14 52 Pa. Code § 5.403(a). *See also* 52 Pa.Code § 5.483 (ALJs are empowered to exclude irrelevant, immaterial or unduly repetitive evidence, to prevent excessive examination of witnesses, to schedule and impose reasonable limitations on discovery and to otherwise regulate the course of the proceeding). Pursuant to the Commission's regulations, "written testimony is subject to the same rules of admissibility and cross-examination of

7. Upon the filing of a motion in limine, Administrative Law Judges ("ALJs") have employed the authority granted by Section 5.403 to exclude evidence that is beyond the proper scope of Commission proceedings and focus the evidence on the matters properly at issue.[15] In *Pa. Public Utility Commission v. PPL Electric Utilities Corporation*,[16] the ALJ struck pre-served written testimony regarding proposals to undertake a cost-benefit analysis and other studies, noting that other Commission proceedings were available for addressing those issues and that challenges could also be effectively pursued in complaint proceedings. The ALJ expressly refused to permit the litigation of issues that are presently pending before the Commission in another proceeding.[17]

8. Both the Legislature[18] and the Commission[19] contemplated a two-step process for making PWSA subject to Commission regulation: (1) this proceeding wherein PWSA's initial PUC Tariff and rates is being reviewed and determined to be just and reasonable;[20] and (2) a second separate proceeding in which PWSA's overall operations, contracts and arrangements

---

the sponsoring witness as if it were presented orally in the usual manner." 52 Pa. Code § 5.412(c). Essential legal principles must be observed when ruling on evidentiary issues. *See, e.g., Pittsburgh & L. E. R. Co. v. PUC*, 85 A.2d 646 (Pa. Super. 1952).

15 Section 5.403(b) of the Commission's regulations requires presiding officers to "actively employ these powers to direct and focus the proceedings consistent with due process." 52 Pa. Code § 5.403(b).

16 Docket No. R-2015-2469275 (Sixth Prehearing Order dated July 14, 2015).

17 *See also Pa. Public Utility Commission, et al. v. Pennsylvania American Water Co.*, Docket No. R-00932670 *et al*, 1994 Pa. PUC LEXIS 120 at *158 (Final Order entered July 26, 1994) (adopting the ALJ's conclusion that the issues raised by OCA were outside the scope of the rate case and would be better addressed in a statewide rulemaking proceeding); *Re Gas Cost Rate No. 5*, 57 Pa. P.U.C. 158 (1983) ("The testimony stricken by the ALJ addresses, in part, matters broader than the scope of the instant proceeding.").

18 66 Pa.C.S. § 3204(a), (b).

19 The Commission, in its FIO, reinforced this bifurcated approach by stating that it will provide "stakeholders with flexibility to coordinate issues between the tariff filings and compliance plans" and that it expects "the parties to harmonize the two proceedings." FIO at 32. In reiterating a directive in its Tentative Implementation Order, the PUC provides that "in its compliance plans, PWSA will propose plans to achieve full regulatory compliance for matters not addressed in its July 2018 tariff filings." FIO at 31.

20 66 Pa.C.S. § 3204(a).

would be carefully reviewed and a plan would be established to bring those contracts and service arrangements into compliance with "rules, regulations and orders of the Commission."[21]

9. Issues regarding PWSA's lead service line replacement program/policies should be stricken because they are irrelevant to PWSA's 2018 Base Rate Case. Any jurisdictional issues[22] are to be investigated as part of PWSA's LTIIP and/or Compliance Plan.[23] Other parties to this proceeding have recognized this fact.[24] The LTIIP and/or Compliance Plan proceeding is intended to provide a sufficient opportunity to fully evaluate such issues, including the steps and timeframes involved for compliance. Base rate proceedings have a constrained timeframe and a narrow focus on the examination of proposed base rates in the Tariff. That being said, it should be clearly noted that the issues raised in the subject testimony do not relate to the proposed base rates of PWSA. The subject testimony makes recommendations or proposals for changes to PWSA's lead service line replacement program/policies. But nothing in said recommendations or proposals makes actual adjustments to PWSA's revenues or expenses for the FPFTY. Such testimony is, therefore, clearly targeted at "compliance" issues (as opposed to base rate issues). Within the context of a base rate proceeding, it is not possible or feasible for PWSA to

---

21 66 Pa.C.S. § 3204(b).

22 Please note that lead service line replacement program/policies are mandated by the Lead and Copper Rules, 25 Pa.Code § 109.1101-109.1108, promulgated by the Pennsylvania Department of Environmental Protection ("DE") and PWSA's Consent Order and Agreement ("COA") with DEP. In addition, the parameters for PWSA's replacement of private-side lead service lines is dictated by the terms of the financing between Pennsylvania Infrastructure Investment Authority ("PENNVEST") and PWSA.

23 Compliance Plan at 119-121. *See also* UNITED's Comments on PWSA's Compliance Plan at p. 16-17 (raising issues related to lead service lines in the Compliance Plan proceeding), which is available at: http://www.puc.state.pa.us/pcdocs/1592410.pdf; and OCA's Comments on PWSA's LTIIP at p. 7-8 (raising issues related to lead service lines in PWSA's LTIIP proceeding), which is available at: http://www.puc.state.pa.us/pcdocs/1591688.pdf; and UNITED's Comments on PWSA's LTIIP at p. 3, 7-12 (raising issues related to lead service line replacements in PWSA's LTIIP proceeding), which is available at: http://www.puc.state.pa.us/pcdocs/1591706.pdf.

24 OCA Statement No. 5 at 4 (The OCA supports the Authority's replacement of lead service lines, including the customer portion of the lead service line. The OCA reserves the right to address the program, including funding, and modifications, as well as education and outreach efforts in detail in the compliance plan filing.).

sufficiently address all of the "compliance" issues or to adequately respond to proposals that necessitate significant, complex and expensive changes. Permitting testimony addressing PWSA's lead service line replacement program/policies would improperly inject "compliance" issues into this proceeding. Given that the LTIIP and Compliance Plan proceedings exist,[25] permitting such testimony would be a waste of time/resources and would divert attention away from the legitimate issues in this proceeding.

WHEREFORE, PWSA respectfully requests that ALJs Hoyer and Johnson bar from admission the testimony of Israel E. Gray (I&E Statement No. 4), Brian Kalcic (OSBA Statement No. 1), Gregory Welter (Pittsburgh UNITED St. No. 4), Bruce Lanphear (Pittsburgh UNITED St. No. 5) and Mitchell Miller (Pittsburgh UNITED St. No. 2, and that said testimony be disregarded in the disposition of PWSA's 2018 Base Rate Case.

Respectfully submitted,

Daniel Clearfield, Esq.
(PA Attorney ID No. 26183)

Deanne M. O'Dell, Esq.
(PA Atty I.D. 80614)

Carl R. Shultz, Esq.
(PA Attorney ID No. 70328)

Eckert Seamans Cherin & Mellott, LLC
213 Market Street, 8th Floor
Harrisburg, PA 17101
717.237.6000
717.237.6019 (fax)
dclearfield@eckertseamans.com
dodell@eckertseamans.com
cshultz@eckertseamans.com
Counsel for
The Pittsburgh Water and Sewer Authority

Dated: November 7, 2018

25 *See* footnote 2.

PWSA

Motion in Limine

Attachment 1

Direct Testimony of
Israel E. Gray
(I&E Statement No. 4)

I&E Statement No. 4
Witness: Israel E. Gray

PENNSYLVANIA PUBLIC UTILITY COMMISSION

v.

PITTSBURGH WATER & SEWER AUTHORITY

Docket Nos. R-2018-3002645 & R-2018-3002647

Direct Testimony

of

Israel E. Gray

Bureau of Investigation & Enforcement

Concerning:

Lead Line Replacement Plan and Data
Leak Survey
Risk Assessment Model
Need for Established Performance Metrics

Q. PLEASE STATE YOUR NAME, OCCUPATION AND BUSINESS ADDRESS.

A. My name is Israel E. Gray. I am a Fixed Utilities Valuation Engineer in the Safety Division of the Pennsylvania Public Utility Commission's (PA PUC or Commission) Bureau of Investigation and Enforcement (I&E). My business address is Pennsylvania Public Utility Commission, P.O. Box 3265, Harrisburg, PA 17105-3265.

Q. WHAT IS YOUR EDUCATIONAL AND EMPLOYMENT EXPERIENCE?

A. I attended the University of Pittsburgh and earned a Bachelor of Science Degree in Civil Engineering in 1995. I joined the Commission's Safety Division in September of 2014. Prior to 2014, I worked for the Pennsylvania Department of Environmental Protection (PA DEP) from 2011 to 2014, where I worked in Water Quality.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?

A. The purpose of my Direct Testimony is to address Pittsburgh Water and Sewer Authority's (PWSA) rate request to ensure that any money requested for pipeline replacement is prudently spent. More specifically, I will address PWSA's need to: (1) establish and maintain accurate pipeline records and data; (2) establish a leak survey; and (3) establish a risk assessment model and performance metrics to

maximize the use of any ratepayer funds that PWSA may be awarded through this case.

Q. DOES YOUR TESTIMONY INCLUDE AN EXHIBIT?

A. Yes. I&E Exhibit No. 4 contains schedules relating to my direct testimony.

Q. DO YOU WISH TO MAKE ANY COMMENTS REGARDING THE OVERALL SCOPE OF YOUR DIRECT TESTIMONY?

A. Yes. I will be addressing some but certainly not all the issues facing PWSA as it is brought under PA PUC jurisdiction. It is important to note that the fact that I have not addressed a certain issue should not be interpreted as my agreement regarding PWSA's position or as a waiver of that issue for future cases. I&E reserves the right to make further recommendations in future proceedings on any safety or operational issues, and, in particular, after review of PWSA's pending Compliance Plan filing (PWSA Ex. RAW-4).

Q. DID PWSA'S FILING DISCUSS ITS PLAN TO ADDRESS LEAD PIPELINES WITHIN ITS SYSTEM?

A. Yes. PWSA witness Weimar indicated that as part of an agreement with the PA DEP, PWSA has budgeted $44 million to replace 2,100 lead waterlines in Pittsburgh in 2018 (PWSA St. No. 1, p. 9). PWSA indicated that it developed its lead line program after lead levels in semi-annual compliance test homes resulted

in the determination that the test homes exceeded a federal Lead Action Level. As a result, in 2016, the PA DEP ordered PWSA to replace at least 7% of its lead pipelines (1,341 pipelines) each year. Additionally, PWSA also indicated that it is finalizing the implementation of an orthophosphate treatment to manage lead corrosion throughout its system (PWSA St. No. 1, pp. 9-10).

Q. DO YOU HAVE ANY CONCERNS REGARDING PWSA'S PIPELINE REPLACEMENT PLAN?

A. Yes. Through the discovery process in this case, it became apparent that PWSA may not have utilized operating records and data supporting key operational requirements when selecting pipeline replacement projects. Specifically, PWSA admits that it has historically not had a prioritization model for selection of water and sewer replacement (I&E Ex. No. 4, Sch. 1). Data such as risk identification, probability assignments, risk score, risk baseline, improvements in risk, mitigation strategies, and identification of highest pipeline risk are not currently available for review. Additionally, PWSA was not able to provide a lead line replacement plan that identified basic information such as the miles of pipelines replaced per year and the number of customer-owned pipelines replaced (I&E Ex. No. 4, Sch. 2) The lack of information is concerning, because in order to gauge its performance, PWSA should have access to and be able to track this information. Finally, PWSA should be able to track and report on crucial operating metrics like pipeline

material, age of the pipeline, installation year, leaks by pipeline type and segments, and pipeline pressure.

Q. WHY IS IT IMPORTANT FOR RATEMAKING PURPOSES THAT PWSA MAINTAIN ACCURATE OPERATING RECORDS AND DATA?

A. All regulated utilities have an obligation to provide safe and reasonable service and to make repairs or improvements that are necessary for the safety of its customers.[1] If service is inadequate, the Commission has the authority to disallow a rate increase in whole or in part.[2] In order for PWSA's engineers and parties to a rate case to determine whether operating decisions such as pipeline replacement and risk assessment/mitigation plans are in the public interest, PWSA must maintain accurate records and supporting data. The records and data will enable PWSA and the Commission to determine whether the funds that PWSA is seeking in this filing are being spent in ways that maximize the safety benefit of any lead line replacement. Additionally, PWSA's records and data are utilized in calculations of depreciation expense, rate base (if utilized for rate of return ratemaking), and cost of service studies (utilized to determine revenue/expense allocations by customer class).

[1] 66 Pa. C.S. §1501.
[2] 66 Pa. C.S. §526(a).

Q MR. GRAY, WITH REGARDS TO PWSA'S PIPELINE RECORDS AND DATA, WHAT IS YOUR RECOMMENDATION?

A. I recommend that PWSA provide the Commission a list of operating metrics to accurately identify and account for the following: (1) pipeline material; (2) pipeline age; (3) leak history per mile; (4) pipeline pressures; (5) installation year; (6) pipeline diameter; (7) pipeline mileage (distribution and services); (8) addition/retirements of plant; (9) materials and supplies; (10) leak repair; (11) pipeline damages from excavation; (12) plant in service; (13) corrosion protection programs; (14) lead levels; (15) miles of lead pipelines; (16) cost of lead pipeline replacement (PSWA work crews and contractors); (17) sanitary flow reduction; (18) miles of combined sewer separation; (19) lost and unaccounted for water; and (20) any other pipeline metrics that would benefit the operator and the regulator in evaluating the operational viability and safety of the water and sewer systems.

Q. DO YOU HAVE ANY CONCERNS REGARDING PWSA'S PLAN FOR PIPELINE REPLACEMENT?

A. Yes. PWSA has not provided any information regarding what, if any, measures it has taken to mitigate pipeline replacements costs. Although I support PWSA's plan to address lead lines, it will not be possible to evaluate whether PWSA's proposed replacement is cost-effective unless it describes such measures.

Additionally, PWSA has not provided a plan that identifies the anticipated quantity of pipeline replaced and the money budgeted for specific projects.

Q. HAVE ANY OF PWSA'S CUSTOMERS EXPRESSED CONCERN REGARDING PWSA'S PLAN FOR LINE REPLACEMENT IN LIGHT OF ITS RATE REQUEST?

A. Yes. As an example, PWSA customer Madeline Weiss testified at the public input hearing held on September 4, 2018, and she indicated that if there is "an infrastructure plan with new funds from rate increases, it should be very explicit where those lead line replacements are going. . ." She also indicated that if rate funds are used for infrastructure improvements, "the priority should always remain on water safety, so people aren't paying for water that they can't drink."[3] Another example is the testimony of PWSA customer Glen Grayson, Jr. at the public input hearing held on September 6, 2018. Mr. Grayson commented that any rate increase funds that go to replacing lead lines must be made in a manner that is "actually changing our infrastructure for the better, that people actually know where the increase is going."[4]

[3] Transcript of Public Input Hearing, September 4, 2018, 7 p.m., Docket Nos. R-2018-3002645 & R-2018-3002647, p. 103.
[4] Transcript of Public Input Hearing, September 6, 2018, 7 p.m., Docket Nos. R-2018-3002645 & R-2018-3002647, pp. 255-256.

Q. DO YOU HAVE ANY RECOMMENDATION THAT WOULD ADDRESS THE CONCERNS YOU DESCRIBED ABOVE?

A. Yes. As a condition of any rate increase that the Commission may award PWSA through this case, PWSA should be required to detail the steps it is taking to ensure that pipeline replacement is cost-effective and makes the best use of ratepayers' funds. As part of this requirement, PWSA should report regarding the 20 operating metrics that I mentioned above. Additionally, in order to maximize the effectiveness of the information provided and ensure accountability, PWSA should also be required to include a plan that identifies the anticipated quantity of pipeline replaced and the money budgeted for that replacement.

Q. DOES PWSA HAVE A LEAK SURVEY PROGRAM?

A. PWSA does not currently have an active program for leak surveying (I&E Ex. No. 4, Sch. 3). This is a concern because, as explained in I&E Statement No. 3, PWSA estimated unaccounted-for water levels in 2016 and 2017 were in excess of 60%. Without a leak survey program, critical performance metrics cannot be established or monitored and it is more difficult to identify the highest risk pipe and water loss in the distribution system. An active and accurate leak survey program will reduce the water treatment costs to the ratepayers by reducing the unnecessary costs that they pay to treat water that is lost through leaks.

Q. DOES PWSA UTILIZE A RISK MODEL FOR PRIORITIZING PIPELINE REPLACEMENT PROJECTS?

A. PWSA does not have a prioritization model for selection of water and sewer pipeline replacement projects (I&E Ex. No. 4, Sch. 1).

Q. HOW WOULD ESTABLISHMENT OF A RISK ASSESSMENT MODEL AND PERFORMANCE METRICS MAXIMIZE THE USE OF ANY RATEPAYER FUNDS THAT PWSA MAY BE AWARDED THROUGH THIS CASE?

A. Developing a Risk Assessment Model and performance metrics will help PWSA provide safe and reliable service to its customers. Specifically, a Risk Assessment Model will help determine pipelines that pose the highest risk to the health and safety of the public and show which pipelines threaten reliable service to customers. The use of a Risk Assessment Model will help develop a pipeline replacement program and budget that will optimize the effectiveness of the dollars spent by replacing the highest risk pipe. Performance metrics will provide data that determines the effectiveness and efficiency of the pipeline replacement program and ensure that ratepayer funds are spent for the best use. It would also ensure that PWSA is accountable to its ratepayers for the money spent on replacement.

Q. WHAT DO YOU RECOMMEND?

A. I recommend that as an additional condition of any rate increase that the Commission may award PWSA through this case, PWSA should be required to develop a leak survey plan, a risk assessment model, and performance metrics as part of its obligation to ensure that customers receive safe and reliable service.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

PWSA

Motion in Limine

Attachment 2

Direct Testimony of Brian Kalcic (OSBA Statement No. 1)

Pages 9-10

OSBA STATEMENT NO. 1

BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Pennsylvania Public Utility Commission, *et. al.*	:	
	:	
v.	:	**R-2018-3002645 *et al.***
	:	**C-2018-3003388**
Pittsburgh Water & Sewer Authority – Water	:	
	:	
	:	
Pennsylvania Public Utility Commission, *et. al.*	:	
	:	
v.	:	**R-2018-3002647 *et al.***
	:	**C-2018-3003384**
Pittsburgh Water & Sewer Authority – Wastewater	:	
	:	

Direct Testimony and Exhibits of

BRIAN KALCIC

On Behalf of the

Pennsylvania Office of Small Business Advocate

Topics:
Cost Allocation
Revenue Allocation

Date Served: September 25, 2018

Date Submitted for the Record: _____

A. Yes, I have. The results are summarized in column 2 of Schedule BK-1.

Q. Please discuss your next area of disagreement with the Authority's revised WCOSS.

A. PWSA is proposing to continue its residential lead service line replacement program ("LSL Program"). For this proceeding, PWSA proposes to fund the program largely through capital financing sources. For PWSA's FPFTY 2019, the associated capital costs are an estimated $44.3 million, the cost of which would be paid through "future debt issuances or rate funded capital."[2]

Q. Recognizing that the capital cost of the LSL Program would be funded via future debt issuances or rate funded capital, does the proposed LSL Program nevertheless have an impact on the Authority's proposed FPFTY 2019 revenue requirement?

A. Yes. The FPFTY 2019 impact of the LSL program is approximately $417,000, which consists of approximately (i) $200,000 in additional rate funded capital requirements and (ii) $217,000 of allocable Engineering & Construction costs.[3]

Q. How does PWSA allocate its proposed FPFTY 2019 LSL Program costs in its WCOSS?

A. The Authority allocates LSL Program costs to all of its water rate classes.

[2] See PWSA's response to OSBA-II-4.

Q. Do you agree that LSL Program costs should be recovered from all customer classes?

A. No, since only residential customers are eligible for the program. To be consistent with the Commission's policy regarding CAP cost recovery, the Authority's LSL Program costs should be recovered solely from residential water customers.

Q. Have you also rerun the Authority's revised WCOSS to allocate LSL Program costs solely to the residential class?

A. Yes, I have. The results are summarized in column 3 of Schedule BK-1.

Q. What are the cumulative class cost-of-service impacts of allocating both BDP-CAP costs and LSL Program costs solely to the residential class, when measured against the Authority's revised WCOSS?

A. Column 4 of Schedule BK-1 shows the difference in cost-of-service results, by class. As shown in column 4, residential customers are assigned an additional $347,000 in revenue responsibility (compared to PWSA"s cost study) when BDP-CAP and LSL Program costs are properly allocated solely to the Residential class.

Q. Please discuss your next area of disagreement with the Authority's revised WCOSS.

[3] These cost figures are determined by rerunning PWSA's revised WCOSS after removing $44.3 million of proposed LSL Program capital costs.

PWSA

Motion in Limine

Attachment 3

Direct Testimony of Mitchell Miller (Pittsburgh UNITED St. 2)

Pages 64-65, 83-88
Excludes Attachments and Exhibits

BEFORE THE PENNSYLVANIA PUBLIC UTILITY COMMISSION

Pennsylvania Public Utility Commission	:	
	:	
v.	:	**Docket No.** R-2018-3002645
	:	R-2018-3002647
Pittsburgh Water and Sewer Authority	:	
	:	

DIRECT TESTIMONY OF MITCHELL MILLER

ON BEHALF OF

PITTSBURGH UNITED

September 25, 2018

Topics Addressed:

Rate Affordability

Rate Design

Tariff Provisions and Associated Policies and Procedures

Low Income Programs

PREPARED DIRECT TESTIMONY OF MITCHELL MILLER

Q: Please state your name, occupation, and business address.

A: Mitchell Miller. I currently provide consulting services regarding utility programs that promote the public interest, with a focus on programs which assist low income households to afford and maintain utility services. My address is 60 Geisel Road, Harrisburg, PA, 17112.

Q: Briefly outline your education and professional background.

A: As my attached resume shows, I received a B.S. in Community Development from Pennsylvania State University, where I graduated *cum laude* in 1974, and an M.A. in Public Administration from Shippensburg University in 1984. I have over 35 years of experience in the development, implementation, and evaluation of program design for residential utility consumers. The focus of my work has concerned education, energy efficiency, credit and collections, and customer assistance programs.

After serving as a research analyst at both the Pennsylvania Governors Action Center and the Pennsylvania Public Utility Commission ("Commission"), I was appointed Chief of the Commission's Division of Research and Planning in 1978 and, in 1992, I was designated as the Director of the Bureau of Consumer Services, where I served until my retirement from the Commission in 2009.

Following my retirement from the Commission in 2009, I served for over three years as a consultant to the Pennsylvania Department of Community and Economic Development ("DCED") on weatherization and energy efficiency for the Pennsylvania Weatherization Assistance Program (WAP). My resume is attached as Appendix A.

PWSA. The provision of interpretive service is part and parcel to the delivery of quality services, and to the consumer's ability to access relief when a problem arises with their service.

Q: Do you have any recommendations?

A: Yes. PWSA indicated that it was currently looking to "piggyback" with the City of Pittsburgh to provide translation services for its notice of termination and interpretation services for limited English proficient callers. If it cannot do so before its next tariff filing, PWSA should be required to provide a proposal in its next tariff filing for how it will ensure that its termination notices, customer communications, and call centers will be able to effectively interact with customers who have limited English proficiency.

III. LOW INCOME ASSISTANCE PROGRAMS

Q: Please briefly describe PWSA's low income assistance programs.

A: PWSA recently adopted four low income assistance programs, which are administered through the Dollar Energy Fund.

In November 2017, PWSA instituted a winter moratorium for low income customers, which protects low income customers with income up to 250% of the Federal Poverty Level (FPL) from termination in the winter months (December 1 through March 31).[158] The winter moratorium protects low income households from the loss of service in the winter months, when the consequences to the individual household and their community would be most severe. Last winter,

[158] PWSA, Bill Discount Program and Winter Moratorium FAQ, http://www.pgh2o.com/CAP.

the moratorium protected 2,152 PWSA customers from termination.[159] In total, the debt placed on hold during the moratorium was approximately $1.65 million.[160]

In January 2018, PWSA opened its Bill Discount Program (BDP), which provides a 50% discount on the minimum (fixed) water and wastewater service charge to consumers with household income up to 150% FPL.[161] From January through July, 2,283 customers enrolled in the BDP.[162] This equates to approximately 11.9% of the estimated eligible population.[163]

In April 2018, PWSA opened its Hardship Fund, which offers grant assistance of up to $300 to households with income that is at or below 150% FPL.[164] To qualify, the household must have made recent payments totaling at least $150 over the prior three month period.[165] The program is funded with $500,000 received through a settlement with Veolia, the private company credited with the mismanagement that resulted in significant billing and lead line issues.[166] From April through September, PWSA issued 110 grants, depleting available funds to approximately $425,000.[167] When asked about plans to raise additional funds for its Hardship Fund program, PWSA asserted that "[b]ased on existing program parameters and experienced take rates, PWSA does not need to raise funds for Hardship Cash Assistance in 2019."

