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

SURREBUTTAL TESTIMONY

OF

GEOFF MARKE

Submitted on Behalf of the Office of the Public Counsel

MISSOURI-AMERICAN WATER COMPANY

CASE NO. WU-2017-0296

** **

Denotes Confidential Information
that has been Redacted

September 14, 2017

Public

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

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

AFFIDAVIT OF GEOFF MARKE

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

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

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

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

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

Geoff Marke
Chief Economist

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

NOTARY PUBLIC NOTARY SEAL STATE OF MISSOURI
JERENE A. BUCKMAN
My Commission Expires
August 23, 2021
Cole County
Commission #13754037

Jerene A. Buckman
Notary Public

My commission expires August 23, 2021.

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OF

GEOFF MARKE

MISSOURI-AMERICAN WATER COMPANY

CASE NO. WU-2017-0296

I. INTRODUCTION

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

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

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

A. Yes.

Q. What is the purpose of your surrebuttal testimony?

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

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

Executive Summary:

Q. Summarize OPC's position.

A. OPC continues to recommend that the Commission reject the Company's current application and, if the Company seeks relief within the pending rate case, consider OPC's alternative for a two-year pilot study in which no more than $4 million annually (or $8 million in total can be spent on planned full lead service line replacement and third-party administrative costs associated with the collaborative research efforts. The pilot study will explore the feasibility, legality and associated policy implications of full lead service line replacement across MAWC's entire territory and the state of Missouri with the results presented to the Missouri Public Service Commission, the Missouri Legislature and the Missouri Governor's Office for consideration. Finally, it is OPC's hope that a byproduct of the pilot study may help substantiate selection of future "shovel ready" infrastructure funding from the federal government to help offset cost considerations.

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

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

Summary of Policy Objections Offered by Other Parties

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

However, later he states:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

OPC's Position

Q. What is OPC's position?

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

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

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

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

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

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

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

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

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

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

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

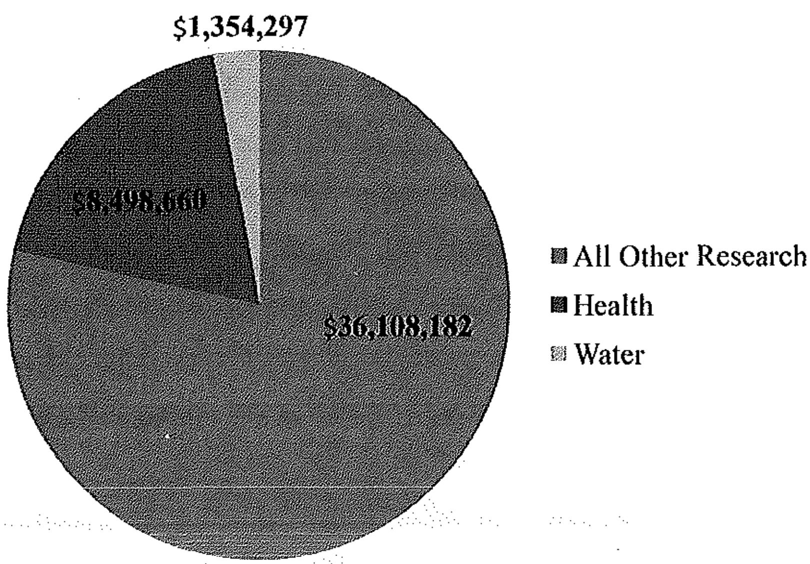
> For the period between 2008 and 2016, Federal non-defense spending in the US accounted for $648.87 billion of which $343.34 billion was dedicated to health

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

III. RESPONSE TO MAWC'S CLAIM OF UNNECESSARY COSTS

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

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

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

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

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

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

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

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

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

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

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

IV. RESPONSE TO COMMENTS REGARDING DELAYED HEALTH BENEFITS

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

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

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

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

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

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

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

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

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

V. RESPONSE TO ASSERTIONS REGARDING THE EFFORTS OF OTHER UTILITIES

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

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

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

The examples listed above can be broken down as:

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

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

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

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

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

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

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

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

[38] See the Rebuttal Testimony of James A. Merciel, Schedule JAM-r5

[39] New Orleans Office of Inspector General (2017) Lead exposure and infrastructure reconstruction. http://files.constantcontact.com/1b8199d3201/c5bc5ad0-0389-4401-afb4-ecaccce8005f.pdf?ver=1500394246000

[40] Phillips, B. (2011) Lead exposure in road construction. Occupational health and Safety. https://ohsonline.com/Articles/2011/03/01/Lead-Exposure-in-Road-Construction.aspx

[41] Reagn, M.H. (1998) Soil is an important pathway to human lead exposure. Environmental Health Perspectives, 106. https://www.ehp.niehs.nih.gov/wp-content/uploads/106/Suppl%201/ehp.98106s1217.pdf

[42] Lead Service Line Collaborative (2017) Disturbing lead service lines. http://www.lslr-collaborative.org/disturbing-lead-service-lines.html

**

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

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

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

A. No. The sixteen-page white paper takes no new formal position on revisions to the LCR. It merely presents information that may be considered moving forward. Publishing a white paper acknowledging that the current LCR rules could be clearer or more prescriptive is far different than submitting a budget request to the US Congress or securing appropriations for a specific abatement strategy. The white paper's focus is centered on potential revisions to the twenty-six-year-old rule and it does not articulate the EPA's official scientific or policy position on full or partial lead service line replacement. This can be surmised by reading the abstract on the EPA's website which merely lists lead service line replacement (not partial, not full) as an option being considered:

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

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

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

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

[43] US EPA (2017) Lead and Copper Rule Long-Term Revisions https://www.epa.gov/dwstandardsregulations/lead-and-copper-rule-long-term-revisions
[44] US EPA (2016) Lead and Copper Rule Revisions White Paper. https://www.epa.gov/sites/production/files/2016-10/documents/508_lcr_revisions_white_paper_final_10.26.16.pdf

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

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

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

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[45] Ibid.