Finally, PWSA's fourth low income assistance program is its Private Lead Line Replacement Community Environmental Project (CEP), which was launched in August 2018. CEP

---

[159] Appendix B, UNITED to PWSA VI-27.
[160] Id.
[161] PWSA, Bill Discount Program and Winter Moratorium FAQ, http://www.pgh2o.com/CAP.
[162] Appendix B, UNITED to PWSA I-8.
[163] Appendix B, UNITED to PWSA I-11, Attach A. As explained at the beginning of my testimony, an estimated 19,193 of PWSA's customers have an income which is at or below 150% FPL.
[164] Appendix B, UNITED to PWSA I-2, Attach A.
[165] Id.
[166] Appendix B, UNITED to PWSA VI-33.
[167] Appendix B, UNITED to PWSA VI-34; OCA VI-82.

was approved by the Department of Environmental Protection (DEP) as part of a Consent Order, dated November 17, 2017, which "resolved certain, specified violations related to lead in drinking water."[168] The program designates $1.8 million of what would have otherwise been a civil penalty to remove and replace private-side lead service lines for homeowners or renters whose income is at or below 250% FPL.[169] To launch the program, Dollar Energy "mailed the first set of 200 letters to customers who had previously expressed an interest in the CEP to DEF or the PWSA."[170] Relatedly, although not a formal low income assistance program, PWSA's broader lead remediation program also has important implications for the finances and health of low income customers, which I discuss below.

Q: Are PWSA's low income assistance programs adequate to address the need for such programs?

A: PWSA is off to a commendable start, having recognized the need for low income assistance programs and established basic program parameters. But critical adjustments and improvements to the program eligibility, design, and implementation are necessary to ensure that the programs are adequately funded and designed to sufficiently offset the substantial impact that PWSA's rate proposal will have on vulnerable consumers, and to meet the demonstrated and widespread need.

Q: Do you have any general recommendations regarding PWSA's low income assistance programs?

A: Yes. In addition to program-specific recommendations, outlined in further detail below with respect to each program, I have three over-arching recommendations to help improve

---

[168] Appendix B, UNITED to PWSA I-3, Attach A.
[169] Appendix B, UNITED to PWSA I-3, Attach A, UNITED I-4.
[170] Appendix B, UNITED to PWSA VI-21.

PWSA's low income assistance programming as a whole: (1) improve program data collection and reporting; (2) form a Low Income Assistance Advisory Committee; and (3) improve program outreach.

First, PWSA should begin tracking its low income population. Currently, PWSA only considers a customer to be "confirmed low income"[171] if they are actively enrolled in its Bill Discount Program.[172] Confirmed low income customer counts are a critical metric which allows for a data-driven assessment of the relative need for low income programming, appropriate enrollment goals, and budget targets. It also allows for targeted outreach to help payment troubled customers to connect with available assistance programs. In short, this metric allows the Commission, and the public, to determine whether available programming adequately serves the needs of those in the service territory. All customers with household income at or below 150% FPL for whom PWSA has income information should be considered confirmed low income customers. This could be gathered through enrollment in the BDP, through agreement to a PWSA-payment arrangement or a Commission-payment arrangement, dispute, or informal complaint.

In addition to better tracking low income customers, PWSA should also be required to begin tracking and reporting on a number of critical data points, which are important to ensure that PWSA's programs are effective at delivering appropriate levels of affordability and, in turn, achieving measurable improvements to uncollectible expenses and termination rates.

---

[171] "Confirmed low income" is a term of art, which is used by the Commission's Bureau of Consumer Services to perform needs assessments, track uncollectible expenses, and evaluate the effectiveness of universal service programming.

[172] Appendix B, UNITED to PWSA I-17, referencing UNITED to PWSA I-8.

Q: Do you have any specific recommendations regarding Hardship Fund enrollment?

A: Yes, in addition to my broader recommendations, above, to work with the Low Income Assistance Advisory Committee to improve community outreach efforts and to develop a routine referral system continue to apply, PWSA should revise its documentation and income requirements in the following manner: (1) A SSN should not be required in order to participate in the program, and applicants should be informed that they are not required to provide a SSN; and (2) child support should no longer be counted as a source of income for applicants.

c. Community Environmental Project

Q: Do you support the Community Environmental Project?

A: Yes. Providing lead service line replacements in low income communities is particularly important, as these households simply do not have the resources necessary to remediate lead issues on their own. It is critical that the assistance remain available for tenants, even if the owner of the property is not themselves low income. Many landlords of low income / affordable rental properties do not make investments into the properties of this magnitude. And if they do make a substantial investment, the landlord most often will raise rent in order to recover the cost of their investment – which would price many low income families out of their homes. Either way, low income families lose.

I note, however, that the Community Environmental Project (CEP) should in no way absolve PWSA from having to prioritize low income communities for full-cost lead line replacement services in its other planned lead line remediation programming. Indeed, $1.8 million pales in comparison to the $44 and $50 million in lead line programming PWSA intends to provide

in 2018 and 2019, respectively.[207] In addition to this targeted low income community programming, low income households – particularly those with young children – should be prioritized for lead line remediation across the board.

Q: Do you have any other concerns about PWSA's lead service line replacement program?

A: Yes, I have three concerns that relate to the ability of low and moderate income customers to participate in and benefit from PWSA's lead reduction and remediation programs.

First, PWSA's policies regarding replacement of private-side lead service lines that fall outside of the CEP are inadequate. As explained by Pittsburgh UNITED expert Gregory Welter, there are currently two circumstances in which PWSA will replace a customer's private-side lead service line at no cost outside of the CEP: (1) if PWSA is replacing the customer's public-side lead service line at the same time, or (2) if PWSA replaced the public-side lead service line between July 2016 and April 1, 2018, in which case it will return to replace the private-side lead service line.[208] Outside of the CEP, PWSA will not replace a private-side lead service line if the public-side service line is non-lead.[209] Instead, PWSA says it will reimburse customers who pay out-of-pocket to replace their private-side lead service line between June 30, 2016, and December 31, 2018, but the amount of reimbursement has not yet been determined.[210]

In 2017, PWSA estimated that the cost of a private-side lead service line replacement is approximately $4,500, excluding the costs of restoring interior and exterior property that is

[207] Appendix B, UNITED to PWSA I-3 Attach. A; Pittsburgh UNITED St. 4, at 18, 2, 38.
[208] Pittsburgh UNITED St. 4, at 21-22.
[209] Pittsburgh UNITED St. 4, at 38.
[210] Pittsburgh UNITED St. 4, at 38.

damaged during the replacement.[211] As I have described, many low and moderate income customers struggle to pay their monthly water and wastewater bills. They have no capacity to pay an expense of this magnitude up front, regardless of any potential reimbursement or financing that might be available. Even customers who might be able to afford a private-side lead service line replacement with the assistance of PWSA's reimbursement are likely deterred from incurring these costs because they do not know how much the reimbursement will be, whether it will fully cover their costs, or when they will receive it. As noted above, many landlords of low income / affordable rental properties are also unwilling to make an investment of this magnitude, especially if the reimbursement details are uncertain. And, even if a landlord is willing to replace a private-side lead service line at their own expense or in reliance on an uncertain future reimbursement, they are likely to pass on the costs to their low income tenants through higher rents, which the tenants cannot afford.

In addition, PWSA has not committed to covering costs for any private-side lead service lines after December 31, 2018, except for the 200 customers served by the CEP.[212] If PWSA stops providing free private-side lead service line replacements to customers who also have a public-side lead service line, low income and moderate income residents who cannot afford to replace the lines on their own will bear a disproportionate risk that lead from their service lines will negatively impact their health and safety.[213]

Second, I am concerned that PWSA does not provide free water filters and replacement cartridges to customers whose service lines are known or suspected to be made of lead, or whose

---

[211] PWSA, PWSA Lead Program Summary, at 17 (June 9, 2017), http://apps.pittsburghpa.gov/pwsa/Lead_Program_Summary.pdf.
[212] Pittsburgh UNITED St. 4, at 38, 41-42.
[213] See Pittsburgh UNITED St. 5, at 5-14, 21-22.

service line composition is unknown.[214] Instead, PWSA advises customers to purchase and use a water filter pitcher, and offers discount coupons for the pitcher and for replacement filter cartridges.[215] PWSA appears to provide a free water filter and replacement cartridges only after a customer receives a lead service line replacement.[216] Pittsburgh UNITED's health expert, Dr. Bruce Lanphear, states that all customers with lead or unknown service lines have an elevated risk of exposure to lead and should be protected from that risk.[217] PWSA's recommended water filter pitcher costs $17.50 and replacement filter cartridges cost $8 each at PWSA's wholesale rates.[218] A six-month supply of filters (one pitcher and three replacement filters) thus costs at least $41.50, and likely more for customers paying retail prices, even with PWSA's coupons.[219] As I have described, that sum is more than the current or proposed monthly rate for many low income customers in PWSA's BDP (Table 3), and is greater than the current or proposed monthly base rate for any customer using 1,000 gallons per month or less (Table 1). Thousands of PWSA's customers already struggle to pay their monthly water bills (see Tables 6, 7, and 9) and cannot afford yet another expense in order to obtain safe drinking water. It is not reasonable, just, or realistic to expect low and moderate income customers to pay for their own water filters to keep their water safe while they await a lead service line replacement.

Third, I am concerned that PWSA does not perform or pay for any property restoration following lead service line replacements, aside from backfilling any pits or trenches dug to access

---

[214] Pittsburgh UNITED St. 5 at 24-27.
[215] Id.
[216] Id. at 24.
[217] Id.
[218] Id.
[219] For example, as of September 19, 2018, Walmart's retail prices were $28.09 for PWSA's recommended ZeroWater ZP-010 filter pitcher and $49.99 for a four-pack of replacement filters. PWSA's coupons are for $10 off a filter pitcher, for $2.50 off a two-pack of replacement filters, and for $5.00 off a four-pack of replacement filters. See http://pittsburghpa.gov/safepgh2o/ZeroWater_Coupons.pdf.

the service line and sealing any wall or floor penetrations.[220] The construction work to access and replace a service line can damage walkways, driveways, landscaping, hardscaping, and interior finishes.[221] The costs to restore this damage are variable, expensive, and hard for customers to predict.[222] For low and moderate income customers, this places the prospect of replacement out of reach. To avoid being forced to shoulder these restoration costs (or tolerate a degraded property and potential fines from the City for things like sidewalk repairs), landlords and low and moderate income homeowners may decline to have their private-side lead service line replaced at all, even if PWSA will replace the service line at no cost. The burden of restoration costs thus increases the likelihood that low and moderate income customers, both renters and homeowners, will be subjected to increased risks of lead exposure from continued use of their lead service lines.

PWSA should develop and fund a program to restore or pay for property damage caused by lead service line replacements for low and moderate income customers, the terms of which should be developed and presented in PWSA's next base rate filing. Assisting with property restoration is particularly important for low and moderate income customers whose households include individuals who are elderly or disabled, or young children, and whose mobility may be severely affected by damage to a paved sidewalk, driveway, stairs, or ramp. In turn, some of the necessary restoration – such as sidewalk restoration – may be subject to enforcement by the City of Pittsburgh,[223] and failure to restore the property may result in fines that the household also cannot afford to pay. In addition, prior to a lead service line replacement, PWSA should provide

---

[220] Pittsburgh UNITED St. 4, at 23.
[221] Id. at 24.
[222] Id. at 24-25.
[223] See Pittsburgh Code of Ordinance, Chapter 1004, Sec. 302.3 ("All sidewalks, walkways, stairs, driveways, parking spaces and similar areas shall be kept in a proper state or repair, and maintained free from hazardous conditions."), http://pittsburghpa.gov/pli/code-enforcement/top-ten-violations.html.

customers with customized information about what property damage will occur, how much of the restoration work PWSA will pay for or perform, and how much PWSA estimates it will cost the customer to restore any remaining damage.

Q: Do you have any specific recommendations regarding PWSA's lead service line replacement program?

A: Yes. In sum, as I explained above, PWSA should (1) replace private-side lead service lines at no direct cost to customers as part of its lead service line replacement program; (2) provide free water filters and replacement cartridges to low and moderate income customers with lead or unknown service lines; and (3) develop a program, to be presented in PWSA's next base rate proceeding, to restore or pay for property damage caused by lead service line replacements for low and moderate income customers, particularly property damage that interferes with customers' mobility or other basic needs. These three measures are necessary and prudent to ensure that economically vulnerable households are able to benefit fully from PWSA's lead service line replacement program, and are provided with reasonably-priced access to safe water.

Ultimately, I do not believe it is just or reasonable for economically vulnerable customers to be expected to bear the costs of lead line remediation directly or indirectly. As I have described throughout this statement, it is critical that low and moderate income customers have adequate protections from PWSA's proposed rate increase so that they do not end up indirectly bearing these lead remediation costs through unaffordable increased rates.

PWSA

Motion in Limine

Attachment 4

Direct Testimony of Gregory Welter (Pittsburgh UNITED St. 4)

PUBLIC VERSION

Excludes Attachments and Exhibits

BEFORE THE PENNSYLVANIA PUBLIC UTILITY COMMISSION

Pennsylvania Public Utility Commission	:	
	:	
v.	:	**Docket No.** R-2018-3002645
	:	R-2018-3002647
Pittsburgh Water and Sewer Authority	:	
	:	

DIRECT TESTIMONY OF GREGORY WELTER

ON BEHALF OF

PITTSBURGH UNITED

September 25, 2018

PUBLIC VERSION

CONFIDENTIAL INFORMATION REDACTED

Topics Addressed:

Assessment of PWSA's Lead Remediation Program

PREPARED DIRECT TESTIMONY OF GREGORY WELTER, PE, BCEE

I. Introduction

Q: Please state your name, occupation, and business address.

A: Gregory Welter. I am a licensed professional engineer and Technical Manager with O'Brien & Gere Engineers, Inc., 4201 Mitchellville Rd., #500, Bowie, MD 20716.

Q: Briefly outline your education and professional background.

A: I received a B.S. in Civil Engineering from Catholic University of America in 1971 and an M.S. in Sanitary Engineering from the University of Michigan in 1973. I have 44 years of experience as a professional engineer, during which I have developed expertise in lead corrosivity management strategies, water distribution system design and management, as well as water system emergency planning. I am registered as a professional engineer in Washington, D.C., and I am Board Certified as an Environmental Engineer by the American Academy of Environmental Engineers and Scientists.

Q: Please describe your professional experience related to lead in drinking water.

A: For the last dozen years I have had significant involvement in advising clients and conducting research on various aspects of management of lead contamination in drinking water. My principal clients in this area have included District of Columbia Water and Sewer Authority (DC Water), Providence Water Supply Board, and the Water Research Foundation, a leading nonprofit funder for drinking water and wastewater research. For DC Water, I have performed various support activities as part of my firm's management of the utility's lead service line replacement program. Representative activities included supervising audits of records of lead service line replacements as reported to regulatory officials; recommending practices for lead service line replacement protocols (such as flushing protocols, selection of lead-certified

household water filtration equipment for mitigation of post-replacement lead effects); and preparation of programmatic reports to regulatory agencies and to the DC Water Board of Directors.

In Providence, I have conducted support activities for the Water Supply Board's lead management program, including data analysis for an initial treatment strategy for lead reduction by means of pH adjustment; analysis of lead service line replacements and their impacts; facilitation of an "expert panel" to advise on lead management strategies; and design and supervision of a multi-year pipe loop study on orthophosphate treatment.

For the Water Research Foundation, I was the principal investigator on a research project on assessment of galvanic corrosion potential resulting from partial lead service line replacements, and a member of a Project Advisory Committee for a research project on internal lining and coating technologies as strategies for lead service line replacement implementation.[1] A more complete description of my educational and work experience, as well as a complete list of my publications, is attached.

By virtue of my training, education, experience, research, and knowledge of relevant literature, I consider myself to be an expert on lead corrosivity management in drinking water distribution systems.

Q: Have you testified in any proceeding before the Pennsylvania PUC?

A: No.

Q: For whom are you testifying in this proceeding?

A: Pittsburgh UNITED.

[1] Gregory Welter et al., Water Research Found. Rep. No. 4349, Galvanic Corrosion Following Partial Lead Service Line Replacement (2013), http://www.waterrf.org/Pages/Projects.aspx?PID=4349; Stephen Randtke et al., Water Research Found. Rep. No. 4351, Evaluation of Lead Service Line Lining and Coating Technologies (2017), http://www.waterrf.org/Pages/Projects.aspx?PID=4351.

Q: What is the purpose of your testimony?

A: Pittsburgh UNITED intervened in this proceeding to ensure that PWSA's lead remediation program reasonably uses ratepayer funds and provides residential customers with safe water service. Accordingly, Pittsburgh UNITED asked me to evaluate the design and implementation of PWSA's lead remediation program, including whether PWSA is taking steps necessary to minimize the risk of lead exposure to its customers from service line corrosion.

Q: How is your testimony organized?

A: I begin by explaining how utilities can manage corrosion of lead-containing water infrastructure through chemical treatment and service line replacement. I describe PWSA's response to the increase in lead concentrations in the water it distributes. I then offer my assessment of PWSA's efforts to control corrosion from lead service lines.

I have identified five deficiencies in PWSA's lead service line replacement program.

First, PWSA's service line inspection protocol will not generate an accurate assessment of the number and location of lead service lines in PWSA's system. If PWSA does not know where its lead infrastructure is located, it cannot appropriately manage the risks of lead release from that infrastructure.

Second, PWSA's per-service-line-replacement costs appear high and exceed those of other utilities. To make reasonable use of ratepayer funds, PWSA should assess the reasons behind its higher costs and take steps to lower these costs.

Third, PWSA's program does not adequately address private-side lead service lines. After December 2018, PWSA may discontinue funding to replace the part of a lead service line that lies under private property (private-side service line) when PWSA replaces the part of the

same service line that is under public property (public-side service line). Similarly, PWSA does not replace service lines where only the private side of the service line is composed of lead.

Excluding private-side service lines from PWSA's replacement program leaves lead in the ground and customers at risk. The public health objectives of the program would not be achieved. Private-side lead service lines are an equal potential source of lead release to the public-side lead service lines that PWSA will pay to replace. And replacing private-side lead service lines now, during a large-scale pipe replacement program, is more efficient and less costly. It would be premature to limit the program's scope so drastically before it has yielded substantial benefits for customers. Rather, PWSA should expand the eligibility criteria for replacement of private-side lead service lines. Based on my experience, it is neither effective nor equitable to make current homeowners responsible for the installation of lead service lines by others several generations ago, at a time when the water system profession was at best ambivalent in its guidance on health considerations of lead in water, and the Pittsburgh water department was installing lead service lines as its default.

Fourth, PWSA's practice of conducting partial lead service line replacements threatens public health. PWSA should cease conducting partial lead service line replacements, where it replaces the public-side portion of the lead line but leaves the private-side portion in place. Partial replacements can cause lead levels to spike for months after replacement and are disfavored by engineers and public health experts. Stopping this practice would reduce risks to customers at no cost to PWSA.

Fifth, PWSA's current practices on customer outreach after service line replacement do not appear to be as effective as they need to be, and thus undermine the efficacy of PWSA's service line replacement program. PWSA should improve customer outreach to increase

participation in its post-replacement monitoring program. Service line replacement can temporarily cause elevated lead levels in drinking water. Accurate and timely testing is essential to prevent residents' exposure and to identify and address remaining sources of lead. Yet, nearly half of PWSA customers who receive lead service line replacements do not return their initial water samples. This is admittedly a difficult problem, but PWSA needs to be creative and energetic in its outreach efforts to achieve better results.

Lastly, I summarize my recommendations and describe their implications for PWSA's lead remediation program.

Q: Why are your conclusions relevant to this rate proceeding?

A: I am advised by counsel for Pittsburgh UNITED that the Commission is considering "the lawfulness, justness, and reasonableness" of PWSA's "existing rates, rules, and regulations."[2] I also understand that PWSA is required to provide "safe" service,[3] and that the Commission may reject a rate increase if PWSA's service is "inadequate in that it fails to meet quantity or quality for the type of service provided."[4]

My conclusions relate to the reasonableness of how PWSA has spent and plans to spend millions of dollars in ratepayer funds. PWSA has budgeted $44.3 million this year and $50 million next year for its lead service line replacement program.[5] It will spend an additional $2.5 million to construct new corrosion control treatment facilities.[6] The effectiveness of PWSA's lead remediation program also has direct bearing on the safety of PWSA's water service in 2018, 2019, and beyond.

---

[2] Suspension Order, Docket No. R-2018-3002645, ¶ 4 (July 12, 2018).
[3] 66 Pa. C.S. § 1501.
[4] Id. § 526(a).
[5] Appendix B, 24, UNITED II-70.
[6] Appendix C, 12, UNITED IV-1 Attach. A, at 1.

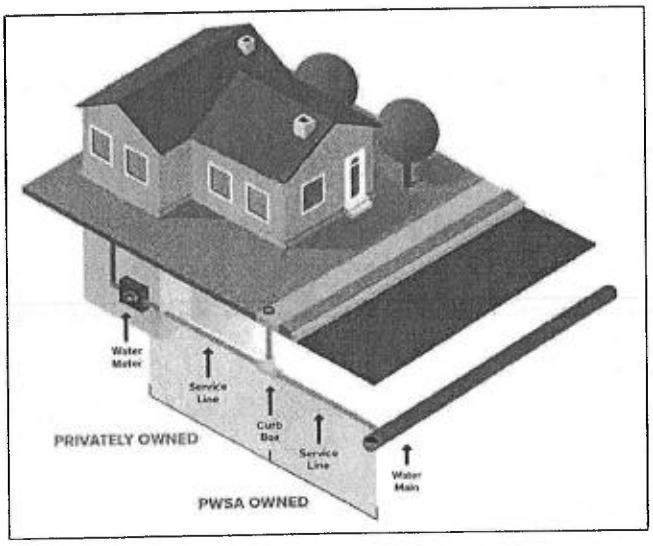
II. Managing the Release of Lead into Drinking Water

Q: How do utilities distribute water to residential customers?

A: Drinking water systems transport water from a treatment plant to customers' homes through pipes. Water travels from a treatment plant through distribution mains, which typically run underneath streets. Distribution mains in streets connect to homes through pipes called service lines. Drinking water moves from these service lines through a home's interior plumbing and, ultimately, out of customers' taps.

Close to the property line, there is generally a shut-off valve on the service line. The "curb box" (a capped vertical pipe) provides access to this shut-off valve, which typically divides the service line into two sections. The section of the service line between the curb box and the distribution main is often referred to by utilities as the "public-side" service line. Utilities call the section of the service line between the curb box and the home the "private-side" service line. Figure A illustrates the water infrastructure I have just described.

Figure A: PWSA's Service Line Diagram[7]



[7] PWSA, Your Water Service Line, http://lead.pgh2o.com/your-water-service-line/.

Many utilities, including PWSA, maintain that they do not own the private-side portion of a service line though, as I explain below, this public-private distinction is artificial.[8]

Q: What are service lines typically made of?

A: Materials currently used for service lines include copper, galvanized steel, galvanized iron, and cross-linked polyethylene. Lead used to be a common choice for service lines because of its durability and flexibility.[9] Older homes, especially those built before 1950, often have service lines made of lead.[10] In 1986, however, the federal government banned the use of lead pipes in potable water supply and domestic plumbing.[11] Nevertheless, millions of old lead service lines remain in use across the country, including an estimated 160,000 in Pennsylvania.[12]

Q: Why were lead pipes banned from use in drinking water infrastructure?

A: The prohibition was enacted to protect public health. Drinking water flowing through service lines chemically reacts with the interior surfaces of metal pipes. This reaction can cause those surfaces to deteriorate in a process called corrosion. When lead pipes corrode, lead is released into drinking water by either dissolving into the water or dislodging from the pipes and remaining in particulate form. That lead then flows to taps and into customers' homes. Consuming water tainted with lead presents serious health risks, as described in the testimony of Pittsburgh UNITED expert witness, Dr. Bruce Lanphear.[13]

[8] PWSA Rules & Regulations § 506.1.
[9] Appendix D, 1, Richard Rabin, The Lead Industry and Lead Water Pipes: "A Modest Campaign," 98 Am. J. Pub. Health 1584, 1585 (2008).
[10] ****BEGIN PROPRIETARY****

****END PROPRIETARY****
[11] 42 U.S.C. § 300g-6.
[12] Appendix D, 2, David A. Cornwell et al., National Survey of Lead Service Line Occurrence, 108 J. Am. Water Works Ass'n E182, E189 tbl.5 (2016).
[13] Pittsburgh UNITED St. 5, at 4-7.

Q: How do utilities control the release of lead from pipes into drinking water?

A: Utilities use two main strategies to control and reduce lead in drinking water caused by the corrosion of pipes. The first is chemical treatment. With this approach, utilities adjust the chemistry of the treated water to minimize its corrosivity to lead-bearing components of the plumbing system. In many cases this is accomplished by adding chemicals (corrosion inhibitors) to their drinking water to minimize the release of lead from pipes. One common inhibitor used is orthophosphate. Orthophosphate reduces the release of lead into drinking water by promoting the formation of a stable protective scale on the interior surfaces of lead pipes. This scale promotes the incorporation of lead into the scale itself rather than the release of dissolved lead into the water. The scale also stabilizes particulate lead to prevent its release. Other chemical treatments include adjusting the pH or alkalinity of the water by adding, for example, soda ash and lime. Federal and state law require utilities to implement an "optimal" corrosion control treatment program, which means that the treatment has minimized lead levels in household tap water.[14] The regulations also require consultation with and approval by the state regulatory agency before any changes are made to the optimal corrosion control treatment program.[15]

The second strategy used by utilities to control the release of lead is to replace lead-containing infrastructure—service lines, in particular—with non-lead materials. Generally, utilities have chosen to physically replace the buried lead service lines. Physical replacement of the buried lead pipe can be accomplished by open cut or "trench" methods, in which old pipe is exposed and a replacement pipe of acceptable material is put in its place. Well-established trenchless methods are also used to reduce the construction impacts. These trenchless replacement methods include pipe pulling (which removes the existing pipe and pulls in a new

[14] 40 C.F.R. §§ 141.2, 141.81(d)(4); 25 Pa. Code § 109.1102(b).
[15] 40 C.F.R. § 141.82(h); 25 Pa. Code §§ 109.1102(b), .1105(c).

pipe behind it), moling (in which a pneumatic "mole" is placed in a pit and run to another pit, dragging the replacement pipe behind in a new alignment), and pipe bursting (in which a splitting tool is pulled through the existing lead pipe, splitting it and making room for the replacement pipe which is pulled behind).[16]

Q: How can utilities assess the effectiveness of their strategies for addressing lead service line corrosion?

A: Federal and state law, including the federal Lead and Copper Rule, define protocols that utilities must follow to assess the effectiveness of their corrosion control strategies for lead and copper release.[17] Utilities must monitor lead levels in the water they distribute. Some of this monitoring occurs in homes that receive drinking water through lead service lines.[18] Trends in lead concentrations offer insight into the efficacy of the utility's strategies to control and reduce lead. Some utilities supplement this regulatory compliance monitoring with other techniques. These include operating a pipe loop apparatus, or analogous devices, to more frequently monitor the efficacy of their chosen treatment strategy.[19]

Q: Why would a utility replace its lead service lines if it is already required by law to optimize its corrosion control treatment system?

A: Designing and implementing optimal corrosion control treatment, as I discuss below, is a process that can take years. And even after a utility has optimized its corrosion control treatment, changes to water treatment or to the chemistry of source water have the potential for unanticipated adverse effects on lead corrosion. Washington, D.C., and Flint, Michigan, offer

[16] See Lead Service Line Replacement (LSLR) Collaborative, Understanding Replacement Techniques, https://www.lslr-collaborative.org/understanding-replacement-techniques.html.
[17] See 40 C.F.R. §§ 141.86 to 141.88.
[18] Id. § 141.86.
[19] Gregory J. Kirmeyer et al., Development of a Pipe Loop Protocol for Lead Control (AWWA Research Found. 1994); Abigail F. Cantor, Water Distribution System Monitoring: A Practical Approach for Evaluating Drinking Water Quality (CRC Press 2009).

recent examples of changes to treatment methods and source water that produced elevated concentrations of lead in drinking water for sustained periods of time. Federal and state regulations and guidance describe how utilities should plan for water treatment or source changes to avoid such unanticipated adverse effects.[20] These kinds of mistakes, however, continue to happen, and the risk remains as long as significant sources of lead remain in the distribution infrastructure. Similarly, construction activity in a street or yard may cause lead to be released from pipes into drinking water due to surface vibrations.[21] Replacement of lead infrastructure is the only permanent solution to control the release of lead into drinking water.

III. Elevated Lead Levels in Drinking Water of PWSA's Customers

Q: How does PWSA monitor lead levels in the drinking water it distributes?

A: As discussed above, supra p. 9, federal and state law require water systems to conduct sampling for lead in household tap water.[22] Large water systems like PWSA must collect at least 100 tap water samples from homes that are most at risk for elevated lead levels, which means homes that are served by a lead service line or contain interior lead plumbing.[23] Under its present circumstances, PWSA is required to conduct two sets of household compliance sampling each year, in two six-month semesters: January through June, and July through December.[24] PWSA has six months to collect each set of tap water samples.[25]

For each six-month monitoring period, PWSA must analyze the samples collected to determine whether more than ten percent of them have lead concentrations greater than 15 parts

[20] 40 C.F.R. § 141.82(f); 35 Pa. C.S. § 721.7(a).
[21] LSLR Collaborative, Disturbing Lead Service Lines, https://www.lslr-collaborative.org/disturbing-lead-service-lines.html.
[22] 40 C.F.R. § 141.86(a)(3); 25 Pa. Code § 109.1103(g)(2).
[23] 40 C.F.R. § 141.86(a)(3), (c); 25 Pa. Code § 109.1103(a)(1)(v), (g)(2).
[24] See 40 C.F.R. § 141.86(d); 25 Pa. Code § 109.1103(a)(1), (c).
[25] 40 C.F.R. § 141.86(d)(1)(i), (d)(3), (d)(4)(vi)(B).

per billion (ppb).[26] That 15 ppb threshold is known as the lead "action level," because an exceedance of this level triggers certain response "actions" the utility must implement to remain in compliance with the federal Lead and Copper Rule.[27] The lead action level, as described in Dr. Lanphear's testimony, is not a safety or health-based standard.[28] It is simply a threshold above which a water system is required to take additional steps to address lead levels in its drinking water.

Q: What happens if more than ten percent of samples collected have lead concentrations greater than 15 ppb?

A: If more than ten percent of samples collected during a monitoring period (the 90th percentile) have a lead concentration in excess of 15 ppb, PWSA must take additional measures to protect customers from lead exposure. These measures include identifying and reporting to the state the number of lead service lines in the water system;[29] conducting additional monitoring of the system's source water to determine whether additional treatment is needed;[30] conducting additional tap water monitoring;[31] sampling the tap water of any customer who requests it;[32] and educating the public about the risks of lead and ways consumers can reduce their exposure to lead in drinking water.[33]

PWSA must also replace at least seven percent of the system's lead service lines with pipes that are lead-free during the year following the six-month monitoring period for which a lead action level exceedance was observed.[34] That replacement obligation continues each year

[26] Id. § 141.80(c)(1), (3).
[27] Id. § 141.2.
[28] Pittsburgh UNITED St. 5, at 9.
[29] 40 C.F.R. § 141.90(e).
[30] Id. §§ 141.83(a)(1), 141.88(b).
[31] Id. § 141.86(d)(4)(vi)(B).
[32] Id. § 141.85(c).
[33] Id. § 141.85(b).
[34] Id. § 141.84.

until less than ten percent of tap water samples collected during each six-month monitoring period exceeds the lead action level of 15 ppb for two consecutive six-month monitoring periods.[35]

Q: Have PWSA's monitoring results exceeded the lead action level?

A: Yes. PWSA's tap water monitoring results over the past two years have regularly exceeded the 15 ppb lead action level. The chart below summarizes PWSA's recent lead action level exceedances:

Table 1: PWSA Lead Monitoring Results 2016 to Present[36]

Sampling Period	Lead concentration at 90th percentile
January 1 – June 30 2016	22 ppb
July 1 – December 31, 2016	18 ppb
January 1 – June 30, 2017	15 ppb
July 1 – December 31, 2017	21 ppb
January 1 – June 30, 2018	10 ppb

Q: What conclusions do you draw from these monitoring results?

A: These data show that PWSA has not yet effectively controlled the release of lead from pipes in its system. The lead concentrations at the 90th percentile are high and do not show a clear, stable downward trend.

Q: What may account for the drop in the 90th percentile lead level from the July-December 2017 monitoring period to the January-June 2018 monitoring period?

A: Lead release from water infrastructure shows seasonal variation. Lead concentrations tend to increase during warmer, summer months and decrease during colder, winter months. Studies have that shown lead concentrations can be significantly higher in the summer than in

[35] Id. § 141.84(f).
[36] Press Release, PWSA, PWSA Releases July 2018 Lead Compliance Test Results (July 25, 2018), http://pgh2o.com/release?id=7717; Michael J. Pickel & Sarah A. Bolenbaugh, Navigating Non-Compliance with the Lead & Copper Rule in a Post Flint World 3 (2017), https://nysawwa.org/docs/pdfs/1508263690.pdf.

the winter.[37] As a result, tap water sampling results for lead collected during the first half of the year (which typically reflect cooler months) tend to be lower than those collected during the second half of the year. A water system with effective corrosion control treatment should be able to show that it can control lead release during both hot, summer months and cold, winter months.

Seasonal variations in lead release may explain why PWSA's monitoring results fell below the action level for the most recent round of sampling. In my opinion, the results for the next six-month monitoring period (which will reflect the warmer summer months) may be above the action level again.

Q: What is your understanding of how PWSA is responding to these exceedances?

A: PWSA has initiated replacement of lead service lines and taken other measures pursuant to the Lead and Copper Rule. It has also proposed to modify its corrosion control treatment to include orthophosphate as a corrosion inhibitor. I understand that it is now in the process of implementing this revised treatment strategy.

Q: How is PWSA changing its corrosion control treatment system?

A: In 2014, PWSA switched its primary corrosion control treatment chemical from soda ash to caustic soda, but it did so without seeking approval from the Pennsylvania Department of Environmental Protection (DEP) as required by law.[38] PWSA subsequently advised DEP of the change after the fact in February 2016, which prompted DEP to begin an investigation.[39] DEP

[37] Appendix D, 3, Sheldon Masters, Gregory Welter & Marc Edwards, Seasonal Variations in Lead Release to Potable Water, 50 Envtl. Sci. Tech. 5269, 5269-70 (2016); Gregory Welter et al., Pipe loop studies of orthophosphate addition for control of lead release in high pH, low DIC waters, AWWA Water Quality & Tech. Conf. 14 (2015), https://www.researchgate.net/publication/286376153_Pipe_loop_studies_of_orthophosphate_addition_for_control_of_lead_release_in_high_pH_low_DIC_waters.

[38] Appendix D, 4, Consent Order and Agreement, In the Matter of Pittsburgh Water and Sewer Authority Regarding Violations of the Pennsylvania Safe Drinking Water Act and the Rules and Regulations Promulgated Thereto Regarding the Lead and Copper Rule ¶ G (Nov. 17, 2017) (hereinafter "Consent Order"); see also 25 Pa. Code §§ 109.501(b), 109.1105(a).

[39] Appendix D, 5, Kay Frederick, Pa. Dep't Envtl. Prot., Notice of Violation Issued to PWSA (Feb. 18, 2016).

eventually ordered PWSA to perform a study to determine how to optimize its corrosion control treatment system.[40] As a result of that study, in April 2018, DEP authorized PWSA to add orthophosphate to its drinking water as its method of corrosion control treatment.[41]

Q: Has PWSA begun to add orthophosphate to its drinking water?

A: No, PWSA has yet to construct the facilities it needs to add orthophosphate to drinking water. It cannot start construction until it receives a permit from DEP.[42] PWSA estimates that it will start using orthophosphate three months after it receives the construction permit.[43]

Q: How is PWSA presently treating its water to control for corrosion?

A: PWSA initially switched back to using soda ash for corrosion management through pH control after its unauthorized switch to caustic soda.[44] PWSA is now using liquid lime to regulate pH.[45]

Q: You said that PWSA is also replacing service lines in response to high lead concentrations in its water. What is your understanding of why PWSA is replacing those lines?

A: PWSA's lead action level exceedances triggered the Lead and Copper Rule's service line replacement requirements. PWSA was supposed to replace seven percent of all lead service lines in its system by June 30, 2017, but it missed that deadline.[46] In November 2017, PWSA and DEP entered into a consent order requiring PWSA to replace seven percent of lead service lines by June 30, 2018, and another seven percent of service lines by December 31, 2018.[47] The consent

---

[40] Appendix D, 4, Consent Order, supra note 38, at ¶ H.
[41] UNITED IV-20 Attach. A, at 1.
[42] Appendix B, 25, UNITED IV-3.
[43] Id.
[44] Appendix D, 4, Consent Order, supra note 38, at ¶ G.
[45] Id. ¶ K.
[46] Id. ¶¶ O, S-U.
[47] Id. ¶¶ T-U, 3(d), (3)(e)(i).

order also requires PWSA to commit $1.8 million to a Community Environmental Project that will fund lead service line replacements for low-income customers.[48]

Q: Are there other reasons why PWSA should be implementing a lead service line replacement program?

A: PWSA should also replace its lead service lines because implementing and seeing the results of an effective corrosion control treatment program is a process that can take years, as I discussed above, supra p. 9. In PWSA's case, it has not yet completed its expected treatment change to orthophosphate. After it does, it will likely take about a year to bring lead levels consistently below the lead action level, and several years before orthophosphate's benefits are fully realized and lead release from PWSA's pipes is stabilized. And again, even when that stability is achieved, treatment decisions with unanticipated side effects or changes to water chemistry always have to potential to produce elevated concentrations of lead in drinking water. That is why replacement of lead infrastructure is the only permanent solution to control the release of lead into drinking water.

Q: When will PWSA's obligation to replace lead service lines under the Lead and Copper Rule end?

A: PWSA's obligation to continue replacing lead service lines in 2019 depends on the sampling results for the current monitoring period, which ends in December 2018. If more than ten percent of tap water samples have lead concentrations above 15 ppb, the Lead and Copper Rule requires that PWSA replace another seven percent of its service lines in 2019.[49]

[48] Id. ¶ 4(b)-(c).
[49] See 40 C.F.R. § 141.84.

Q: How many lead service lines does PWSA have in its system?

A: PWSA estimates that it has ****BEGIN PROPRIETARY****

****END PROPRIETARY**** 27,255 are copper,[52] and 30,878 are of unknown composition.[53] PWSA's lead service line estimate, however, is only an estimate of the public-side lead service lines in PWSA's system; PWSA has not done a similar analysis to develop an estimate of the number of private-side lead service lines in its system.[54]

Q: What is your understanding of how PWSA calculated its estimated number of public-side lead service lines?

A: ****BEGIN PROPRIETARY****

****END PROPRIETARY**** PWSA continues to conduct inspections, and it must provide an updated estimate of the lead service lines in its system to DEP in 2020.[56]

Q: How many lead service lines has PWSA replaced?

A: Between June 30, 2016, and August 15, 2018, PWSA replaced 1,723 public-side lead service lines ****BEGIN PROPRIETARY****

****END PROPRIETARY**** and 675 private-side lines.[57]

50

51

[52] Appendix B, 1, UNITED II-5.
[53] Appendix B, 2, UNITED II-7.
[54] See Appendix B, 33, UNITED IX-8.
55

[56] Appendix D, 4, Consent Order, supra note 38, at ¶ 3(c)(iii).
[57] Appendix B, 11, UNITED II-35; Appendix B, 12, UNITED II-36.

Q: How many lead service lines remain in PWSA's system?

A: ****BEGIN PROPRIETARY****

****END PROPRIETARY**** PWSA does not effectively track the number of private-side lead service lines in its system.[58]

IV. Service Line Inspections

Q: How does PWSA identify service lines that are made of lead?

A: PWSA uses historical records, followed by field verification by curb-box inspections and excavations, to determine the composition of its service lines.

Q: How does PWSA use historical records to determine service line composition?

A: PWSA has digitized and reviewed its historical records on service line composition.[59] If a historical record indicates that a public-side service line is non-lead, PWSA conducts no further investigation.[60] If the historical record is missing, inconclusive, or indicates that the public-side service line is lead, the line is scheduled for a curb-box inspection.[61]

Q: How does PWSA use curb-box inspections to determine service line composition?

A: During a curb-box inspection, a camera is sent down the curb-box to take pictures of the public- and private-side lines.[62] If the pictures show a bulbous "wiped joint," the service line is identified as lead.[63] PWSA does not, however, rely on curb-box inspections to designate a

[58] Appendix B, 33, UNITED IX-8.
[59] PWSA, Community Lead Response, http://lead.pgh2o.com/your-water-service-line/planned-water-service-line-replacement-map/.
[60] Appendix B, 4, UNITED II-15; Appendix B, 6, UNITED II-19; Appendix B, 26, UNITED VIII-6.
[61] Appendix B, 4, UNITED II-15; Appendix B, 28, UNITED VIII-25.
[62] Brian Conway, What Pittsburgh homeowners need to know about curb box inspections for lead service lines, Public Source (July 20, 2017), https://www.publicsource.org/what-pittsburgh-homeowners-should-know-about-curb-box-inspections-for-lead-service-lines/.
[63] Id.

service line as non-lead.[64] If a wiped joint is not visible, the service line is marked as needing further investigation.[65]

Q: Does PWSA use curb-box inspections to determine the composition of every service line in its system?

A: No. As noted above, PWSA conducts curb-box inspections only on service lines where historical records indicate that the public side of the line is lead or of uncertain composition. PWSA does not conduct curb-box inspections on service lines where the historical records indicate that the public side is not lead, even if the historical records identify the private side as lead or of uncertain composition.

Q: How does PWSA choose where to conduct curb-box inspections?

A: PWSA prioritizes areas for curb-box inspections throughout the distribution system based on age of water mains, parcel ages, child births, and blood lead levels.[66] PWSA has not explained how it weighs those factors in selecting areas for inspection.[67]

Q: How does PWSA use excavations to determine service line composition?

A: If historical records and a curb-box inspection suggest that a public-side service line might be lead, then it is scheduled for replacement.[68] Before replacement, work crews conduct excavations to verify the service line's composition, which involves exposing at least 18 inches of pipe on either side of the curb box.[69]

---

[64] Appendix B, 5, UNITED II-17.
[65] See Appendix B, 28, UNITED VIII-25; UNITED II-21(h) Attach. C.
[66] Appendix B, 6, UNITED II-19.
[67] See id.; Appendix B, 27, UNITED VIII-15.
[68] See Appendix B, 9, UNITED II-33(a)-(b).
[69] Appendix B, 10, UNITED II-34(e); UNITED II-1 Attach. II, at 11; Appendix C, 6, UNITED II-1 Attach. YY, at 01200-11.

Q: **What is your opinion of PWSA's service line inspection procedures?**

A: It is concerning that PWSA does not typically conduct curb-box inspections or excavations to verify the composition of service lines when historical records say the public side of the line is not lead.[70] This decision can result in lead service lines going undiscovered and unreplaced in two ways.

First, historical service line records are often inaccurate. If the historical record incorrectly identifies a public-side service line as non-lead, PWSA has no mechanism for correcting that "false negative" because it schedules no follow-up curb-box inspection.

****BEGIN PROPRIETARY****

****END PROPRIETARY****

Second, PWSA's inspection protocol prevents it from obtaining an accurate estimate of private-side lead service lines. Even if a public-side line is unlikely to be lead, PWSA should still conduct a curb-box inspection to determine the composition of the private-side service line so it has an accurate inventory of the lead infrastructure in its distribution system. This is important information for both the utility and customers, and PWSA should collect it. With this information, customers can take steps to protect themselves from further lead exposure, and PWSA can more efficiently and effectively administer its pipe replacement program. Although PWSA disclaims ownership of private-side service lines based on an arbitrary distinction I explain below, infra pp. 39-40, PWSA should still assemble an accurate estimate of all of the lead infrastructure in its distribution system, including private-side service lines.

[70] Appendix B, 6, UNITED II-19.
[71]

Q: What is your recommendation for PWSA's inspection procedures?

A: PWSA should conduct curb-box inspections on all service lines in its system to enable it to estimate the total number of lead service lines in its system.

Q: How would adopting this recommendation affect the costs of PWSA's lead service line replacement program?

A: There are approximately 71,000 service lines in PWSA's system.[72] PWSA plans to complete its curb-box inspection program in 2021 and to inspect at least 41,500 service lines during that time.[73] Thus, adopting this recommendation could require another 29,500 curb-box inspections. At $190 per inspection,[74] it would cost PWSA about $5.6 million to complete these additional inspections. These costs would not be immediately incurred but rather would be spread out over the life of the program.

V. Cost of PWSA's Lead Service Line Replacement Program

Q: How is this section of your testimony organized?

A: I first describe how PWSA is replacing lead service lines. Then I describe the costs incurred by other utilities that have implemented lead service line replacement programs and compare them with the information PWSA has provided on the costs of its replacements. I find that the costs associated with PWSA's lead service line replacement program are high compared to those of other utilities, and that PWSA's documents and testimony do not reasonably explain those high costs. I conclude that PWSA can and should investigate the reasons for these high

[72] Press Release, PWSA, PWSA Kicks Off 2018 Curb Box Inspection Program to Find Lead Water Service Lines (Mar. 20, 2018), http://lead.pgh2o.com/pwsa-kicks-off-2018-curb-box-inspection-program-to-find-lead-water-service-lines/.
[73] Appendix C, 8, UNITED II-16 Attach. A (11,293 inspections completed by contractors); Appendix B, 7, UNITED II-21(a) (245 inspections completed by PWSA); Appendix B, 8, UNITED II-24 (23,761 planned inspections through 2019); PWSA St. 1, RAW-2, at 7 (indicating PWSA target of 4,500 inspections in 2020 and 2,000 inspections in 2021).
[74] Appendix B, 7, UNITED II-21(f).

expenditures and take steps to reduce its lead service line replacement costs. I also conclude that, if PWSA can bring down its service line replacement costs, additional funds will become available for other critical improvements to PWSA's lead remediation program.

Q: Please provide an overview of how PWSA is replacing lead service lines.

A: As noted above, supra p. 18, once PWSA identifies a public-side service line as lead, it is scheduled for replacement. PWSA issues a work order to a contractor identifying the lead service lines scheduled for replacement in a multi-block area. The contractor excavates the service line to verify that it is actually lead. If it is, the contractor replaces it using either an open trench or trenchless method. PWSA provides residents who receive replacements instructions for flushing their interior plumbing, a water sampling kit, and a pitcher filter with six months of replacement cartridges.

Q: What does PWSA do after it identifies a public-side service line composed of lead?

A: In some circumstances, PWSA will replace the line. Through its 2018 Lead Service Line Replacement Program, PWSA has contracted with five companies to replace lead service lines in each City Council district and in Millvale.[75] PWSA replaces the full service line if both the public- and private-side lines are lead, or if the public side is lead and the private side is galvanized steel or iron.[76] (Galvanized steel and iron can become "seeded" with lead released from an upstream lead source, which can later be released into drinking water.) PWSA does not replace service lines when only the private side is lead. From January 1 to August 15, 2018, PWSA replaced 802 lead service lines through this program.[77]

[75] See Press Release, PWSA, PWSA Launches Online Water Service Line Map (June 12, 2017), http://lead.pgh2o.com/pwsa-launches-online-water-service-line-map/; Appendix B, 16, UNITED II-44.
[76] Appendix B, 9, UNITED II-33.
[77] See Appendix C, 9, UNITED II-35 Attach. A.

PWSA also conducts emergency replacements of lead service lines when the lead service line or the water main to which it connects leaks or bursts. PWSA replaces lead service lines during a "relay," when it conducts scheduled replacement of the water main to which the lead service line connects.[78] As with the 2018 Lead Service Line Replacement Program, PWSA only replaces a service line if the public side is lead. From January 1 to August 15, 2018, PWSA replaced 202 lead service lines through emergency repairs and relays.[79]

Q: What does PWSA do after it identifies a private-side service line composed of lead?

A: If PWSA identifies a private-side service line as lead through its review of historical records, it takes no additional steps unless the public-side service line is also identified as lead or if the material is uncertain. If a curb-box inspection identifies a private-side service line as lead, it notifies the property owner, but only schedules it for replacement if it is paired with a public-side lead service line.

Q: How does PWSA replace a lead service line?

A: PWSA uses contractors to replace many of its service lines.[80] PWSA allows contractors to choose between open trench and trenchless methods, which I have described above.[81] Contractors are encouraged to use trenchless methods to reduce property damage.[82] Nevertheless, since June 2018 (when PWSA began tracking methods of replacement), slightly more than half of public-side lead service line replacements have been completed using an open trench.[83] According to PWSA's specifications, private-side replacements are done with copper pipe. The specifications call for public-side replacements to be done with either PEX (cross-

[78] Appendix C, 7, UNITED II-1 Attach. BBB, at 2-3.
[79] Appendix C, 9, UNITED II-35 Attach. A.
[80] See id.; Appendix B, 23, UNITED II-65(b)*.
[81] Appendix B, 14, UNITED II-41.
[82] Appendix B, 21, UNITED II-56; Appendix C, 6, UNITED II-1 Attach. YY, at 02515-14.
[83] Appendix B, 15, UNITED II-42(a).

linked polyethylene, a type of plastic) piping or copper, with the large majority of the public replacement lines to be PEX.[84]

Q: How does PWSA decide the order in which lead service lines will be replaced?

A: PWSA indicates that it issues work orders for its replacements in the areas where it has conducted curb-box inspections.[85] ****BEGIN PROPRIETARY****

****END PROPRIETARY****

Q: If PWSA were to prioritize lead service line replacements and curb-box inspections in vulnerable and low-income communities (using blood lead levels, water lead levels, age of homes and infrastructure, and other risk factors as described by Dr. Lanphear[87]), how would that affect the costs of PWSA's lead service line replacement program?

A: Selecting neighborhoods that are at higher risk of lead exposure would not have a meaningful effect on costs, so long as PWSA continues to perform lead service line replacements and curb-box inspections on a block-by-block basis, rather than at individual homes scattered throughout the city.

Q: Does PWSA restore property damaged during replacement?

A: No. PWSA backfills and regrades excavation trenches, and it patches holes made in customers' interior walls and floors. It does not repair damaged walkways, driveways, stairs, landscaping, or the finish on interior floors and walls.[88] Customers bear these restoration costs.

---

[84] Appendix C, 6, UNITED II-1 Attach. YY, at Bid Form p. 5, 02515-6 to 02515-7, 02515-15.
[85] Appendix B, 16, UNITED II-44; Appendix B, 17, UNITED II-45.
[86]
[87] Pittsburgh UNITED St. 5, at 17-18.
[88] Appendix B, 21, UNITED II-56.

Q: How much does it cost customers to restore their property following lead service line replacement?

A: Costs vary depending on the method of replacement and the nature of the damage, but the cost can be considerable. For instance, Flint, Michigan, reports that the average cost of restoration following lead service line replacements there is $1,700.[89] Flint pays for restoration.[90]

Q: Aside from restoration, what factors influence the cost of a lead service line replacement?

A: The total cost of a lead service line replacement depends upon both the construction costs, including material and labor, and the programmatic costs, consisting of the engineering, Geographic Information Systems (GIS), and other administrative support expenses necessary for construction to occur. Costs can vary from city to city and contractor to contractor.

According to PWSA's contract specifications, there is a cost differential for lead service line replacement based on length. Both the public portion and the private portion are paid for as a basic bid price amount per replacement up to a length of ten feet.[91] For service lines that are longer than ten feet, in either the private side or the public side, there is a per-foot surcharge paid as bid by the contractor.[92]

PWSA's 2018 contracts do not differentiate payment amounts based on the method of replacement (that is, open-cut methods or trenchless methods), and the method of replacement is left to the discretion of the contractor.[93] In the reported lead service line replacements since June 2018, mostly open-cut excavation has been used.[94] In many cities, including Pittsburgh, the

---

[89] Appendix D, 6, City of Flint's Paragraph 30 Evaluation 5 (Feb. 8, 2018), filed in Concerned Pastors for Social Action v. Khouri, No. 16-10277 (E.D. Mich.), ECF No. 172-4 (July 12, 2018).
[90] See id.
[91] Appendix C, 6, UNITED II-1 Attach. YY, at 01200-8 to 10.
[92] Id.
[93] Appendix B, 14, UNITED II-41; Appendix B, 15, UNITED II-42(b).
[94] Appendix B, 15, UNITED II-42(a).

trenchless methods (typically, moling or pulling) have been found to be less costly for the contractor, with lower restoration costs.[95]

Mobilizing a work crew to a home and neighborhood only once also reduces costs. Replacing the entire service line is cheaper than replacing the public side at one time and the private side later. (Replacing them in a single operation also is advantageous in that it eliminates the immediate adverse effects of a partial replacement, described below, infra pp. 45-46.) Replacing groups of neighboring lead service lines at the same time takes advantage of economies of scale.

Q: Are you familiar with how much it typically costs a utility to replace a lead service line?

A: Yes. I am familiar with the costs of lead service line replacement through my professional experience with replacement programs. I have personally worked on the program management teams that have implemented Washington, D.C.'s and Providence's lead service line replacement programs. I also reviewed publicly available information about the costs of lead service line replacements in Flint and Lansing, Michigan, Madison and Milwaukee, Wisconsin and York, Pennsylvania.

Q: Based on your experience and the publicly available information you reviewed, how much does it typically cost a utility to replace a lead service line?

A: Approximately $6,000 is a reasonable estimate of the average construction costs for replacing a full lead service line though, as noted above, costs can vary.

---

[95] Adam Smeltz, PWSA touts cheaper lead line replacements—with less lawn damage, Pittsburgh Post-Gazette (May 4, 2018), http://www.post-gazette.com/local/city/2018/05/04/PWSA-lead-service-line-replacement-pulling-method-trenchless/stories/201805040159 (quoting PWSA Executive Director Robert Weimar as saying that trenchless replacement can cut costs by over 50% compared to the open trench method); Lead Service Line Collaborative, Understanding Replacement Techniques, https://www.lslr-collaborative.org/understanding-replacement-techniques.html.

Q: How did you calculate that figure?

A. I reviewed and analyzed financial data from seven utilities that have conducted or are planning to conduct lead service line replacement programs. I also relied on my experience. For some programs, publicly available information on costs is limited. Where I could not determine whether the prices quoted were for bare construction costs or construction and programmatic costs combined, I made the conservative assumption that they were for construction costs alone. For the oldest programs I reviewed, I adjusted the relevant costs for inflation.

Overall, the costs ranged from $1,700 to $12,675 per line. The average per line cost of replacement was $6,145. Below, I offer details on each of the replacement programs I reviewed.

Madison, Wisconsin. Madison implemented a service line replacement program to remove all lead service lines from its system. From 2000 to 2006, Madison replaced more than 8,000 lead service lines.[96] About 5,600 were full service line replacements; the remainder were public-side-only replacements.[97] Madison reports that the average cost of private-side replacement was $1,340, and the average cost of public-side replacement was $1,997, totaling $3,337 for a full service line replacement.[98] This estimate likely excludes programmatic costs. Adjusted for inflation, Madison's average cost for a full service line replacement is **$5,047**.

Washington, D.C. In 2004, DC Water launched a service line replacement program as a mandatory initiative prompted by exceedances of the lead action level. The program targeted public-side replacements of lead and galvanized steel lines, working on one group of city blocks at a time. DC Water replaced more than the seven percent of total public-side lead service lines required by the Lead and Copper Rule. In the first three years of the DC program, DC Water

[96] Madison Water Utility, Information for utilities on lead service replacement, https://www.cityofmadison.com/water/water-quality/lead-service-replacement-program/information-for-utilities-on-lead-service.
[97] Id.
[98] Id.

replaced approximately 7,400 public-side lead service lines at an average cost of about $4,700. Accounting for an annual inflation of about 3%, given the age of the program, this would translate into a per unit cost of about $6,300 in 2018 for a public-side replacement.[99] For private-side replacements, customers were offered use of a DC Water contractor at a contractually fixed price of $500 for the foundation crossing plus $100 per foot of line replaced. While the length of private-side lines varied, a reasonable average cost for replacement of a private-side line was $3,000,[100] for a total replacement cost of $9,300.

The DC program resulted in mostly partial service line replacements, where only the public side of a full lead service line is replaced. In 2008, after research revealed adverse health effects of partial lead service line replacements, DC Water discontinued its service line replacement program. It has since pursued almost exclusively full service line replacements.

Since 2008, DC Water has offered two programs for service line replacement. The first invites customers to replace their service lines during construction projects, such as water main replacements or emergency repairs on their block.[101] Under this program, the average cost for replacement has been $1,069 for the private portion of the line.[102] The second program is a "demand" program for customer-initiated lead service line replacements.[103] This means that the

[99] The city sometimes required DC Water to repave entire streets following a service line replacement, increasing the cost of public-side work. To minimize these costs, DC Water's program was coordinated with the paving schedule of the transportation department. However, additional repaving costs were incurred in instances where such coordination could not be accomplished.
[100] Neal Augenstein, Before Flint: D.C.'s drinking water crisis was even worse, WTOP (Apr. 4, 2016), https://wtop.com/dc/2016/04/flint-d-c-s-drinking-water-crisis-even-worse/.
[101] DC Water, Construction Projects May Give You an Opportunity to Replace Your Lead Service Line, https://www.dcwater.com/construction-project-replacements.
[102] DC Water, Performance Oversight Responses 1 34 (2019), http://dccouncil.us/budget/2019/transportation-and-the-environment.
[103] DC Water, Replacement Occurs During Construction or By Request, https://www.dcwater.com/lead-pipe-replacement.

customer initiates a replacement at a single address. The average cost charged to customers for replacing the private side has ranged between $2,000 and $2,500.[104]

While none of these programs is perfectly analogous to PWSA's, DC Water's first service line replacement program is closest in design to PWSA's program, as it conducted replacements by targeting certain areas of the city. As a conservative estimate, I have used **$9,300** for my calculations.

Lansing, Michigan. In 2004, amidst widespread public concern about lead contamination, Lansing's water system decided to replace all lead service lines in its system within 10 years.[105] Lansing had previously established ownership over the entire service line, from the street connection to the house, though it still had to coordinate with customers to accomplish the work on private property and in the home.[106] In its program, Lansing also considered galvanized steel lines to be "nonstandard," and a target for replacement.[107] From 2004 to 2017, Lansing spent approximately $42 million to replace over 13,000 lead and galvanized steel service lines, at a reported cost per service line replacement of **$3,150**.[108]

Providence, Rhode Island. In 2006, Providence initiated a mandatory lead service line replacement program after its tap water monitoring under the Lead and Copper Rule exceeded the lead action level.[109] Providence's mandatory program conducted service line replacements through mid-2010 before being put on hold.[110] Since 2010, the utility has conducted additional

---

[104] DC Water, Performance Oversight Responses 1 34 (2019), http://dccouncil.us/budget/2019/transportation-and-the-environment.
[105] Randall Roost, Lansing Bd. of Water & Light, Am. Water Work Works Assoc. Get the Lead Out Event 5:10 – 5:45 (2016), https://www.youtube.com/watch?v=r3w_EOQILHI&feature=youtu.be.
[106] Id. at 2:50 – 3:15.
[107] Id. at 4:00 – 4:15.
[108] Id. at 15:00 – 15:48.
[109] Providence Water Supply Bd., Financial Statements for the Years Ended June 30, 2017 and 2016, at 19 (Dec. 29, 2017), https://www.provwater.com/sites/default/files/reports/FY_2017_Audited_Financials_0.pdf.
[110] Id.

replacements incidental to water main capital projects, when customers voluntarily replace private-side lead service lines, or by operating crews in response to leaks.[111] A new program launched this year makes low-interest loans available to property owners to replace their private-side service lines.[112]

Providence Water has estimated that private-side replacements cost about $2,500 to $3,000.[113] Through June 30, 2017, Providence reported that it had replaced 17,456 public-side lead service lines at a total cost of $56,316,773, or about $3,226 per public-side line.[114] Combining these estimates results in a total of about $5,726 to $6,226 for a full replacement. Based on my experience with Providence Water's program, this estimate is reasonable. For purposes of my calculations, I will use the higher figure of **$6,226**.

Milwaukee, Wisconsin. In 2016, Milwaukee stopped repairing leaking and broken lead service lines, and started replacing them.[115] Pursuant to an ordinance, partial replacements are not permitted.[116] In 2017, Milwaukee replaced 610 lead lines, at an average cost of **$12,675**.[117]

---

[111] Id. at 20.
[112] New Providence Water Program Aims to Get Lead Out, ecoRI (May 17, 2018), https://www.ecori.org/public-safety/2018/5/17/new-providence-water-program-aims-to-get-lead-out.
[113] Providence Water, Providence Water Introduces 0% Interest Loan to Help Homeowners Replace Private Lead Service Lines, https://www.provwater.com/loan (stating that average cost is $2,500 to $3,000); see also Providence Water, Deciding Whether to Replace Your Lead Service Line, http://www.provwater.com/sites/default/files/uploads/forms/Shoud%20I%20Replace%20My%20Service%20Line_1.pdf (Feb. 4, 2016) (stating that average cost is approximately $2,500); Frank Carini, Expert Panel Advises Providence Water on Lead Problem, ecoRI (Nov. 12, 2017), https://www.ecori.org/public-safety/2017/11/9/expert-panel-advises-providence-water-on-lead-problem (stating that average cost is about $2,000 to $3,000).
[114] Providence Water Supply Bd., Financial Statements for the Years Ended June 30, 2017 and 2016, at 20 (Dec. 29, 2017), https://www.provwater.com/sites/default/files/reports/FY_2017_Audited_Financials_0.pdf; see also Richard Gell & Michelle McEntire, Strategies for Implementation of Full Lead Service Replacement Program, Tifft Water Supply Symp. 12 (Sept. 22, 2016), nysawwa.org/docs/pdfs/1474903108.pdf (stating Providence replaced 9,955 public-side lines at a cost of $32 million, or about $3,214 per line).
[115] Jennifer Gonda, Milwaukee Water Works Public Works Committee, Lead Service Line Program Semi-Annual Update 4 (2018), https://city.milwaukee.gov/WaterQuality/LeadandWater/Updates-LSL-Program.htm#.W6RXOmhJF3g.
[116] Id. at 5.
[117] Id. at 8, 17.

This per line cost is the highest reported cost I am aware of and slightly higher than the estimate I calculated for PWSA's per line replacement costs below.

However, there is an important difference between PWSA's program and Milwaukee's; Milwaukee is replacing service lines one-by-one.[118] 438 of its 2017 replacements stemmed from leaks or other emergency disruptions.[119] Another 149 were conducted at child care facilities.[120] This ad hoc approach is more expensive than PWSA's systematic, block-by-block approach to replacement, which takes advantage of economies of scale. As a result, I would expect PWSA's per line costs to be lower than Milwaukee's.

York, Pennsylvania. The York Water Company reported to the Public Utility Commission that it expected the average cost for replacing a private-side lead service line in 2017 to be $1,150 for a line shorter than 10 feet, and $1,250 for a line longer than 10 feet.[121] York also estimated that it would cost $2.7 million to replace 1,600 full lead service lines, averaging about **$1,700** per replacement.[122] This cost is considerably lower than other per line estimates I reviewed.

Flint, Michigan. Flint is in the midst of an aggressive, city-wide program for replacing all of its lead and galvanized steel service lines. As of February 2018, Flint had replaced 6,256 full lead or galvanized steel service lines at an average cost of $4,800 per line, excluding excavation and restoration costs.[123] Flint expects to replace 3,600 lead service lines in 2018 at a cost of **$4,920** per line.[124]

---

[118] See id. at 11.
[119] Id. at 8.
[120] Id.
[121] Recommended Decision at 15, Petition of York Water Company, Docket No. P-2016-2577404 (Feb. 2, 2017).
[122] Id.
[123] Appendix D, 6, City of Flint's Paragraph 30 Evaluation, supra note 89, at 3.
[124] Id. at 5.

Table 2 summarizes the per line construction costs for the seven utilities described above, as well as the overall average construction cost.

Table 2: Utilities' Lead Service Line Replacement Costs

City	Cost per full service line	Year
Madison, WI	$5,047	2000-2006
Washington, D.C.	$9,300	2004-2008
Lansing, MI	$3,150 (includes restoration)	2004-2016
Providence, RI	$6,226	2007-2014
Milwaukee, WI	$12,675	2017
York, PA	$1,700	2017
Flint, MI	$4,920	2018
Average Construction Cost	**$6,145**	

This estimate of the average cost for a full service line replacement, $6,145 per line, is close to the cost estimates included in a 2016 white paper issued by the U.S. Environmental Protection Agency. EPA observed that "the cost of full [lead service line replacements] has been estimated to be $2,500-$5,500 per line, though some industry estimates for an average replacement are as high as $8,700 per line."[125]

Q: How much does PWSA spend to conduct a service line replacement?

A: Based on the information available to me, I conclude that **$12,541 per line** is a reasonable estimate of the average cost that PWSA pays a contractor to replace a full lead service line.

I was unable to estimate the average cost of replacement for lead lines replaced directly by PWSA because PWSA does not track these costs.

[125] EPA Office of Water, Lead and Copper Rule Revisions White Paper 7 (2016), https://www.epa.gov/dwstandardsregulations/lead-and-copper-rule-revisions-white-paper.

Q: In your opinion, how do PWSA's lead service line expenditures compare to those of the utilities you reviewed?

A: PWSA's per line costs are high, more than double the average per line cost of the seven utilities described above.

Q: How did you reach that conclusion?

A: PWSA has not calculated an average cost for contractor replacements and does not intend to do so until its service line replacement project is complete.[126] I reviewed information provided by PWSA, including a tabulation of the executed bids for the 2018 Lead Service Line Replacement Contract, PWSA's programmatic cost estimates for lead service line replacements in 2018 and 2019, and a June 2017 summary of costs on PWSA's lead program.

The most direct evidence of PWSA's per line replacement costs comes from a tabulation of the five winning bids for PWSA's 2018 Lead Service Line Replacement Contract.[127] The tabulation shows the amount PWSA will pay to each contractor to replace lead service lines. PWSA solicited bids to replace 400 lead service lines,[128] and the "total bid prices" included in the tabulation are the amounts each contractor proposed to bill PWSA for 400 lead line replacements.[129] The bids are further broken down into "unit costs" for various aspects of the replacement.[130] Bidders provided a base estimate for the cost of replacing service lines up to ten feet in length and then offered estimates for the expense of replacing each additional foot of

---

[126] Appendix B, 18, UNITED II-46(g).
[127] Appendix C, 1, UNITED II-1 Attach. K.
[128] See Appendix C, 1, UNITED II-1 Attach. K (requesting bid for replacement of 60 public-side service lines with copper pipe and 340 public service lines with PEX pipe); ****BEGIN PROPRIETARY****

****END PROPRIETARY****

[129] Appendix C, 1, UNITED II-1 Attach. K.
[130] Appendix C, 6, UNITED II-1 Attach. YY at Bid Form pp. 4-6, 01200-3 to 01200-14.

service line over that ten-foot base length.[131] There are also unit cost pay items for exploratory excavations, plus numerous other incidentals, mostly associated with water mains.[132] The tabulation also includes PWSA's engineer's estimate for the cost of replacing 400 lead service lines. I calculated each contractor's per line replacement costs by dividing their total bid price by 400. Table 3 contains the results of that calculation.

Table 3: Summary of 2018 Lead Service Line Replacement Contract Bids[133]

	Engineer	Folino	Zottola	Independent	Petrakis	Merante
Total project estimate	$5,392,594	$3,174,305	$4,919,868	$5,299,656	$5,477,123	$6,210,788
Number of replacements	400	400	400	400	400	400
Average unit cost	$13,481	$7,936	$12,300	$13,249	$13,693	$15,527

To obtain an average cost of replacement for all PWSA contractors, I summed the total bid prices ($25,081,740) and divided by the total number of lines contracted for replacement (2,000). The result was an average replacement cost of **$12,541 per line.**

It is worth noting that the contractors' bids cover a wide range: from $7,936 to $15,527 per line. Four of the bids fall relatively close to the engineer's estimate, but the low bid from A. Folino Construction, Inc. is an outlier, well below the engineer's estimate. I could not tell from the material provided by PWSA why Folino's bid came in so much lower than its competitors.

The other information provided by PWSA corroborates the high construction costs estimated from the bid tabulation. Below is an itemized budget for PWSA's 2018 and 2019 Lead Service Line Replacement Programs:

[131] Id.
[132] Id.
[133] Appendix C, 1, UNITED II-1, Attach. K.

Figure B: 2018 and 2018 Lead Service Line Replacement Itemized Budget[134]

PWSA Lead Service Line Replacement Programs

Activity	2018 LSLR			2019 LSLR
	Budget	Cost Paid (as of July 31, 2018)	Contractual Commitments (as of July 31, 2018)	Budget
Program Management	$ 843,552.82	$260,892.88	$970,972.15	$ 760,254.21
Professional Services	$ 1,321,948.52	$226,009.82	$1,497,641.99	$ 1,106,866.44
GIS	$ 1,116,178.32	$166,792.52	$1,136,465.70	$ 1,049,388.29
Construction Management	$ 1,378,590.41	$234,395.42	$1,384,022.02	$ 1,209,066.29
Misc (filters, sampling, etc.)	$ 649,452.28	$23,115.80	$495,224.79	$ 350,000.00
Construction (including CM/CI)	$ 22,910,628.43	$10,170.39	$22,910,628.43	$ 41,755,779.67
Urgent/CEP[1]	$ 8,800,000.00	$0.00	$0.00	$ -
Operations[2]	$ 863,200.00	$291,200.00	$0.00	$ -
Homeowner Reimbursement[3]	$ 1,200,000.00	$0.00	$0.00	$ -
Contingency	$ 5,516,449.22	-	-	$ 3,816,248.95
Total	$ 44,300,000.00	$1,212,576.83	$28,394,955.08	$ 50,047,603.85

The construction allocation for 2018 is approximately $22.9 million. The budget also contains separate line items for programmatic costs (the first five rows), replacements of private-side lead lines where PWSA had previously performed a partial service line replacement and through the Community Environmental Project ("Urgent/CEP" and "Operations"),[135] the reimbursement program, and a contingency. I excluded those items when calculating the average construction cost. If the $22.9 million allocation was made with the expectation of funding the 2,000 replacements that PWSA has contracted for, then the per line construction cost is **$11,455**. This per line cost is within 10 percent of the per line cost calculated from the bid tabulation.

The third piece of information I reviewed was a June 2017 PWSA presentation, which included the following estimate of PWSA's replacement costs:

[134] Appendix B, 24, UNITED II-70.
[135] Appendix B, 31, UNITED IX-1.

Figure C: 2017 Lead Service Line Replacement Budget[136]

Lead Service Line Replacement Cost: Public and Private

Public Side Replacement Cost	$6,600
Private Side Replacement Cost	$4,500
Locating, Historical Record Search, Data Management	$1,050
CM/CI/Design/Planning	$3,600.00
Contingency (30%)	$4,700.00
Subtotal Single Line Replacement	**$20,450.00**
Total Residential Service Lines	71,000
Total Lead Lines (25%)	17,750
Total Cost	**$363,000,000**

*Approximately 14 years to replace all lead lines in PWSA service territory

The rows for "Public Side Replacement Cost" and "Private Side Replacement Cost" reflect the construction costs of replacement. Excluding the programmatic costs and the contingency and adding the public- and private-side costs yields an estimate for the cost of replacing a full lead service line of $11,100. Of the three data sources I reviewed, the 2017 Presentation is the oldest and least specific, so I find it to be the least reliable. Also, it uses a 30% contingency, which I would consider overly conservative for this kind of construction.

The construction cost estimates from these three data points are $12,541, $11,450, and $11,100. Since the bid tabulations reflect the actual prices PWSA has agreed to pay its contractors, I conclude that **$12,541** is a reasonable estimate of PWSA's per line replacement costs. This cost greatly exceeds other utilities' average per line cost of $6,145. It is also higher than the per line costs for all but one utility for which I could find replacement cost data.

[136] PWSA, PWSA Lead Program Summary 17 (June 9, 2017), http://apps.pittsburghpa.gov/pwsa/Lead_Program_Summary.pdf

Q: Do you have an opinion as to why PWSA's replacement costs are higher than those for other utilities?

A: No. It is not clear from the data I reviewed why PWSA's costs exceed those for other utilities.

Q: How much money could PWSA save if it lowered its construction costs for full lead service line replacement to $6,145 per line?

A: PWSA plans to replace 2,800 lead lines in 2019 if it receives state funding.[137] If PWSA could replace those service lines for $6,145 per line instead of $12,541 per line, its total construction costs would be about $17 million instead of over $35 million.[138] Even reducing average per line costs by $2,000 (about 15 percent) would save over $5.5 million. This still would be a significant reduction from PWSA's planned costs and would enable additional replacements or other health protective measures to be accomplished with the available funds.

Q: What is your recommendation with respect to PWSA's lead service line replacement costs?

A: PWSA should investigate the reasons behind its higher costs and take steps to lower these costs. Bringing costs in line with those of other utilities that have similarly undertaken large-scale service line replacement projects will help ensure that PWSA is reasonably using ratepayer funds. In addition, PWSA work crews, not contractors, performed 43 percent of replacements between June 30, 2016 and August 15, 2018.[139] Yet, PWSA does not track the costs of these replacements.[140] PWSA should begin doing so to enable it to evaluate whether there are

[137] Appendix B, 22, UNITED II-60 (revised).
[138] Note that it appears PWSA has budgeted $41.8 million in construction costs for 2019. Appendix B, 24, UNITED II-70. If PWSA replaces 2,800 lead lines for $41.8 million dollars, its average per line replacement cost would be $14,900.
[139] Appendix B, 18, UNITED II-46(a)-(d).
[140] Id.

opportunities for improving their efficiency, and to allow PWSA to direct cost savings to other necessary services associated with lead line replacement, as discussed below and in the testimony of Dr. Bruce Lanphear, Pittsburgh UNITED Statement 5, and Mr. Mitchell Miller, Pittsburgh UNITED Statement 2.

VI. Replacement of Private-Side Lead Service Lines

Q: How many private-side lead service lines are in PWSA's system?

A: PWSA does not know how many private-side lead service lines are in its system.[141] I reviewed a summary of PWSA's historical records on lead service line composition. They identify more than 30,000 private-side lead service lines, and more than 10,000 others as either of unknown composition or lacking records.[142] In addition, the records indicate that about 8,000 private-side service lines are made of a form of iron (typically, galvanized or wrought iron) and are potentially connected to a public-side lead service line.[143] This is noteworthy because iron pipes can become "seeded" with lead released from an upstream lead service line and then release that lead even after the upstream pipe is removed.

PWSA's historical records, however, are not always accurate. To verify the composition of these lines, PWSA would have to conduct curb-box inspections or excavations. PWSA has inspected some of them but has not provided that data to Pittsburgh UNITED.

Q: How much does it cost to replace the private-side portion of a lead service line?

A: PWSA estimates put the cost at around $4,500.[144] As noted above, PWSA's costs are high compared to other utilities.

---

[141] Appendix B, 3, UNITED II-8.
[142] See UNITED II-18 Attach. A.
[143] Id.
[144] PWSA, PWSA Lead Program Summary 17 (June 9, 2017), http://apps.pittsburghpa.gov/pwsa/Lead_Program_Summary.pdf.

Q: What financial support does PWSA provide to customers for the replacement of private-side service lines?

A: Residential customers with full lead service lines are eligible to have the private-side of their line replaced without cost when PWSA replaces the public side, at least through the end of 2018.[145] If PWSA conducted a partial lead service line replacement between July 2016 and April 1, 2018, where it replaced only the public-side and left a private-side lead line in the ground, PWSA will go back to the residence to replace the private side of the line.[146] Sixty-three customers have had their private-side lead lines replaced through this program.[147]

For customers with lead only on the private side of their service line, PWSA does not fund the cost of replacement except in two narrow situations. First, PWSA will reimburse customers for replacement of their private-side lines if those replacements are conducted between June 30, 2016 and December 31, 2018. But customers do not know how much they will be reimbursed because PWSA does not plan to announce the amount of its reimbursement until early 2019.[148] PWSA knows of 155 customers who may seek reimbursement for self-funded private-side replacements.[149] Second, PWSA expects to fund and replace the private-side lead service lines of approximately 200 low-income households with $1.8 million through its Community Environmental Project, at an apparent cost of roughly $9,000 per line.[150]

Q: Are these programs adequate?

A: No. As explained by Pittsburgh UNITED expert Mr. Mitchell Miller, many of PWSA's customers cannot afford to pay the cost of service line replacement up front, and thus cannot take

---

[145] Appendix C, 7, UNITED II-1 Attach. BBB, at 2.
[146] Id. at 2-3.
[147] Appendix B, 32, UNITED IX-7.
[148] Appendix C, 7, UNITED II-1 Attach. BBB, at 2.
[149] Appendix B, 34, UNITED IX-12.
[150] PWSA, Currents 2 (April 2018), http://pgh2o.com/newsletters; Appendix D, 4, Consent Order, supra note 38, at ¶ 4(c).

advantage of the reimbursement program.[151] If customers have not previously received a partial service line replacement and are not among the approximately 200 customers selected for the Community Environmental Project, then they will not receive financial support from PWSA to replace their private-side lead service line.

Q: What is your understanding of PWSA's plans to support replacement of private-side lead service lines in 2019?

A: PWSA's plans for private-side lead service line replacements are unclear. PWSA has not committed to replacing any private-side lead service lines next year, aside from the 200 replacements through the Community Environmental Project; PWSA stated that it "anticipates continuing to voluntarily replace *public* lead service lines after 2018."[152] Nor has PWSA decided whether to provide financial assistance to customers who replace their own private-side lead service lines.[153] And while PWSA has set a goal of replacing all known public-side lead service lines in its system by 2025,[154] including 2,800 in 2019,[155] I am not aware of any statements by PWSA declaring goals or intentions with respect to private-side service line replacements in 2019 or beyond.

Q: What is your understanding of why PWSA takes a different approach to replacing private-side lines than it takes to replacing public-side lines?

A: Through its rules and regulations, PWSA disclaims ownership of the private side of service lines in its system.[156] PWSA maintains that customers are responsible for the maintenance and replacement of service lines that run underneath private property.

---

[151] Pittsburgh UNITED St. 2, at 84-85.
[152] Appendix B, 22, UNITED II-60 (revised) (emphasis added).
[153] PWSA St. 1, at 9.
[154] Appendix B, 13, UNITED II-60 (revised).
[155] Id.
[156] PWSA Rules & Regulations § 506.1.

Q: **What is your opinion of PWSA's approach?**

A: The "private-side" issue is enormously critical. Ironically, this issue has been the major stumbling block in resolving the lead management approach nationally for over two decades. PWSA's distinction between private- and public-side service lines is not mandated by law, nor is it health-protective or efficient.

First, I am advised by counsel that neither federal, state, nor local law prevent PWSA from taking responsibility for replacing private-side lead service lines. In fact, Pennsylvania law allows PWSA to use ratepayer and public funds to replace private-side service lines when doing so "will benefit the public health [or the] public water supply system."[157] In 2016, the Public Utility Commission granted a tariff supplement allowing The York Water Company to use ratepayer funds to replace private-side lead service lines.[158]

Second, as I noted above, supra pp. 3-4, excluding private-side lines from PWSA's replacement program leaves lead in the ground. Private-side lead service lines are an equal potential source of lead release as the public-side lead service lines that PWSA will pay to replace. Private-side lines corrode in the same manner as public-side lines, and the replacement protocols are the same. As Dr. Lanphear explains, private-side lines present the same risks to public health as public-side lines.[159] Also, most private-side service lines were installed by a utility, not the customer. Unless the customer has replaced their private-side line, the material used in a private-side service line is typically a legacy of the water utility's historical choices.[160]

****BEGIN PROPRIETARY****

---

[157] 72 Pa. C.S. § 1719-E(c)(1), (2).
[158] Order, Public Utility Comm'n, Petition of York Water Company, Docket No. P-2016-2577404 (Mar. 2, 2017).
[159] Pittsburgh UNITED St. 5, at 22-23.
[160] See generally Appendix D, 1, Rabin, supra note 9, at 1585-88 (describing the efforts of Lead Industries Association to encourage use of lead in drinking water pipes and the inclusion of lead as an acceptable material in plumbing codes long after its adverse health effects were well-established).

****END PROPRIETARY****

Third, PWSA's limited support for the replacement of private-side lines creates significant inefficiencies in its program—inefficiencies that will only be exacerbated if PWSA stops funding full lead service line replacements in 2019. It is far more cost effective to replace a private-side lead service line at the same time as the public-side. I am advised by counsel that the Public Utility Commission recently approved a supplement to The York Water Company's tariff allowing it to use ratepayer funds to replace private-side lead service lines at the same time it was replacing public-side lines. The PUC noted: "The efficiency of this approach minimizes total costs, thereby providing better service to York Water customers, particularly to those who might find the total cost of replacing the customer-owned line to be burdensome or too expensive a task to undertake independently."[162]

Q: What is the impact on customers of PWSA's choice to decline to conduct a replacement when only the private side of the service line is lead?

A: Under the terms of PWSA's current replacement program, many customers with service lines that are lead only on the private side will not receive PWSA-funded replacements. Their exclusion from the replacement program increases the number of lead pipes that continue to carry drinking water to customers because customers are unlikely to replace lead service lines on their own. Arranging for replacement is expensive and time-consuming. Landlords, in particular, may be unwilling to undertake this expense for the benefit of their tenants. For instance, in the District of Columbia, DC Water offered financial incentives, loans, and extended repayment terms for private-side replacement, but only about 10 percent of customers elected to pay for

[161]

[162] Order, Public Utility Comm'n, Petition of York Water Company, Docket No. P-2016-2577404, at 6 (Mar. 2, 2017).

replacement of their private-side lead service line at the same time DC Water replaced the public-side.[163] The participation rate in Providence, Rhode Island, under similar circumstances, was about two percent.[164]

Q: How will customers be affected if PWSA discontinues support for private-side lead service lines in 2019?

A: If PWSA's support for private-side lead line replacements is reduced or terminated in 2019, I anticipate it will cause an increase in the number of lead lines that remain in use for PWSA's customers. As I have described, PWSA's support for private-side lead service line replacements in 2018 is already limited and does not benefit all affected customers, and customers are unlikely to pay to replace their own service lines. And as Pittsburgh UNITED witness Mitchell Miller explains, many of PWSA's customers cannot afford to self-fund the cost of service line replacement.[165]

Q: Is PWSA's implementation of a new corrosion control treatment system an alternative to replacing private-side lead service lines?

A: No. PWSA's corrosion control treatment system complements, rather than substitutes for, replacement of lead service lines on both the public and private side. ****BEGIN PROPRIETARY****

****END PROPRIETARY****

[163] Appendix D, 7, Gregory Welter, Pipe coating or lining as alternative strategies for lead service line replacement, AWWA Water Quality & Tech. Conf. 5 (2016).
[164] Richard Gell & Michelle McEntire, Strategies for Implementation of Full Lead Service Replacement Program, Tifft Water Supply Symp. 12 (2016), http://nysawwa.org/docs/pdfs/1474903108.pdf.
[165] Pittsburgh UNITED St. 2, at 83-85.
[166]

In the near term, while PWSA seeks to optimize its corrosion control treatment system by introducing orthophosphate, private-side lead service line replacements can protect some customers from elevated lead levels. As I mentioned earlier, orthophosphate reduces lead pipe corrosion by causing a protective scale to form on the pipe's interior surfaces. That scale does not form overnight. Typically, a utility switching to orthophosphate will see a substantial decline in lead levels within about 12 months, after orthophosphate has had time to distribute throughout the entire system and react with the pipes. It may take several years before orthophosphate's benefits are fully realized. This result has been documented by DC Water through its Lead and Copper Rule compliance monitoring results in the years since orthophosphate was implemented.[167]

It is my understanding that PWSA has yet to construct the three interim facilities it needs to begin adding orthophosphate to drinking water. PWSA estimates that it will complete one of these facilities and start using orthophosphate within three months after it receives a construction permit from DEP.[168] Consequently, even if PWSA receives its construction permit tomorrow, it may take another 15 months before orthophosphate treatment has been maintained for long enough to bring about a substantial decline in lead levels in some portion of PWSA's distribution system, much less systemwide. Private-side lead service line replacements are thus an important, reasonable mechanism for reducing customers' lead exposure in the coming months and years while PWSA works to optimize its corrosion control treatment system.

In the long term, private-side lead service line replacements can help prevent future

[167] See DC Water, Lead Levels in the District are Historically Low, https://www.dcwater.com/regulatory-lead-testing (noting that orthophosphate was added to the system beginning in 2004 and linking to Lead and Copper Rule monitoring results from 2005 to present); Tech. Expert Working Grp., Discussion of Washington Aqueduct Dalecarlia Pipe Loop Results 1, Attach. A (Feb. 25, 2014), https://archive.epa.gov/region03/dclead/web/pdf/tewg022514.pdf (graphs showing pipe loop lead concentrations from March 2005 to January 2014).
[168] Appendix B, 25, UNITED IV-3; UNITED IV-4 Attach. B, at 56-69.

episodes of elevated lead levels. Assuming that orthophosphate eventually forms a stable scale in PWSA's lead service lines and causes lead levels to drop, PWSA's sampling will no longer exceed the lead action level, and it will no longer be obligated to replace seven percent of service lines each year.[169] However, this protection is dependent on the continuous application of the orthophosphate treatment. Should there be some future error in human judgement and the treatment discontinued (as was the case in Flint), then the lead pipe left in the system could once again release lead. As long as lead service lines remain part of PWSA's system, there is the potential that they will leach lead into customers' drinking water. Replacement is necessary and reasonable, and the only way to ensure that a lead service line will no longer release lead. That is why Lansing, Michigan and Madison, Wisconsin replaced all lead service lines in their systems, and Flint is in the process of replacing all of its lead service lines.[170] Numerous other cities and utilities have set a goal of full lead service line replacement.[171]

Q: What policy would you recommend for PWSA's financial support for replacements of private-side lead service lines?

A: To maximize the efficiency of replacing lead infrastructure and to provide safe service to its customers, PWSA should continue to replace full lead service lines at no direct cost to customers, and it should start replacing private-side only lead service lines at no direct cost to customers.

---

[169] See 40 C.F.R. § 141.84(f); 25 Pa. Code § 109.1107(d)(5); Appendix D, 4, Consent Order, supra note 38, at ¶ 3(e)(ii).

[170] Madison Water Utility, Information for utilities on lead service replacement, https://www.cityofmadison.com/water/water-quality/lead-service-replacement-program/information-for-utilities-on-lead-service; Michael Gerstein, Lansing replaces city's final lead service line, The Detroit News (Dec. 14, 2016), https://www.detroitnews.com/story/news/local/michigan/2016/12/14/lansing-lead-service-line/95435604/.

[171] Environmental Defense Fund, Community and utility efforts to replace lead service lines, https://www.edf.org/health/recognizing-community-efforts-replace-lsl.

Q: How do your recommendations affect the total cost of PWSA's lead service line replacement program?

A: Maintaining the program under its existing terms would keep costs at or near their current levels. Expanding eligibility for PWSA-funded replacement to all private-side lines would entail additional expenditures over the lifetime of PWSA's lead service line replacement program. The total cost for funding private-side-only lead service line replacements depends on the number of such service lines in PWSA's system, for which PWSA has not provided reliable data. I would note that at least some of this additional cost could be offset with savings achieved by lowering PWSA's current per line replacement costs.

VII. Partial lead service line replacements

Q: What is a partial lead service line replacement?

A: A partial lead service line replacement typically refers to the practice of replacing only the public-side portion of a lead service line, while leaving the private-side portion of a lead service line in the ground.

Q: Are partial lead service line replacements effective in reducing lead exposure?

A: No. Lead concentrations in drinking water often spike after a partial service line replacement. Replacing the public-side lead line physically disturbs the private-side lead line, shaking loose lead-containing scales from the pipe's interior, which then flow to the household tap.[172] In addition, joining a lead private-side line to a copper public-side line can lead to "galvanic corrosion," which further accelerates lead release from the private-side line.[173] The rise

[172] Appendix D, 8, Benjamin Trueman et al., Evaluating the Effects of Full and Partial Lead Service Line Replacement on Lead Levels in Drinking Water, 50 Envt'l Sci. Tech. 7389, 7389 (2016).
[173] Gregory Welter et al., Water Research Foundation Rep. No. 4349, Galvanic Corrosion Following Partial Lead Service Line Replacement (2013), http://www.waterrf.org/Pages/Projects.aspx?PID=4349.

in lead levels caused by partial replacements can be dramatic and last for months.[174] Even after the immediate increase in lead subsides, the lead release rate is still comparable to what it was prior to the removal of part of the lead pipe, so the public health benefit of a partial service line replacement is at best questionable.[175] The U.S. Environmental Protection Agency's Science Advisory Board observed that partial replacements "have not been shown to reliably reduce drinking water lead levels in the short term, ranging from days to months, and potentially even longer."[176]

The negative effects of partial service line replacements are well documented in scientific literature.[177] In 2017, the Allegheny County Health Department's Lead Task Force concluded that "Water Systems should not conduct partial lead line replacements given the risk that they pose to the public."[178] These health risks are discussed further in Dr. Lanphear's testimony.[179]

Q: Why do utilities conduct partial lead service line replacements?

A: The Lead and Copper Rule presently permits a utility to conduct partial service line replacements to meet its obligations under the Rule after a lead action level exceedance.[180] Accordingly, some utilities conduct partial replacements to meet the Rule's requirements, even

---

[174] Appendix D, 8, Trueman et al., supra note 172, at 7394.
[175] Id. at 7394-95.
[176] EPA Science Advisory Board, Evaluation of the Effectiveness of Partial Lead Service Line Replacements 1 (2011), https://www.epa.gov/dwstandardsregulations/science-advisory-board-evaluation-effectiveness-partial-lead-service-line.; see also Order, Public Utility Comm'n, Petition of York Water Company, Docket No. P-2016-2577404, at 6 (Mar. 2, 2017) (stating that "a 'partial lead service line replacement' may not significantly reduce the lead level at the customer's tap, but may temporarily increase lead at the customer's tap").
[177] See, e.g., Appendix D, 8, Trueman et al., supra note 172, at 7393-95; Mary Jean Brown & Stephen Margolis, Lead in Drinking Water and Human Blood Lead Levels in the United States, 61 CDC Morbidity & Mortality Wkly. Rep. 6-7 (2012), https://www.cdc.gov/mmwr/pdf/other/su6104.pdf.
[178] Allegany Cty. Health Dep't Lead Task Force, Final Report and Recommendations 32 (2017), http://www.p4pittsburgh.org/pages/allegheny-county-health-department-lead-task-force. The website of the Allegheny County Health Department's plumbing program also notes that the "Plumbing Division will no longer be permitting partial lead line replacements or repairs to lead water service lines. All lead water service lines must be replaced with approved materials and inspected by the plumbing division." Allegheny County, Plumbing Program, https://www.alleghenycounty.us/Health-Department/Programs/Plumbing/Plumbing-Program.aspx.
[179] Pittsburgh UNITED St. 5, at 21-22.
[180] 40 C.F.R. § 141.84(d).

though these partial replacements can cause increased lead release from the remaining portion of the service line, and have no discernable public health benefit. Partial replacements also require less coordination with homeowners and residents and therefore can be accomplished more quickly than full service line replacements.

Increasingly, however, utilities are recognizing the public health risks and lack of benefits that result from partial service line replacements and choosing not to conduct partial replacements of full lead service lines. EPA has also raised questions about the efficacy of partial lead service line replacement.[181]

Q: Has PWSA conducted partial service line replacements?

A: Yes, it has. PWSA conducted 492 partial lead service line replacements between June 30, 2016, and August 15, 2018, almost 30 percent of its total replacements.[182]

On June 2, 2017, PWSA announced that it was suspending partial replacements because post-replacement monitoring revealed elevated lead levels in some customers' homes.[183]

****BEGIN PROPRIETARY****

****END PROPRIETARY**** Since that announcement, PWSA has completed 270 partial service line replacements, about 20 percent of total lead service line replacements during that period.[185]

[181] EPA Office of Water, Lead and Copper Rule Revisions White Paper 8-9 (2016), https://www.epa.gov/dwstandardsregulations/lead-and-copper-rule-revisions-white-paper.
[182] Appendix B, 11, UNITED II-35; Appendix B, 13, UNITED II-39.
[183] PWSA, PWSA to Temporarily Suspend Partial Lead Line Replacements (June 2, 2017), http://lead.pgh2o.com/pwsa-to-temporarily-suspend-partial-lead-line-replacements/.
[184]
[185] Appendix C, 9, UNITED II-35 Attach. A; Appendix C, 10, UNITED II-39 Attach. A.

Q: Under what circumstances does PWSA now conduct partial lead service line replacements?

A: It is my understanding that PWSA conducts partial lead service line replacements when PWSA schedules a full lead service line for replacement, but the property owner does not authorize PWSA to replace the private-side.[186] ****BEGIN PROPRIETARY****

****END PROPRIETARY****

It should be noted that PWSA's required liability waiver from the homeowner to qualify for private side replacement is very broad and might be reasonably be expected to discourage participation. The liability waiver includes provisions that require the property owner(s) to "release and hold harmless the PWSA from any and all claims, causes of action, damages, or losses, of any nature whatsoever" with respect to the work performed by PWSA or its subcontractors.[188]

Q: How does PWSA attempt to obtain a property owner's consent for a private-side lead service line replacement?

A: ****BEGIN PROPRIETARY****

[186] Appendix C, 7, UNITED II-1 Attach. BBB, at 3.
[187]
[188] Appendix C, 11, UNITED II-50 Attach. A, at 3.
[189]
[190]

**END

PROPRIETARY**

For residences that are not owner occupied, such as rental units, PWSA seeks authorization to replace the private-side lead line from the landlords, not the tenants. Landlords can deny authorization to avoid the inconvenience of replacement or the expense of restoring their property to its pre-replacement condition.[192] In that case, PWSA leaves a door hanger at the residence 48 hours ahead of time notifying them of the pending partial replacement.[193]

Q: If a customer refuses to authorize PWSA to replace the customer's private-side lead service line, does PWSA have any alternatives to partial lead service line replacement?

A: PWSA could refrain from replacing the public-side line, thereby avoiding the partial replacement. Several utilities have implemented strategies for complete removal of all lead service lines, with the express provision of not doing partial replacements.

- Lansing, Michigan passed an ordinance asserting utility ownership of the entire service line, with the initial purpose of controlling leaks from service lines. Once Lansing's municipal utility began replacing lead service lines, the ordinance made clear that the utility could replace the full lead service line without charging the customer.[194]
- In Flint, Michigan, partial service line replacements are prohibited by a settlement agreement resolving claims asserted in a citizen suit for Safe Drinking Water Act

191

192 Appendix B, 21, UNITED II-56; see also supra pp. 23-24, 46-47.
193 See Appendix C, 6, UNITED II-1 Attach. YY, at 02515-5.
194 Anna Clark, The City that Unpoisoned Its Pipes, Next City (Aug. 8, 2016), https://nextcity.org/features/view/flint-lansing-michigan-replaced-lead-water-pipes.

violations.[195] Local and state public funds were authorized for complete lead service line removal, private side included.[196]

It should be noted that the Pennsylvania legislature has enacted legislation authorizing publicly owned water utilities to use both ratepayer and PennVEST funding for replacement of lead service lines on private property if it is intended for the objective of public health goals.[197]

Q: What is your recommendation with respect to PWSA's partial lead service line replacement procedures?

A: PWSA should stop conducting partial lead service line replacements. Partial replacements have not shown to be effective in controlling lead release in the short- or long-term, and they expose customers to elevated lead levels, as Dr. Lanphear describes.[198] PWSA should also develop and implement a plan to reduce the rate of refusal for property owners who decline to have their private-side lead service line replaced when PWSA replaces the public side of the line, and begin to track the reasons why customers are refusing private-side service line replacements.

VIII. Post-replacement sampling

Q: How does replacing a home's lead service line affect lead levels in the home's drinking water?

A: In the short term, the immediate results of lead service line replacements vary. In some homes following a full replacement, the concentration of lead in drinking water falls quickly to

[195] Settlement Agreement ¶ 17, Concerned Pastors for Social Action v. Khouri, No. 16-10277 (E.D. Mich.), ECF No. 147-1 (Mar. 27, 2018).
[196] Id. ¶¶ 21-33.
[197] 72 Pa. C.S. § 1719-E(c)(2).
[198] PWSA St. 5, at 21-22.

very low levels. However, at other homes, lead levels remain elevated or even increase for several reasons.

When lead pipes are disturbed during a full service line replacement, there is a temporary risk that lead can mobilize, causing significant short-term spikes of lead levels in drinking water.[199] And at some homes, particularly those with galvanized iron interior pipes, lead that leached from the service line over many decades has collected in a scale that coats the inside of the galvanized pipes.[200] After the lead service line is replaced, the interior plumbing releases that residual lead unpredictably. Finally, if the interior plumbing contains lead solder or brass fixtures, it can be an ongoing source of lead that contributes to elevated lead levels even after the service line has been replaced.

This is particularly true of older plumbing. The Safe Drinking Water Act prohibits the use of pipes, plumbing fixtures, solder, and flux that are not "lead free" in public water systems and facilities that provide drinking water, including residences.[201] Until 2011, "lead free" was defined as solder and flux with no more than 0.2 percent lead and pipes with no more than 8 percent lead.[202] In 2011, Congress lowered the maximum lead content of the wetted surfaces of pipes, pipe fittings, plumbing fittings and fixtures from 8 percent to a weighted average of 0.25 percent.[203]

---

[199] Appendix D, 8, Benjamin Trueman et al., supra note 172, at 7389-96 (2016); Am. Water Works Ass'n, Communicating About Lead Service Lines 7 (2017), https://www.awwa.org/portals/0/files/ resources/publicaffairs/pdfs/finaleadservicelinecommguide.pdf.

[200] EPA Science Advisory Board, Evaluation of the Effectiveness of Partial Lead Service Line Replacements 11 (2011), https://www.epa.gov/dwstandardsregulations/science-advisory-board-evaluation-effectiveness-partial-lead-service-line.

[201] 42 U.S.C. § 300g-6(a)(1)(A).

[202] EPA, Use of Lead Free Pipes, Fittings, Fixtures, Solder and Flux for Drinking Water, https://www.epa.gov/dwstandardsregulations/use-lead-free-pipes-fittings-fixtures-solder-and-flux-drinking-water.

[203] Id.

In the long term, lead concentrations typically stabilize within six months of a full service line replacement.

Q: How do utilities manage post-replacement lead release?

A: Three common approaches used by utilities are (1) flushing the service line and interior plumbing to remove residual lead particles, (2) directing customers to use NSF International-certified water filters to remove lead, and (3) monitoring water sampling results.

Flushing removes residual lead particles from the interior plumbing by opening all interior faucets simultaneously with the aerators removed, which allows the high rate of water flow to flush out lead particles. Typically, immediately following the service line replacement, the utility or contractor will conduct vigorous flushing of the service line by opening an outside spigot for an extended period. They then leave instructions with the homeowner for follow-up and repeated flushing using the interior plumbing appliances.

Certain types of filters can remove lead from drinking water, but they require consistent use and replacement of the filter elements to retain effectiveness. Tap water monitoring allows a utility to assess whether the replacement was effective, whether significant ongoing sources of lead remain that may require further interventions, and whether the home's water is safe to drink.

Q: Does PWSA use any of these approaches?

A: Yes. PWSA provides all customers who receive a replacement with flushing instructions, a pitcher filter with six-months of replacement cartridges, and a water testing kit.[204] PWSA warns customers that lead levels may be elevated for up to six months following construction and directs them to use the water filter pitcher for drinking and cooking needs.[205] PWSA directs customers to flush their plumbing immediately after a service line replacement and to send in a

[204] Appendix C, 11, UNITED II-50 Attach. A at 5; Appendix B, 2, UNITED II-55(a)-(b).
[205] UNITED II-51 Attach. B.

water sample within 72 hours of the replacement.[206] If the water sample detects a lead concentration above 100 parts per billion, PWSA goes to the house to assist with additional flushing and provide bottled water.[207] If lead levels are below 100 ppb but above 15 ppb, PWSA sends the customer a second water testing kit three months after the replacement and additional filter cartridges.[208] If the three-month water sample exceeds 15 parts per billion, PWSA sends another water testing kit six months after the replacement.[209]

Q: What steps does PWSA take to encourage customers to return post-replacement water samples for testing?

A: In the information packet PWSA sends to customers at least 45 days before replacement, PWSA notes that customers will be provided with a post-replacement sampling kit.[210] PWSA also hangs a notice on customers' doors following replacement requesting that they send in a sample within 72 hours.[211] PWSA hangs a second notice on the doors of customers who receive partial lead service line replacements and fail to return their 72-hour samples within one month.[212] PWSA's Lead Help Desk answers questions about sampling via phone and email.[213]

Q: What percentage of PWSA customers return post-replacement water samples?

A: **BEGIN PROPRIETARY**

[206] Appendix C, 11, UNITED II-50 Attach. A, at 5
[207] Appendix B, 30, UNITED VIII-37.
[208] Id.; Appendix B, 19, UNITED II-54(b).
[209] See UNITED IV-41 Attach. A.
[210] Appendix C, 11, UNITED II-50 Attach. A, at 5.
[211] UNITED II-51 Attach. B-D.
[212] Appendix B, 29, UNITED VIII-33.
[213] Appendix B, 19, UNITED II-54(f).
[214]

END PROPRIETARY

Q: Do you have an opinion on the response rate for customer return of water samples after lead service line replacement?

A: These response rates are disappointingly low, although not necessarily out of line with the experience of other utilities. Some utilities continually review and revamp their customer outreach protocols and materials with the objective of getting higher rates of response. In general, a water utility's post-replacement monitoring program is most effective and allows the utility to provide better information and targeted interventions if the water sample response rate is as high as possible.

Q: What, if anything, should PWSA do to improve its post-replacement sampling procedures?

A: This is a difficult problem. Generally, the solution is to implement more vigorous customer outreach practices to encourage the return of the prescribed samples for analysis. These measures could include some combination of mailings, telephone outreach, and in-person visits to encourage customers to return a water sample. To the extent PWSA is not already doing so, PWSA could also explore partnerships with community organizations that may assist it in communicating with customers.

In addition, to the extent it is not already doing so, PWSA or its contractors should

---

215

216

identify homes with visible interior galvanized iron pipes during service line replacements and notify customers. Such pipes may be readily observed in unfinished basements when interior work is being done as part of a full lead service line replacement. Customers who have galvanized interior pipes should be warned that they have a continued risk of ongoing elevated lead exposure even following a full service line replacement and could be prioritized for water sampling outreach. This inspection and notification could be readily incorporated into PWSA's service line replacement procedures because contractors already must enter the home to replace the private-side service line, and the notification could be added to the written information PWSA leaves behind after a replacement.

Finally, for homes with sustained lead levels above 15 ppb in post-replacement water samples, PWSA should assist residents with inspecting their interior plumbing and identifying potential sources of lead exposure, such as galvanized pipes, lead solder, or brass fixtures. DC Water conducts such interior inspections when high lead concentrations are detected in sampling of homes that have had full lead service line replacements.

Q: How much would it cost for PWSA to enhance its post-replacement customer outreach?

A: The cost would depend on the methods employed. However, even comparatively resource-intensive outreach procedures, such as sending representatives door-to-door to encourage customers to return water samples or to inspect interior plumbing, would likely make up a small percentage of the overall cost of replacement. The cost of identifying exposed, interior galvanized pipes and notifying customers about them would be negligible in many cases because PWSA's contractors must enter the customer's home to replace the private-side service line.

VI. Conclusion

Q: Please summarize your conclusions and recommendations.

A: PWSA's lead service line replacement program involves a significant investment of ratepayer funds. PWSA can improve the efficiency and efficacy of its lead remediation program by adjusting the program's design and implementation. PWSA should take the following steps to ensure that this investment is appropriated wisely to generate the greatest possible improvements to the safety and reliability of its service:

Curb Box Inspections

- PWSA should develop and implement a plan to conduct curb-box inspections on all service lines in its system. PWSA's current inspection protocol does not examine public- or private-side service lines when historical records suggest that the public-side line is not lead.[217] This prevents PWSA from obtaining an accurate inventory of the lead infrastructure in its system.

Cost of Service Line Replacement

- PWSA should develop and implement a plan to reduce its per-line costs for replacing lead service lines.
- PWSA should investigate why its per-line costs for replacing service lines are so high. The average cost for a PWSA contractor to replace a lead service line is $12,541—more than twice the average of the costs reported by seven other utilities.

[217] Appendix B, 6, UNITED II-19.

- PWSA should investigate why more than fifty percent of its contractors' replacements have been performed using a more costly open trench method, and, if possible, take steps to bring that percentage down.
- PWSA should start tracking how much it spends to replace service lines with its own work crews to determine whether there are opportunities for conducting those replacements more efficiently. Reducing the replacement costs by even a few thousand dollars per service line would save millions of dollars in total, which could be used to fund additional lead service line replacements, other health protective measures, or other programs.

Scope of service line replacement program

- PWSA should continue replacing private-side lead service lines at no direct cost to customers during full lead service line replacements after December 2018.
- PWSA should develop and implement a plan to include private-side-only service lines in its replacement program at no direct cost to customers.
- PWSA should stop conducting partial replacements of lead service lines. If PWSA cannot obtain customer authorization to replace a private-side lead line, then PWSA should not replace the public-side lead line, except in the case of emergency repair, and the customer's refusal should be recorded.
- PWSA should develop and implement a plan to reduce the 15% rate of refusal for property owners who decline to have their private-side lead service line replaced when PWSA replaces the public side of the line. PWSA should also begin to track the reasons why customers are refusing private-side service line replacements, and consider revising the broad language in its homeowner liability waiver.

- PWSA should not prematurely terminate its lead service line replacement program and should develop and implement a plan to provide full service line replacements to all affected customers by 2025.

Post-replacement procedures

- PWSA should develop and implement a plan to increase customers' low participation rate in post-replacement tap water sampling. Without post-replacement monitoring, PWSA does not know whether a replacement was effective, and residents do not know whether their water is safe to drink. These measures could include some combination of mailings, telephone outreach, and in-person visits to encourage customers to return a water sample. To the extent PWSA is not already doing so, PWSA could also partner with community organizations that may assist it in communicating with customers.
- PWSA should develop and implement a plan to identify homes with visible interior galvanized iron pipes during service line replacements and notify customers. This inspection and notification could be incorporated into PWSA's service line replacement procedures.
- For homes with sustained lead levels above 15 ppb in post-replacement water samples, PWSA should assist residents with inspecting their interior plumbing and identifying potential sources of lead exposure, such as galvanized pipes, lead solder, or brass fixtures.

Q: **Does this conclude your direct testimony?**

A: Yes. I reserve the right to supplement my testimony based on subsequent information provided by PWSA, including, but not limited to, information disclosed with PWSA's Compliance Plan.

PWSA

Motion in Limine

Attachment 5

Direct Testimony of
Bruce Lanphear
(Pittsburgh UNITED St. 5)

PUBLIC VERSION

Excludes Attachments and Exhibits

BEFORE THE PENNSYLVANIA PUBLIC UTILITY COMMISSION

Pennsylvania Public Utility Commission	:	
	:	
v.	:	**Docket No.** R-2018-3002645
	:	R-2018-3002647
Pittsburgh Water and Sewer Authority	:	
	:	

DIRECT TESTIMONY OF BRUCE LANPHEAR, M.D., M.P.H.

ON BEHALF OF

PITTSBURGH UNITED

September 25, 2018

PUBLIC VERSION

CONFIDENTIAL INFORMATION REDACTED

Topics Addressed:

Safety of PWSA's Water Service

Health Implications of PWSA's Lead Remediation Program

PREPARED DIRECT TESTIMONY OF BRUCE LANPHEAR, M.D., M.P.H.

Q: Please state your name, occupation, and business address.

A: Bruce Lanphear. I am currently a Professor on the Faculty of Health Sciences at Simon Fraser University and a Clinician Scientist at the Child and Family Research Institute at British Columbia Children's Hospital. My business address is Blusson Hall, 8888 University Drive, Burnaby, BC V5A 1S6, Canada.

Q: Briefly outline your educational and professional background.

A: I am a medical doctor. I received my M.D. in 1986 from the University of Missouri at Kansas City. I completed an internship at the University of Arkansas for Medical Sciences from 1986-87, and a fellowship in general academic pediatric research at the University of Rochester School of Medicine from 1992-95. Since 1989, I have been certified by the American Board of Medical Specialties, with a specialization in general preventative medicine and public health. I also received a Master of Public Health degree from the Tulane School of Public Health and Tropical Medicine in 1988.

Since completing my academic training, I have served as a member of numerous public health agencies and task forces, including the Science Advisory Board for Evaluating the Hazards of Partial Water Line Replacement for the U.S. Environmental Protection Agency (EPA) and the Peer-Review Panel for the National Toxicology Program of the U.S. Department of Health and Human Services Monograph on Health Effects of Low-Level Lead. I was also a member of two National Academies of Sciences Committees: "Ethical Consideration for Research on Housing-Related Health-Hazards Involving Children" and "Contaminated Drinking Water at Camp Lejeune." In June 2017 I was consulted by the Allegheny County Lead Task

Force, which was charged with developing strategies for addressing childhood lead exposure in the County.

I have served as an editorial board member for several scientific journals, including PLOS Medicine and Environmental Health Perspectives. A more complete description of my educational and work experience, as well as a complete list of my publications, is included at Appendix A.

Q: Please describe the focus of your work over the past 20 years.

A: My research focuses on quantifying and preventing health effects in children that result from exposures to toxic chemicals, such as lead. My original research includes over 40 studies on lead exposure and lead poisoning, including a study funded by the Centers for Disease Control and Prevention on the primary prevention of exposure to lead, for which I served as principal investigator, and a study funded by the National Institute of Environmental Health Sciences on the neurobehavioral effects of low-level lead exposure in children, for which I also served as principal investigator. Currently, I am senior investigator for a study examining fetal and early childhood exposures to lead and other prevalent environmental neurotoxins. I have also written and presented extensively on the sources and health effects of lead exposure, including for the recent American Academy of Pediatrics Lead Policy Statement (2016).

By virtue of my medical and public health training, my clinical work, my research, and my knowledge of pertinent scientific literature, I am often considered by my peers to be an expert on lead toxicity and the sources and effects of lead exposure, particularly in children.

Q: Have you testified in any proceeding before the Pennsylvania PUC?

A: No.

Q: For whom are you testifying in this proceeding?

A: I am testifying on behalf of Pittsburgh UNITED.

Q: What is the purpose of your testimony?

A: Pittsburgh UNITED intervened in this proceeding to ensure, among other things, that PWSA's lead remediation program will provide safe drinking water to all residential customers. My testimony focuses on the dangers of lead contamination and the health implications of PWSA's lead remediation program.

Q: How is your testimony organized?

A: My testimony is divided into four sections. In the first section, I discuss the sources and effects of lead exposure. In the second section, I discuss the risks of lead exposure in Pittsburgh. In the third section, I evaluate the health implications of PWSA's lead remediation program. I begin by evaluating PWSA's selection and prioritization of service line replacements. I then examine the scope of PWSA's service line replacement program. Next, I discuss PWSA's water filter distribution program. I then evaluate PWSA's post-service-line replacement procedures. In the fourth and final section, I summarize my conclusions and recommendations.

Q: Why is PWSA's lead remediation program relevant to this rate proceeding?

A: I have been informed by counsel that the Commission is investigating "the lawfulness, justness, and reasonableness of the existing rates, rules, and regulations of The Pittsburgh Water and Sewer Authority,"[1] that PWSA is required to provide "safe" service,[2] and that the Commission may reject a rate increase if PWSA's service is "inadequate in that it fails to meet quantity or quality for the type of service provided."[3] In my opinion, PWSA must take

[1] Suspension Order, Docket No. R-2018-3002645, ¶ 1 (July 12, 2018).
[2] 66 Pa. C.S. § 1501.
[3] 66 Pa. C.S. § 526(a).

additional, appropriate steps to reduce exposure to lead in water to deliver safe, reasonable, high-quality water service to its customers. I understand that PWSA's expenditures on lead remediation measures—a budgeted $44 million for 2018—contribute significantly to its increasing operational and capital investment costs, which in turn are one of the "key factors" driving PWSA's requested rate increase.[4] I believe the Commission should consider and understand the health implications of PWSA's lead remediation activities as part of its evaluation of whether PWSA's costs for those activities, and the requested rates to fund that work, are just and reasonable, and will ensure that customers receive safe, high-quality water service.

I. Sources and effects of lead exposure

Q: Please describe how drinking water serves as a source of lead exposure.

A: Exposure to lead from drinking water is due to the presence of lead-containing water infrastructure, particularly in older homes and cities. Lead is soluble and can enter drinking water through the corrosion of plumbing materials, including lead pipes and fixtures.[5] Lead in drinking water has become a more significant source of exposure as exposures to lead in paint and gasoline have been reduced.[6]

Lead exposure through water can occur by drinking or cooking with contaminated water. Infants may be exposed by ingesting formula prepared with lead-contaminated tap water. Lead can also pass from a mother to a developing fetus and from nursing mothers to their babies through breastmilk.

---

[4] PWSA St. 1, at 9, 15-16.
[5] Appendix D, 1, Ronnie Levin et al., Lead Exposures in U.S. Children, 2008: Implications for Prevention, 116 Envtl. Health Persp. 1285, 1287 (2008).
[6] See Appendix D, 2, Patrick Levallois et al., The Impact of Drinking Water, Indoor Dust and Paint on Blood Lead Levels of Children Aged 1-5 Years in Montréal (Québec, Canada), 24 J. Exposure Sci. & Envtl. Epidemiology 185, 185 (2014); Appendix D, 3, Allegheny Cty. Lead Task Force, Final Report & Recommendations 5 (2017).

Q: Please describe other major sources of lead exposure.

A: Other major sources of lead exposure are the ingestion of lead-contaminated dust and soil, primarily due to the presence of lead-based paint and legacy lead gasoline emissions.[7]

Q: Are certain populations particularly vulnerable to lead exposure?

A: Yes. An individual's level of exposure to lead varies based on age and other factors. Developing fetuses, infants, and children are uniquely vulnerable to lead toxicity because their brains are still developing.

Children's brains rapidly grow during fetal development and early childhood. Rapidly growing tissues are more vulnerable to lead and other toxicants. Lead interferes with the formation of nerve connections, which are formed during brain development. Developing fetuses and newborns do not have fully developed blood-brain barriers, which make their brains more permeable to lead. Children are also more exposed to lead than adults because of their normal developmental behavior, including crawling and hand-to-mouth activity. Children who have iron or calcium deficiency also more readily absorb lead. This is because lead mimics iron and calcium in the way it is absorbed in the gastrointestinal tract.

Infants are especially vulnerable to lead-contaminated drinking water because their primary interaction with their environment is what they drink.[8] For infants consuming formula, EPA has concluded that tap water may account for more than 85% of their total lead exposure.[9] Infants also absorb lead more efficiently than adults, particularly lead from drinking water.

---

[7] Appendix D, 4, Bruce P. Lanphear et al., Environmental Lead Exposure During Early Childhood, 140 J. of Pediatrics 40, 40 (2002) (hereinafter "Lead Exposure During Early Childhood"); Nat'l Toxicology Program, U.S. Dep't of Health & Human Servs., Health Effects of Low-Level Lead 13 (2012), https://ntp.niehs.nih.gov/ntp/ohat/lead/final/monographhealtheffectslowlevellead_newissn_508.pdf.

[8] Appendix D, 5, Michael W. Shannon & John W. Graef, Lead Intoxication in Infancy, 89 Pediatrics 87, 89-90 (1992).

[9] 56 Fed. Reg. 26,460, 26,470 (June 7, 1991).

Infants can absorb 40-50% of water-soluble lead they ingest compared with 3-10% for adults.[10] Young children also have a greater risk of exposure from lead-contaminated water because, pound for pound, they drink more water than older children and adults.

Other factors also make certain children and adults particularly vulnerable to lead exposure. Because the majority of lead is stored in bones, where it can remain for years, lead can be released during times of physiological change, including stress, pregnancy, lactation, fractures, and menopause. The concentration of lead in a woman's blood, for instance, increases by about 30% after menopause.[11]

People who live in older homes and poorly maintained rental housing are at increased risk for higher blood lead concentrations, as are people with nutrient-deficient diets.[12] Black people and people of low-income backgrounds are also at higher risk for elevated blood lead levels because they are more likely to be living in older, poorly maintained housing that contains residual lead paint and older pipes and plumbing fixtures that are more likely to contain lead.[13]

Q: What are the health effects of lead exposure?

A: Lead is toxic to the central nervous system. It damages numerous organ systems and causes permanent, irreversible injuries to children's developing brains. Even at low levels of exposure, lead is harmful to both children and adults. There is no safe level of exposure to lead.

Lead can pass from a mother's lead stores and blood to her unborn baby, increasing the risk that the baby will be born too early or too small. Lead exposure has also been associated

---

[10] U.S. Dep't of Health & Human Servs., Toxicological Profile for Lead 156 (2007), http://www.atsdr.cdc.gov/toxprofiles/tp13.pdf.
[11] Nat'l Toxicology Program, U.S. Dep't of Health & Human Servs., Health Effects of Low-Level Lead xxii, 11, 16 (2012), https://ntp.niehs.nih.gov/ntp/ohat/ lead/final/monographhealtheffectslowlevellead_newissn_508.pdf.
[12] Id. at 16.
[13] Appendix D, 3, Allegheny Cty. Lead Task Force, supra note 6, at 12; Appendix D, 4, Lead Exposure During Early Childhood, supra note 7, at 45-46.

with an increased incidence of miscarriages and delays in the time to achieve pregnancy.[14] One case control study showed that the odds of miscarriage nearly doubled for every 5 µg/dL increase in maternal blood lead concentration.[15]

Childhood lead exposure has been associated with a wide array of irreversible neuropsychological and developmental effects. Increased levels of lead in blood can result in lower IQs, diminished academic achievement, increased risk of attention-related disorders, and increased risk of problem behaviors, like conduct disorder. These associations occur even at low blood levels (below 5 µg/dL).[16] Blood lead levels of 10 µg/dL and lower are also associated with stunted growth and impaired hearing.

Childhood lead exposure can have lifelong effects. Children with elevated blood lead levels may never reach the same peak cognitive ability later in life as children with lower exposure to lead.[17] There is some evidence that lead exposure is a risk factor for developing Alzheimer's disease.[18]

Adults exposed to lead can also experience adverse health impacts. Chronic lead exposure in adults can result in increased blood pressure (or hypertension) and chronic kidney disease. Adult lead exposure has been associated with increased risk of cardiovascular problems, decreased cognitive function, and increased incidence of tremors.[19]

---

[14] Appendix D, 6, Marc Edwards, Fetal Death and Reduced Birth Rates Associated with Exposure to Lead-Contaminated Drinking Water, 48 Envtl. Sci. & Tech. 739, 739-46 (2014); Appendix D, 7, Motao Zhu et al., Maternal Low-Level Lead Exposure and Fetal Growth, 118 Envtl. Health Pers. 1471, 1471-75 (2010).
[15] Appendix D, 8, Victor H. Borja-Aburto et al., Blood Lead Levels Measured Prospectively and Risk of Spontaneous Abortion, 150 Am. J. Epidemiology 590, 590-97 (1999).
[16] Nat'l Toxicology Program, U.S. Dep't of Health & Human Servs., Health Effects of Low-Level Lead xviii (2012), https://ntp.niehs.nih.gov/ntp/ohat/ lead/final/monographhealtheffectslowlevellead_newissn_508.pdf.
[17] Appendix D, 9, Bruce P. Lanphear, The Impact of Toxins on the Developing Brain, 36 Annual Rev. Pub. Health 211, 218 (2015) (hereinafter "The Impact of Toxins").
[18] Id. at 219.
[19] Appendix D, 10, Bruce P. Lanphear et al., Low-Level Lead Exposure and Mortality in U.S. Adults: A Population-Based Cohort Study, 3 Lancet Pub. Health e177, e182-83 (2018); Appendix D, 11, Simoni Triantafyllidou & Marc

Q: Are the effects of lead exposure cumulative?

A: Yes. The adverse effects of lead exposure build up over time. There is evidence that, while both acute exposures and cumulative lead exposure adversely affect childhood brain development, cumulative lead exposure over time is a stronger predictor of long-term adverse outcomes than short-term peak exposure to lead. For example, children's blood lead levels measured at ages 5-6 were more strongly associated with adverse health impacts than peak blood lead levels measured during early childhood (ages 0-2), suggesting that lead exposure throughout childhood—not just early peak exposure—significantly affects negative health outcomes.[20]

II. Lead exposure in Pittsburgh

Q: Are Pittsburgh residents at risk of lead exposure from drinking water?

A: Yes. PWSA's tap water testing results over the past two years have shown consistently high levels of lead. This testing was conducted pursuant to the Lead and Copper Rule, issued by EPA under the Safe Drinking Water Act. Under the Lead and Copper Rule, PWSA must collect at least 100 tap water samples from a qualifying pool of residential homes every six months.[21] Samples are then analyzed to determine the 90th percentile level of lead concentrations. EPA has set a lead action level at 15 parts per billion (ppb).[22] An exceedance of that level triggers additional requirements under the Lead and Copper Rule.[23]

The publicly available results of PWSA's most recent six-month testing periods are as follows:

Edwards, Lead (Pb) in Tap Water and in Blood: Implications for Lead Exposure in the United States, 42 Crit. Rev. Envtl. Sci. & Tech. 1297, 1319 (2012).

[20] Appendix D, 12, Christopher J. Brubaker et al., The Influence of Age of Lead Exposure on Adult Gray Matter Volume, NeuroToxicology (2010).

[21] 40 C.F.R. § 141.86(c), (d)(1).

[22] Id. §§ 141.2, 141.80(c)(1).

[23] Id. § 141.2.

Monitoring Period	90th Percentile Lead Level (ppb)
January-June 2016	22
July-December 2016	18
January-June 2017	15
July-December 2017	21
January-June 2018	10

Table A: PWSA's Recent Monitoring Results Under the Lead and Copper Rule[24]

PWSA's tap water testing results have thus exceeded or equaled the lead action level of 15 ppb for four of the last five testing periods.

EPA's lead action level of 15 ppb is not a health-based standard.[25] There is no safe level of exposure to lead.[26] Even chronically elevated blood lead levels below 5 µg/dL have been associated with antisocial, disruptive, and violent behaviors; with increased risk of criminal arrests; and with significant developmental and neuropsychological effects in children.[27] The risk of lead exposure from drinking water to Pittsburgh residents, particularly children and other vulnerable populations, is troubling.

---

[24] Press Release, PWSA, PWSA 2016 Lead Test Results (July 12, 2016), http://lead.pgh2o.com/pwsa-2016-lead-test-results/; Press Release, PWSA, PWSA Releases December 2016 Lead Compliance Test Results (Jan. 19, 2017), http://lead.pgh2o.com/pwsa-releases-december-2016-lead-compliance-test-results/; Press Release, PWSA, PWSA Releases June 2017 Lead Compliance Test Results (July 18, 2017), http://lead.pgh2o.com/pwsa-releases-june-2017-lead-compliance-test-results/; Press Release, PWSA, PWSA Releases December 2017 Lead Compliance Test Results (Jan. 22, 2018), http://lead.pgh2o.com/pwsa-releases-december-2017-lead-compliance-test-results/; Press Release, PWSA, PWSA Releases July 2018 Lead Compliance Test Results (July 25, 2018), http://pgh2o.com/release?id=7717.

[25] Appendix D, 13, EPA Office of Water, Lead and Copper Rule Revisions White Paper 11-12 (2016) (confirming that the lead action level is not health based, and recommending that EPA establish a health-based benchmark for lead in drinking water); Appendix D, 14, Adrienne Katner et al., Weaknesses in Federal Drinking Water Regulations and Public Health Policies That Impede Lead Poisoning Prevention and Environmental Justice, 9 Envtl. Just. 1, 3 (2016).

[26] Appendix D, 13, EPA Office of Water, supra note 25, at 11.

[27] Appendix D, 9, The Impact of Toxins, supra note 17, at 221.

Q: Please describe Pittsburgh residents' overall risk of lead exposure.

A: Several of the lead-exposure risk factors I discussed above are present in the Pittsburgh area. As the following map shows, a significant proportion of the housing stock in Pittsburgh was built before 1950, when lead-based paint and lead service lines were still frequently used.[28]

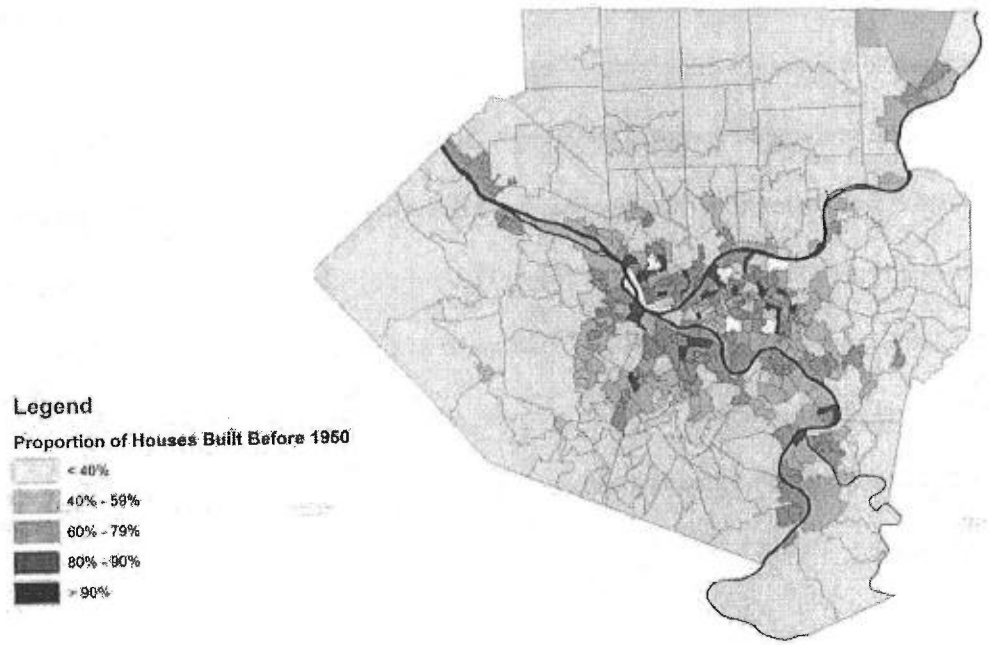


Figure A: Allegheny County Census Tract Housing Built Before 1950[29]

Less than half of Pittsburgh housing units are owner occupied.[30] The median household income between 2012 and 2016 was $42,450, with 22.3% of Pittsburgh residents living in poverty.[31] About a quarter of the population is black.[32] As Mr. Miller explains in his testimony, an

[28] Appendix D, 3, Allegheny Cty. Lead Task Force, supra note 6, at 10 (noting that, in Allegheny County, 41% of homes were built before 1950); Pittsburgh UNITED St. 4, at 7.
[29] Allegheny Cty. Health Dep't, Allegheny County Census Tract: Housing Built Before 1950, http://www.alleghenycounty.us/uploadedFiles/Allegheny_Home/Health_Department/Programs/Special_Initiatives/Lead/Housing-Built-Before-1950.pdf.
[30] U.S. Census Bureau, QuickFacts: Pittsburgh city, Pennsylvania, https://www.census.gov/quickfacts/fact/table/pittsburghcitypennsylvania/PST045217.
[31] Id.
[32] Id.

estimated 28% of PWSA's customers have incomes at or below 150% of the Federal Poverty Level.[33] As I discussed above, supra p. 6, these residents, who make up a significant portion of Pittsburgh's population and PWSA's customer base, have a heightened risk of elevated blood lead levels because they are more likely to live in poorly maintained homes with aging infrastructure. Additionally, due to significant industrial activity since the early 1800s, Allegheny County also has areas with higher levels of lead in soil.[34]

The blood lead levels of Pittsburgh children are also a reliable indicator of ongoing lead exposure. According to a recent report from the Allegheny County Health Department, the confirmed rate of elevated blood lead level ($\geq$ 5 µg/dL) for children younger than 6 years old in Allegheny County was about 2% in 2016 and 2017;[35] 1- to 3-year-old children would undoubtedly have a higher rate.[36] Moreover, as the following map shows, there are neighborhoods within Pittsburgh and Allegheny County where the blood lead level would be much higher.

[33] Pittsburgh UNITED St. 2, at 12.
[34] Appendix D, 3, Allegheny Cty. Lead Task Force, supra note 6, at 11.
[35] Appendix D, 15, Allegheny Cty. Health Dep't, Lead Exposure in Allegheny County 8 (2018).
[36] Appendix D, 4, Lead Exposure During Early Childhood, supra note 7, at 46.

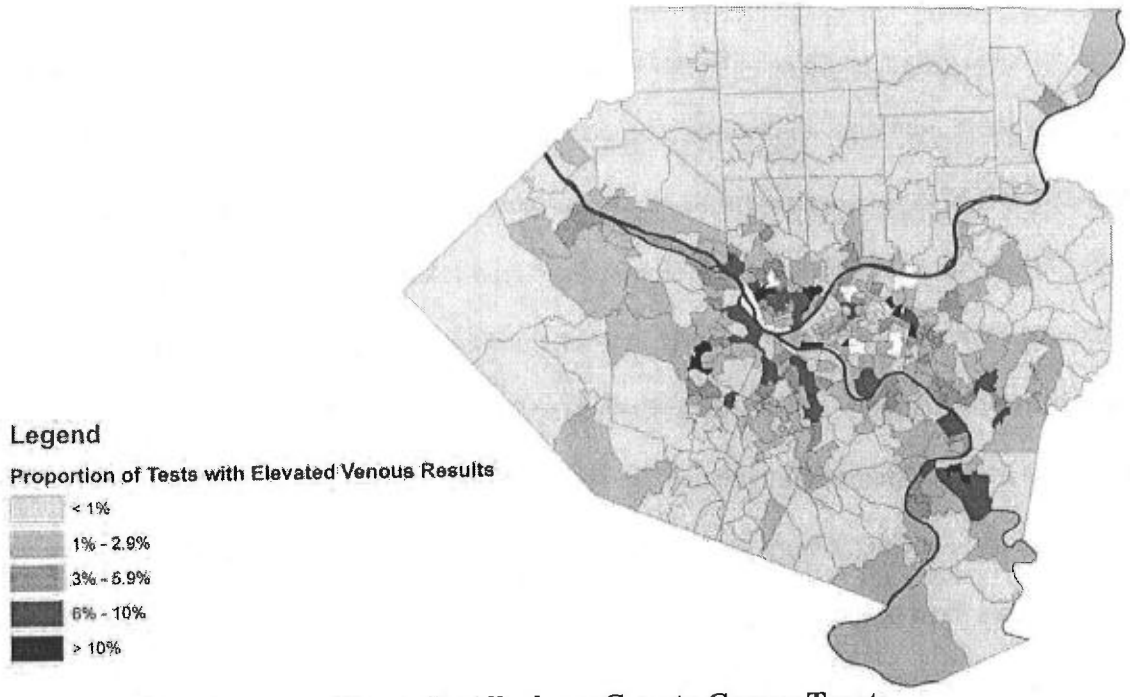


Figure B: Allegheny County Census Tracts
2015 - 2017 Proportion of Blood Lead Level Tests With Venous Results ≥ 5 µg/dL
(Children 6 Years And Younger)[37]

Some of the highest blood lead level rates occur in neighborhoods directly north, south, and west of downtown Pittsburgh, and fall within PWSA's service area.[38]

The presence of these lead exposure risk factors and the data on children's blood lead levels indicate that Pittsburgh residents, and particularly certain neighborhoods and vulnerable populations, are at serious risk of lead exposure.

Q: **Should PWSA take steps to reduce lead exposure from drinking water?**

A: Yes. It is important for PWSA to take steps to reduce lead exposure from drinking water because Pittsburgh residents are being exposed to high levels of lead in their drinking water.

---

[37] Allegheny Cty. Health Dep't, Allegheny County Census Tracts 2015 - 2017 Proportion of Blood Lead Level Tests With Venous Results > 5 µg/dL (Children 6 Years And Younger), http://www.alleghenycounty.us/uploadedFiles/Allegheny_Home/Health_Department/Programs/ Special_Initiatives/Lead/2017-Proportion-of-Blood-Lead-Level-Tests-with-Venous-Results.pdf.

[38] See Appendix D, 15, Lead Exposure in Allegheny County, supra note 35, at 7.

PWSA's lead levels over the past few years have routinely exceeded the 15-ppb lead action level, as noted above, supra p. 9. These levels indicate that the drinking water provided to many residents poses an unreasonable threat to their health. In addition, many people in Pittsburgh are already exposed to lead from multiple other sources. As a result, these residents face serious risks of lead exposure and, in turn, serious risks of lead-related health threats. Exposure to an additional source of lead from tap water increases and compounds these risks. Moreover, as I have described, supra pp. 4-6, drinking water may be the dominant source of lead exposure for some residents, including some infants.

To prevent further harm to Pittsburgh residents, and especially children and pregnant women, steps must be taken to reduce or prevent their ongoing exposure to lead in tap water. This means providing access to safe, reliable, and clean drinking water. Primary prevention—eliminating lead hazards *before* exposure—is the only effective way to protect children from lead toxicity.

Q: What steps should PWSA be taking to reduce lead exposure from drinking water?

A: The primary, critical step is to eliminate a major source of lead exposure by removing all lead service lines from the water system.[39] While those removals are occurring, and until they are complete and water lead levels are reduced to consistently low levels, e.g., less than 5 ppb, PWSA must take additional steps to help Pittsburgh residents reduce their lead exposure from drinking water. These interim steps include providing water filters certified by NSF International and replacement cartridges to households with lead or unknown service lines, collecting and analyzing tap water samples following service line replacements, and educating consumers on

[39] See Appendix D, 3, Allegheny Cty. Lead Task Force, supra note 6, at 32.

the risks of lead exposure and ways in which they can minimize their exposure.[40] These steps are necessary to ensure the safety of PWSA's water service for all of its customers.

In the next section, I discuss these steps in more detail. Specifically, I describe the steps PWSA is currently taking and planning to take to reduce lead exposure from drinking water and evaluate whether those efforts will adequately protect Pittsburgh residents' health.

III. Health implications of PWSA's lead remediation program

Q: What is your overall understanding of PWSA's lead remediation program?

It is my understanding that, following its exceedance of the lead action level in 2016 and a subsequent Administrative Order issued by the Pennsylvania Department of Environmental Protection, PWSA began investigating lead levels within its system.[41] PWSA has since begun implementing a lead remediation program, which includes service line replacement.[42] Under this program, PWSA is replacing lead service lines for some Pittsburgh residents.[43]

Q: What is your understanding of PWSA's process for selecting residences for service line inspection and replacement?

A: As an initial matter, it is my understanding that PWSA views a service line as having two components: (1) a public side, i.e., the portion of the service line on the street side of the curb box, lying primarily beneath public property; and (2) a private side, i.e., the portion of the service line on the residence side of the curb box, lying primarily beneath private property. According to PWSA, it only owns the public side of the service line, and thus, many of its processes and

---

[40] See id.
[41] Press Release, Pa. Dep't of Envtl. Prot., DEP Agreement with PWSA Could Allow $1.8 Million Investment in Lead Line Replacement (Nov. 17, 2017), http://www.ahs.dep.pa.gov/NewsRoomPublic/articleviewer.aspx?id=21340&typeid=1.
[42] PWSA St. 1, at 8-9.
[43] See Pittsburgh UNITED St. 4, at 13-15.

procedures focus on the composition of the public side only.[44]

It is my understanding that PWSA's process for selecting residences for service line inspection stems from its analysis of historical construction records of the service line.[45] PWSA has thousands of historical records of service lines, which sometimes contain information about the composition of the service line.[46] PWSA has digitized and examined many of these records, and maintains a database of the information collected.[47] If PWSA's review of the historical record indicates that the public-side service line is made of lead or galvanized iron, then it will schedule the line for inspection.[48] PWSA will also schedule a service line for inspection if the historical record for the public-side service line is unavailable or indicates that the line material is unknown.[49] If the historical record indicates that the public-side service line is made of copper, then PWSA will take no further action.[50] PWSA takes no independent or additional action with respect to the private-side service line beyond what is done for the public-side service line.[51]

It is my understanding that, once service lines are scheduled for inspection, they are grouped into work orders made up of several contiguous blocks of between 200 and 1200 residences.[52] The locations of each work order are rotated through PWSA's distribution system and are determined based on the age of the water mains, parcel ages, and census tract data for child births and average blood lead levels.[53] However, it is unclear how these factors are weighed

[44] See, e.g., Appendix B, 13, UNITED VIII-6.
[45] Appendix B, 2, UNITED II-15.
[46] See Press Release, PWSA, PWSA Posts Historical Record Information to Interactive Lead Line Map (May 3, 2018), http://lead.pgh2o.com/pwsa-posts-historical-record-information-to-interactive-lead-line-map/.
[47] Id.; Appendix B, 11, UNITED VIII-2.
[48] Appendix B, 2, UNITED II-15; Appendix B, 13, UNITED VIII-6.
[49] Appendix B, 2, UNITED II-15.
[50] Id.
[51] Appendix B, 13, UNITED VIII-6.
[52] Appendix B, 3, UNITED II-19.
[53] Id.

or prioritized.[54] Inspection sites are intentionally dispersed among each City Council District.[55] It is my understanding that inspection work orders are used to create service line replacement work orders.[56]

It is my understanding that, after the inspection, PWSA notifies the homeowner and tenant, if any, of the inspection results and provides some information about how to reduce exposure to lead in drinking water, although there can be a delay of up to six months before this notification occurs.[57] The following chart summarizes the action PWSA takes, if any, following an inspection:

Result of Inspection	Action Taken by PWSA, If Any
The public-side service line is lead	The line is scheduled for replacement[58]
Both the public and private sides of the service line are lead	The full line is scheduled for replacement[59]
Only the private-side service line is lead	PWSA takes no further action[60]
The material is "unknown" or the service line is "not accessible" on either the public or private side	The line is scheduled for verification by excavation as part of a service line replacement work order for that area[61]
Either the public-side service line is non-lead or both the public- and private-side service lines are non-lead, and the historical record shows the same result	PWSA takes no further action[62]

[54] Appendix B, 14, UNITED VIII-15.
[55] Press Release, PWSA, PWSA Launches Online Water Service Line Map (June 12, 2017), http://lead.pgh2o.com/pwsa-launches-online-water-service-line-map/.
[56] Appendix B, 7, UNITED II-44.
[57] See generally Appendix C, 5, UNITED II-1 Attach. TT; Appendix C, 8, UNITED II-21(h) Attach. C; Appendix B, 15, UNITED VIII-20.
[58] Appendix C, 5, UNITED II-1 Attach. TT, at 3.
[59] Id.
[60] Id.
[61] Appendix B, 17, UNITED VIII-25.
[62] Appendix B, 18, UNITED VIII-26.

Either the public-side service line is non-lead or both the public- and private-side service lines are non-lead, and the historical record shows a different result	The line is scheduled for verification by excavation as part of a service line replacement work order for that area[63]

Q: What health-based concerns, if any, do you have about PWSA's process for selecting residences for service line inspection and replacement?

A: I have several concerns with PWSA's process for selecting residences for service line inspection and replacement. First, I am concerned about how PWSA prioritizes service lines for inspection and replacement. As discussed above, supra pp. 4-6, certain communities and populations—in particular, children, pregnant women, black people, and low-income individuals—are at higher risk of lead exposure. Neighborhoods with higher concentrations of these at-risk populations must be prioritized for service line inspection and replacement. Based on my understanding of PWSA's practices, it is not clear that PWSA adequately prioritizes these populations. PWSA has identified some, but not all, of the factors that should be used to guide prioritization. PWSA also has not indicated how it weighs these factors to choose and order the homes where inspections take place.

A primary guiding factor in prioritization of homes for service line inspection and replacement should be blood lead levels in children. Another guiding factor should be drinking water lead levels. Other factors to consider are the age of the water mains and the age of the housing stock. All of these factors should be overlaid with a census map depicting race and income data and, where possible, homes with pregnant women and young children. This map might be supplemented by information collected by PWSA; for example, with the next water bill, PWSA could include a leaflet asking customers to identify whether any pregnant women or

[63] Id.

children under the age of six live in the household. Areas for service line replacement should be selected by identifying where these concentrations of factors are the highest and prioritizing accordingly. Prioritizing service lines for inspection and replacement in this way will help ensure safe service to all Pittsburgh residents—especially to those who are disproportionately exposed to lead and especially vulnerable to lead toxicity—and should incur little to no additional costs.[64]

In addition, PWSA's procedures for prioritizing service line inspections and replacements should be more open and transparent. PWSA should explain clearly and publicly what factors it considers and why those factors led PWSA to identify and select particular areas for inspection and replacement. Such transparency and accountability would help to ensure that PWSA's program is implemented in the most health-protective manner to maximize the safety of its customers.

Second, I am concerned that PWSA takes no further action if the historical record of a service line indicates that the public side of the line is made of copper. I understand that PWSA takes this approach because **BEGIN PROPRIETARY**

[64] See Appendix D, 3, Allegheny Cty. Lead Task Force, supra note 6, at 32 (recommending that water systems in Allegheny County prioritize homes with sensitive populations for replacement using elevated blood lead levels and water lead levels as guidance); Pittsburgh UNITED St. 4, at 23 (concluding that prioritizing higher-risk neighborhoods for inspection and replacement "would not have a meaningful effect on costs, so long as PWSA continues to perform [replacements and inspections] on a block-by-block basis").

[65]

[66]

END PROPRIETARY To protect Pittsburgh residents from the threat of ongoing lead exposure from their drinking water, as evidenced by PWSA's high lead levels over the past two years, PWSA should commit to the inspection of both the public and private sides of all service lines in its system. PWSA's goal should be to develop an accurate inventory, using inspection results, of every public-side and private-side lead service line in its system. This will give PWSA and its customers accurate information about potential lead exposures and facilitate the prioritization of PWSA's remediation activities.

It is my understanding that, based on the total number of residential service lines in PWSA's system (approximately 71,000)[67] and the number of inspections that PWSA expects to complete by 2021 (at least 41,500),[68] at most 29,500 service lines would remain to be inspected. Using an average cost per inspection of $190,[69] it would cost PWSA about $5.6 million to complete these additional inspections. PWSA should prioritize inspections for vulnerable households and neighborhoods.

Third, I am concerned that PWSA takes no independent or additional action if either a historical record or an inspection indicates that only the private-side service line is made of lead.

[67] Press Release, PWSA, PWSA Kicks Off 2018 Curb Box Inspection Program to Find Lead Water Service Lines (Mar. 20, 2018), http://lead.pgh2o.com/pwsa-kicks-off-2018-curb-box-inspection-program-to-find-lead-water-service-lines/.
[68] Appendix C, 7, UNITED II-16 Attach. A (11,293 inspections completed by contractors through July 2018); Appendix B, 4, UNITED II-21 (245 inspections completed by PWSA); Appendix B, 5, UNITED II-24 (23,761 planned inspections through 2019); PWSA St. 1, RAW-2, at 7 (indicating PWSA target of 4,500 inspections in 2020 and 2,000 inspections in 2021).
[69] Appendix B, 4, UNITED II-21.

If a historical record indicates that the private side only is made of lead, PWSA will publish this information in its online map but otherwise will not notify the resident.[70] And if an inspection indicates that the private side only is made of lead, PWSA will notify the resident, but makes clear that any additional steps—including purchasing water filters and replacing the private-side service line—are the responsibility of the homeowner.[71] It generally takes PWSA up to six months to send this information to residents following an inspection.[72] Due to PWSA's approach, many residents will not have the necessary information or resources to take any follow-up steps to protect themselves from ongoing lead exposure due to the presence of a private-side lead service line.[73]

A safer, more health-protective approach would be for PWSA to follow many of the same protocols when only the private side of the service line is lead as it does when the public side of the service line is lead. Thus, if a historical record indicates that only the private side of the service line is made of lead, then PWSA should schedule that line for inspection and, based on the inspection result, schedule the line for replacement, regardless of whether the public side of the line is also made of lead. To ensure that all customers receive safe service, it is critical that PWSA develop an accurate inventory, based on inspection results, of all private-side lead service lines in its system so that the lead exposure risks associated with those private-side lines can be disclosed and eventually remediated. PWSA should also notify residents within 14 days if the result of a service line inspection or historical record review indicates the presence of a public- and/or private-side lead service line.

---

[70] Appendix B, 12, UNITED VIII-5.
[71] See generally Appendix C, 5, UNITED II-1 Attach. TT; Appendix C, 8, UNITED II-21(h) Attach. C.
[72] Appendix B, 15, UNITED VIII-20.
[73] Pittsburgh UNITED St. 2, at 86.

Q: What is your understanding of the scope of PWSA's lead service line replacement program?

A: It is my understanding that PWSA replaced 1,723 public-side lead service lines between June 30, 2016 and August 15, 2018, and that it plans to replace 100% of its public-side lead service lines by 2025.[74] It is also my understanding that, in 2018, PWSA has been replacing private-side lead service lines at no cost to the customer when the public side is also lead and the homeowner consents to the replacement.[75] If the homeowner explicitly does not consent to the replacement, PWSA conducts a partial replacement,[76] meaning that it replaces the public-side lead service line but leaves the private-side lead service line in place.

It is my understanding that, for replacements scheduled after December 31, 2018, PWSA has not decided whether it will continue to replace private-side lead service lines at no cost to the customer when the public side is also lead.[77]

It is my understanding that PWSA will not replace a private-side lead service line unless the public side of the service line is also lead.[78]

Q: What health-based concerns, if any, do you have about the scope of PWSA's lead service line replacement program?

A: I have two concerns with the scope of PWSA's lead service line replacement program. The first involves PWSA's use of partial replacements. Partial replacements are worrisome from a health perspective because they are generally followed by spikes in lead levels that could last

[74] Appendix B, 6, UNITED II-35; Appendix B, 9, UNITED II-60 (revised).
[75] Appendix C, 6, UNITED II-1 Attach. BBB, at 1, 3.
[76] See id. at 3; Appendix B, 21, UNITED VIII-38.
[77] Appendix B, 10, UNITED II-63.
[78] Appendix B, 16, UNITED VIII-23; Appendix C,5, UNITED II-1 Attach. TT; Appendix C,8, UNITED II-21(h) Attach. C.

for several months.[79] These spikes occur because the public-side lead service line replacement can disrupt the protective scale inside pipes that prevents the water from leaching lead.[80] Because the private-side lead service line is still in use, lead may be released into the water, posing serious health risks to the resident.[81] In contrast, a full line replacement is much less likely to cause lead spikes and is therefore more health protective.[82] Due to the associated health risks, PWSA should not conduct partial replacements.[83]

My second concern involves PWSA's exclusion of private-side-only lead service lines from its replacement program. PWSA's approach means that more lead service lines will remain in the water system. This is because residents—particularly those who are low income—are unlikely to have the information or resources needed to conduct the replacement on their own.[84] Similarly, if PWSA continues to conduct partial replacements, and if it no longer funds private-side lead service line replacements where the public side is also lead after December 31, 2018, those actions will further increase the chance that lead service lines remain in the water system and that occupants will be exposed to lead. I also understand that the agreements PWSA requires homeowners to sign if they agree to a private-side replacement and PWSA's policy on surface restoration following replacement may further discourage homeowners from having their private-side service lines replaced through PWSA's program.[85]

So long as lead service lines remain in the water system, they continue to pose a health

---

[79] Appendix D, 16, Benjamin F. Trueman et al., Evaluating the Effects of Full and Partial Lead Service Line Replacements on Lead Levels in Drinking Water, 50 Envtl. Sci. & Tech. 7389, 7393-94 (2016); see also Pittsburgh UNITED St. 4, at 45-46.
[80] Appendix D, 16, Trueman et al., supra note 79, at 7393.
[81] See id. at 7393-94.
[82] See id. at 7394.
[83] Appendix D, 3, Allegheny Cty. Lead Task Force, supra note 6, at 32 (asserting that water systems in Allegheny County "should not conduct partial lead line replacements given the risk that they pose to the public").
[84] Pittsburgh UNITED St. 2, at 83-85.
[85] Pittsburgh UNITED St. 4, at 48; Pittsburgh UNITED St. 2, at 86-87.

threat to residents. As the lines age, or as other changes occur to the system, lead can be released into the system and cause elevated lead levels. To protect Pittsburgh residents' health and ensure access to safe drinking water, PWSA's goal should be to eventually replace *all* lead service lines, both public and private.[86] It should not be a question of *whether* to replace these lines, but *when* and *how*.

Q: What is your understanding of the steps PWSA is taking to provide customers with water filters?

A: It is my understanding that PWSA generally does not provide water filters to residents prior to service line replacement. Instead, PWSA encourages residents to purchase their own filters.[87] PWSA has indicated in the media that it may soon provide filters to residents free of charge if the residents' water lead levels exceed 15 ppb.[88] However, PWSA's website and other materials do not reflect this position.[89]

It is my understanding that, following either a partial or full lead service line replacement, PWSA provides the household with a NSF-certified pitcher filter and six months of replacement cartridges, free of charge.[90] If the customer is present, these items will be given to the customer in person; otherwise, the filter and cartridges are left in a bag by the front door.[91] PWSA does not

---

[86] See id.; Pittsburgh UNITED St. 4, at 36-37 (noting that at least some of the additional cost of replacing private-side service lines could be offset with savings achieved by lowering PWSA's current per line replacement costs).
[87] PWSA, Community Lead Response: Lead Filters and Other Products, http://lead.pgh2o.com/resources/lead-filters-and-other-products/; Appendix C, 5, UNITED II-1 Attach. TT; Appendix C, 8, UNITED II-21(h) Attach. C.
[88] Adam Smeltz, PWSA to offer water filters for homes with high lead test results, Pittsburgh Post-Gazette (May 27, 2018), http://www.post-gazette.com/local/city/2018/05/27/PWSA-lead-filters-high-test-results-lead-test-kits-link-15-ppb/stories/201805270143.
[89] See PWSA, Community Lead Response: Lead Filters and Other Products, http://lead.pgh2o.com/resources/lead-filters-and-other-products/; **BEGIN PROPRIETARY**

END PROPRIETARY
[90] Appendix B, 8, UNITED II-54.
[91] Id.

follow up with customers to verify that they are using the filter and replacement cartridges correctly.[92]

It is my understanding that, if a resident conducts a post-replacement tap water sample and that sample is above EPA's lead action level of 15 ppb, PWSA will send the household another six months' worth of filter cartridges.[93]

Q: **What health-based concerns, if any, do you have about PWSA's provision of water filters to customers?**

A: I have three principal concerns about PWSA's provision of water filters. First, I am concerned that PWSA does not currently provide free filters to customers, particularly low-income and other vulnerable customers, *prior* to replacement. All customers who have or may have a lead service line, either on the public or private side, are at risk of elevated lead exposure, especially in view of PWSA's high lead levels over the past two years. There is no safe level of exposure to lead; even low levels of exposure are harmful to both children and adults. These customers must be protected from exposure until their lines are replaced. This is especially important because, based on PWSA's projections, it may be several years from the date a suspected lead service line is identified by historical records or confirmed through an inspection until it is replaced.[94] The amount of lead exposure to residents during that time poses significant health concerns.

That PWSA encourages residents to buy their own filters prior to replacement, and identifies discount coupons, does not address my concerns. Residents may not have the

---

[92] Id.
[93] Id.
[94] See Appendix B, 1, UNITED II-13 (PWSA has already examined 48,890 historical records); PWSA St. 1, RAW-2, at 7 (PWSA expects to complete all inspections by 2022); Appendix B, 9, UNITED II-60 (revised) (PWSA's goal is to complete replacements of known public-side lead service lines by 2025).

information or resources needed to buy and maintain their own filters.[95] Additionally, filters are only effective at protecting residents' health if they are used properly and consistently. Providing residents with filters and replacement cartridges at no cost helps facilitate the transition to filter use, and increases the chance that the filters will be used properly and consistently. That PWSA plans to provide free filters to residents who test their tap water and have water lead levels above 15 ppb also does not address my concerns. As with filters, many residents may not have the information or resources to test their own water.[96] Additionally, as discussed above, supra p. 9, 15 ppb is not a health-based threshold of lead concentration in drinking water.

Accordingly, PWSA should provide NSF-certified filters and replacement cartridges, free of charge, to customers at residences where PWSA's historical records or inspection results indicate that public- and/or private-side service lines are made of lead or unknown material. PWSA should provide replacement cartridges to those customers until those service lines are replaced or confirmed to be made of a non-lead material, and until tap water samples show consistently low levels of lead (i.e., < 5 ppb) in the near term.[97] Because of the time it currently takes to schedule an inspection and process the results, PWSA should distribute filters based on the system's historical records and the inspection results PWSA already has. At a minimum, PWSA should distribute free filters to vulnerable populations, including low- and moderate-income households and households that include infants, children, and pregnant women, who may otherwise be unable to obtain the health-protective benefits of water filters prior to their service

[95] See Pittsburgh UNITED St. 2, at 85-86.
[96] See Adam Smeltz & Christopher Huffaker, PWSA offers lead tests to Pittsburgh residents for free, but not everyone is biting, Pittsburgh Post-Gazette (Jan. 7, 2018), http://www.post-gazette.com/local/city/2018/01/07/Pittsburgh-Water-Sewer-Authority-pwsa-lead-test-kits-Our-Water-Campaign/stories/201801050122.
[97] Appendix D, 3, Allegheny Cty. Lead Task Force, supra note 6, at 32 (recommending that water systems offer customers "with lead or unknown service lines (private or public) access to free water testing and to NSF-certified filters and education regarding their use and maintenance (with a particular focus on vulnerable populations such as infants and pregnant women).").

line replacement.[98]

The costs of a more comprehensive filter distribution program are necessary and justified from a health standpoint: until PWSA can confirm that its customers' service lines are not made of lead, or until it can replace those lines, customers, and especially vulnerable populations, are at serious risk of lead exposure—particularly because PWSA's lead levels over the past few years have routinely exceeded the 15-ppb lead action level, as noted above, supra p. 9. As Mr. Welter discusses in his testimony, efforts to reduce PWSA's construction costs for service line replacement would make additional funds available for other health-protective measures, such as filter distribution.[99]

My second concern about PWSA's filter program is that PWSA distributes pitcher filters rather than faucet filters. In general, health-protective interventions are most effective if people can follow their normal routines and still get the benefit of the intervention. The intervention should be seamless; people should not have to think about it or remember to change their behaviors. For example, a study on exposure to lead dust found that providing a household with education and cleaning supplies, and conducting regular follow-up visits, did not prevent children's exposure to lead—residents did not consistently follow the cleaning recommendations. In contrast, removing lead from paint and gasoline *did* reduce exposure because people did not have to think about it; they could purchase and use paint and gasoline as usual. Pitcher filters, while better than nothing, are only effective if people use them consistently. Based on my knowledge of other public health interventions, and the importance of making interventions passive and easy to use, I am concerned that people may not use pitcher filters

[98] See id.; Pittsburgh UNITED St. 2, at 85-86, 95.
[99] See Pittsburgh UNITED St. 4, at 36-37.

consistently. It is easy for people to forget to fill or use the pitcher, meaning that they use the kitchen tap instead. Faucet filters provide a more passive solution that does not require residents to change their routines; they can continue using the kitchen faucet as they usually do. However, to be effective, faucet filters must be installed and maintained correctly. While some residents are able to install faucet filters themselves, others need assistance.

For these reasons, PWSA should offer to install faucet filters for those customers who want them. It is my understanding that the NSF-certified PUR basic faucet filter is available for $20,[100] and six months of replacement cartridges cost $26.[101] Thus, the cost of providing faucet filters to customers appears to be comparable to the filters PWSA is already providing, especially because PWSA can likely negotiate a lower rate or purchase the filters and replacements wholesale.[102] The only added cost would likely be the staff or contractor time needed for those customers needing help with installation.

My third concern about PWSA's filter program is with PWSA's lack of follow up to ensure that customers are using the filters and replacement cartridges correctly. It is important to verify that customers are taking steps to minimize their lead exposure by using filters—either pitcher or faucet—consistently and correctly. If filters are not used properly, they do not provide their intended health benefits. Collecting data on water filter use—for example, through periodic home visits—would help PWSA determine whether the distributed water filters are health protective, and whether further efforts are needed to get customers to use them.

---

[100] PUR Classic Faucet Filtration System, PUR, https://www.pur.com/faucet-filtration-systems/pur-classic-faucet-filtration-system.
[101] PUR Basic Faucet Filter, PUR, https://www.pur.com/filters-and-accessories/pur-basic-faucet-filter (individual cost of replacement cartridge, which lasts three months, costs $13).
[102] See, e.g., PUR Faucet Mount Replacement Filter, 5 pk., BJ's, https://www.bjs.com/product/pur-faucet-mount-replacement-filter--5-pk-/300000000000734198 (replacement cartridges available for $7 each).

Q: **What is your understanding of the measures PWSA takes after a service line replacement to ensure customers are protected from additional lead exposure?**

A: It is my understanding that, following a service line replacement, PWSA leaves an informational door hanger at the residence.[103] The door hanger informs the resident of the work that was done, instructs them how to flush their pipes and taps, and directs them to collect a post-replacement water sample after allowing the water to sit unused for 6 to 8 hours.[104] It is my understanding that PWSA also provides the household with a tap water sample kit.[105] The kit, which includes a bottle for collection, instructs the resident to remove any aerators or filters from the kitchen tap, allow cold water to run until a significant change in temperature is noted (about 30 seconds), fill the bottle, put the bottle back in the kit, and place it in the mail.[106] Unless a partial replacement was conducted, PWSA takes no other steps to encourage the resident to collect the sample.[107] If a partial replacement was conducted, and the resident fails to return the sample, PWSA will provide another door hanger reminder about one month after the date of replacement.[108]

It is my understanding that ****BEGIN PROPRIETARY****

****END**

[103] See Appendix B, 19, UNITED VIII-33; Appendix C, 12, UNITED II-51 Attach. B; Appendix C, 13, UNITED II-51 Attach. D.
[104] Appendix C, 13, UNITED II-51 Attach. D.
[105] See Appendix B, 19, UNITED VIII-33; Appendix C, 11, UNITED II-51 Attach. A.
[106] Appendix C, 11, UNITED II-51 Attach. A.
[107] See Appendix B, 19, UNITED VIII-33.
[108] Id.

PROPRIETARY** When PWSA sends the customer the second test kit, it also sends an additional six months' worth of water filter cartridges, at no cost.[111] If the second sample shows water lead levels above 15 ppb, PWSA will send the customer a third test kit and ask them to collect a sample six months after the date of the replacement.[112] If a post-replacement sample shows water lead levels above 100 ppb, PWSA will visit the household to assist with flushing the line and to provide bottled water (although it is unclear how much bottled water is provided).[113]

BEGIN PROPRIETARY

END PROPRIETARY

It is my understanding that, **BEGIN PROPRIETARY**

[111] See Appendix B, 8, UNITED II-54.
[112] See Appendix C, 15, UNITED IV-41 Attach. A.
[113] See Appendix B, 20, UNITED VIII-37.

****END PROPRIETARY****

Q: What health-based concerns, if any, do you have about the measures PWSA takes after a service line replacement to ensure customers are protected from additional lead exposure?

A: I have three concerns about PWSA's post-replacement procedures. First, I am troubled by

---

116

117

118

the low rate of customer participation in PWSA's post-replacement sampling program. As discussed above, supra p. 29, **BEGIN PROPRIETARY**

END PROPRIETARY In view of PWSA's high water lead levels over the past few years, this sampling is critical for determining whether the service line replacement achieved the objective of minimizing the concentration of lead in a household's water. If not, and if residents are still exposed to elevated levels of lead in their water, they need to continue taking steps to control their risk of exposure. This is particularly important because some people may assume that their water is safe once the service line has been replaced, but that is not necessarily true. Even after a service line replacement, residual lead stuck to the protective scale inside the pipes in the home's interior plumbing and other lead sources such as lead solder or brass fixtures can cause elevated water lead levels to persist.[119] It can take time, sometimes many months, for lead concentrations to decline following a lead service line replacement.[120]

PWSA's low sampling participation rate is worrisome because it means that many customers who receive lead service line replacements are not getting critical information about the concentration of lead in their water following replacement, and thus, may not be taking adequate steps to reduce their lead exposure, like using water filters. This low participation rate also suggests to me that PWSA should reconsider how it conducts water testing. Its current approach—providing instructional door hangers and test kits—is not achieving a health-protective participation rate. PWSA should be making every effort to get at least one post-

[119] Pittsburgh UNITED St. 4, at 51.
[120] Id. at 52.

replacement water sample from every household that has part or all of its service line replaced. Possible steps could include having PWSA staff or contractors collect water samples, instead of relying on customers, and additional outreach efforts to encourage participation such as follow-up phone calls and home visits. Unless PWSA improves its post-replacement sampling participation rate, PWSA cannot know whether its service line replacements are leading to the provision of safe drinking water, or whether its customers' health is adequately protected following service line replacements.

My second concern is about the results of PWSA's post-replacement samples. These results indicate that lead concentrations in drinking water remain high in many homes immediately after a service line replacement. As the graph above shows, supra p. 30, ****BEGIN PROPRIETARY****

****END PROPRIETARY**** As discussed above, supra p. 9, the lead action level of 15 ppb is an administrative standard, not a health-based standard. There is no safe amount of lead exposure. These initial test results show that a number of PWSA's customers had alarmingly high levels of lead in their water following service line replacement.

The results are particularly troubling due to the sampling protocols PWSA uses and instructs its customers to follow. There are several ways to test tap water for lead, and each method reveals different information. One method is to collect a water sample using a high flow rate of hot water, with the aerator left in place. This method maximizes the likelihood of detecting elevated lead levels because lead particles are more readily mobilized by hot, high-flow

water.[121] Lead particles may also collect inside the aerator.[122] PWSA's chosen method, by contrast—which instructs customers to remove the aerator and then collect a cold-water sample—is less likely to reveal lead contamination, if it exists, and so may underestimate customers' normal, day-to-day exposures to lead in their water. Even using PWSA's chosen method, PWSA's post-replacement results indicate that a significant number of residents are exposed to high water lead levels following replacement, **BEGIN PROPRIETARY** **END PROPRIETARY** Because PWSA's testing method may underestimate exposure, these residents may be exposed to even higher water lead levels than their results indicate. Of the second-round sample results discussed above, the data suggest that lead concentrations at many homes continue to decline over time, but that some households continue to have elevated water lead levels even months after replacement. Overall, these sampling results show that service line replacements alone are not enough to ensure that customers are receiving safe water in the months following replacement. PWSA should take additional measures to protect consumers' health, such as providing NSF-certified faucet filters, until water lead levels reach consistently low levels.[123]

Finally, I am concerned about **BEGIN PROPRIETARY**

END PROPRIETARY PWSA's use of a much higher threshold (100 ppb) for assisting customers with flushing and providing bottled water. As I have described, supra p. 9,

[121] Appendix D, 17, Memorandum from Peter C. Grevatt, Dir., EPA Office of Ground Water & Drinking Water, to Water Div. Dirs. Regions I-X (Feb. 29, 2016) (hereinafter "EPA Memorandum"); Appendix D, 18, Cartier et al., Investigating Dissolved Lead at the Tap Using Various Sampling Procedures, 103 J. AWWA 55, 57, 62 (2011).
[122] Appendix D, 17, EPA Memorandum, supra note 121.
[123] See also Pittsburgh UNITED St. 4, at 54-55 (suggesting that, for homes with sustained lead levels above 15 ppb in post-replacement water samples, PWSA should assist residents with inspecting their interior plumbing and identifying potential sources of lead exposure).

the 15-ppb lead action level is not a health-protective standard. Thus, the lead action level is not an appropriate metric for determining when households are at risk of elevated lead exposures. A more health-protective approach would be to use a much lower threshold, such as 5 ppb, for requiring customers to collect follow-up testing three months later. If a result is higher than 15 ppb, then the follow-up test should be conducted much sooner, such as one month later. Follow-up samples should continue to be collected at regular intervals until the samples reveal consistently low lead concentrations, e.g., below 5 ppb. This is because a single sample showing low water lead levels is not necessarily a clean bill of health; lead levels can fluctuate, sometimes dramatically, and a second sample might come back much higher.[124]

PWSA's 100-ppb threshold for flushing and providing bottled water is not sufficiently health protective, either. This threshold seems to be arbitrary,[125] and is troubling from a health perspective. PWSA should consider using a lower threshold for triggering these follow-up actions. At a minimum, PWSA should adopt a lower threshold for vulnerable populations, such as children, pregnant women, and low-income families. Doing so will help PWSA ensure that it is providing safe service to its customers.

IV. Conclusion

Q: Please summarize your conclusions and recommendations.

A: Lead in drinking water poses a serious threat to public health. Lead is toxic to the central nervous system; even at low levels of exposure, it is harmful to both adults and children. There is

[124] **BEGIN PROPRIETARY**

END PROPRIETARY

[125] See Appendix B, 20, UNITED VIII-37.

no safe level of exposure to lead. Young children, pregnant women, black people, and low-income households are particularly vulnerable to lead exposure.

Pittsburgh residents are at risk of lead exposure from drinking water. In addition to other sources of lead exposure, tap water testing results over the past two years have shown consistently high levels of lead. Because Pittsburgh residents—and particularly children and other vulnerable populations—are being exposed to high levels of lead in their tap water, it is important for PWSA to take steps to reduce lead exposure from drinking water.

The primary step PWSA must take to protect its customers' health and ensure access to safe drinking water is to fully replace all lead service lines connected to its water system. In the interim, PWSA must take additional steps to help Pittsburgh residents control their lead exposure from drinking water.

Based on my evaluation of the health implications of PWSA's lead remediation program, I make the following recommendations:

Service line inspection and replacement

- Prioritize neighborhoods with higher concentrations of at-risk populations for service line inspection and replacement by: analyzing blood lead levels in children, drinking water lead levels, water main ages, and parcel ages; overlaying these factors with a census map depicting race and income data and, where possible, homes with pregnant women and young children; identifying areas where these concentrations of factors are the highest; and selecting areas for service line inspection and replacement accordingly. PWSA should also make its procedures for prioritizing inspections and replacements more open and transparent.
- Due to the associated health risks, do not conduct partial replacements.

- Develop and implement a plan to replace all lead service lines in the water system, both public and private.
- Develop and implement a plan to inspect all service lines in the water system—including both public-side and private-side lines—and develop an accurate inventory based on inspection results.
- Notify residents within 14 days if the result of a service line inspection or historical record review indicates the presence of a public- and/or private-side lead service line.

Filter distribution

- Develop and implement a plan to provide NSF-certified filters, free of charge and prior to service line replacement, (a) to customers at residences where the public- and/or private-side service lines are made of either lead or unknown material, based on the historical records and inspection results PWSA already has, or, (b) at a minimum, to low-income households and households that include infants, children, and pregnant women where the public- and/or private-side service lines are made of either lead or unknown material, based on the historical records and inspection results PWSA already has.
    - Provide replacement cartridges, free of charge, until these customers' service lines are replaced or confirmed to be made of non-lead material, and tap water samples show consistently low levels of lead (e.g., < 5 ppb).
- Offer to install faucet filters for those customers who want them.
- Collect data on water filter use—for example, through periodic home visits—to determine whether the distributed water filters are health protective, and whether further efforts are needed to get customers to use them.

Post-replacement measures

- Improve post-replacement tap water sampling participation rates, such as by having PWSA staff or contractors collect water samples, instead of relying on customers, and by conducting additional outreach efforts such as follow-up phone calls and home visits.
- Ask customers to collect a three-month follow-up tap water sample when a prior tap water sample exceeds 5 ppb.
- Ask customers to collect a one-month follow-up tap water sample when a prior tap water sample exceeds 15 ppb.
- Consider using a threshold lower than 100 ppb for providing flushing assistance and bottled water to customers, especially for vulnerable populations.

In my opinion, PWSA must take these additional, appropriate steps to reduce exposure to lead in water and deliver safe, reasonable, high-quality water service to its customers.

Q: Does this conclude your direct testimony?

A: Yes. I reserve the right to supplement my testimony based on subsequent information provided by PWSA, including, but not limited to, information disclosed with PWSA's Compliance Plan.