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

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

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

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

[47] Ibid

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

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

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

VII. RESPONSE TO COMMENTS REGARDING FLINT, MICHIGAN

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

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

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

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

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

Q. Provide some context for Flint, Michigan?

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

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

> Poverty is endemic in Flint, with 41.6 percent of the population living below federal poverty thresholds—2.8 times the national poverty rate. The median value of owner-occupied housing is $36,700, roughly one-fifth of the national

[49] Rosner, D. (2016) Flint Michigan: A century of environmental injustice. American Journal of Public Health 106(2); https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4815825/

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

[51] See also, Scorsone, E. & N. Bateson (2011) "Long-Term Crisis and Systemic Failure: Tasking the Fiscal Stress of America's Older Cities Seriously: Case Study, Flint Michigan," Michigan State University. https://www.cityofflint.com/wp-content/uploads/Reports/MSUE_FlintStudy2011.pdf qtd. in Davis et al (2016).

[52] BiggestUSCities.com, www.biggestuscities.com/city/flint-michigan qtd. in Davis et al (2016).

[53] U.S. Census, Quickfacts for Flint, Michigan and the United States, www.census.gov/quickfacts/table/PST045215/00 qtd. in Davis et al (2016).

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

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

Q. What took place in Flint, Michigan?

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

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

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

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

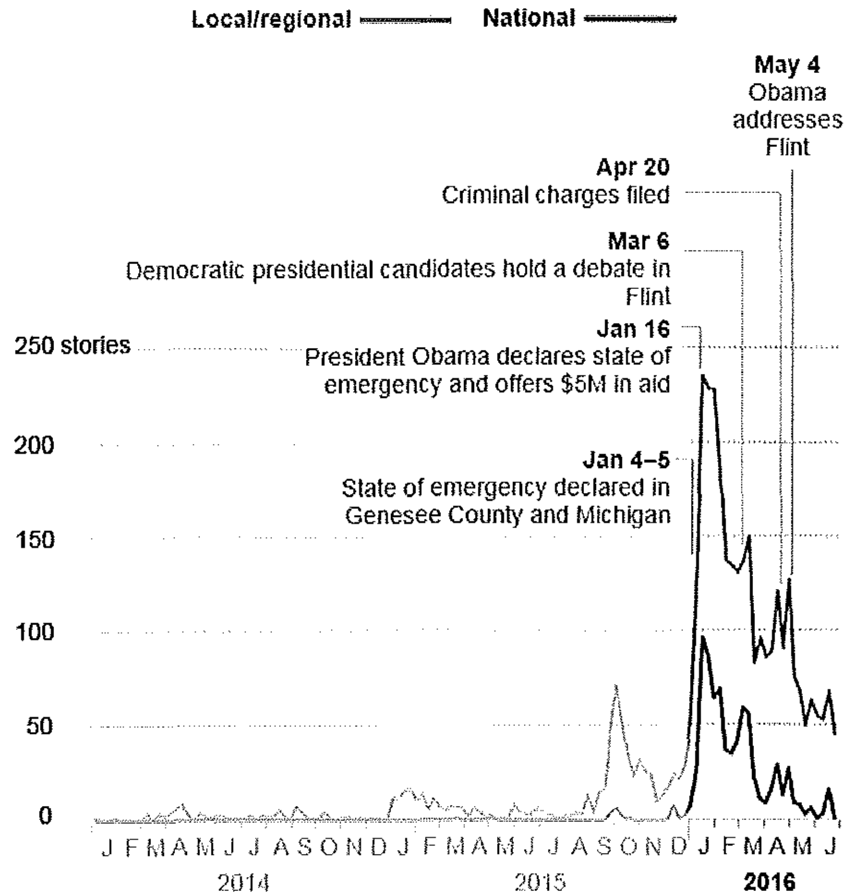
Eventually, the immediate cause was understood: the water from the Flint River was significantly more corrosive than local officials had thought. This, and other governmental failures, resulted in improper water treatment. Central to the problem was that, like many U.S. cities, Flint's water infrastructure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

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

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

[58] Abernethy et al. (2017) A data science approach to understanding residential water contamination in Flint. https://arxiv.org/pdf/1707.01591.pdf
[59] Matsa K.E. et al. (2017) Searching for News: The Flint Water Crisis. Pew Research Center: Journalism and Media http://www.journalism.org/essay/searching-for-news/

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



Water Lead Levels

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

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

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

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

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

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

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

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

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

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

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

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

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

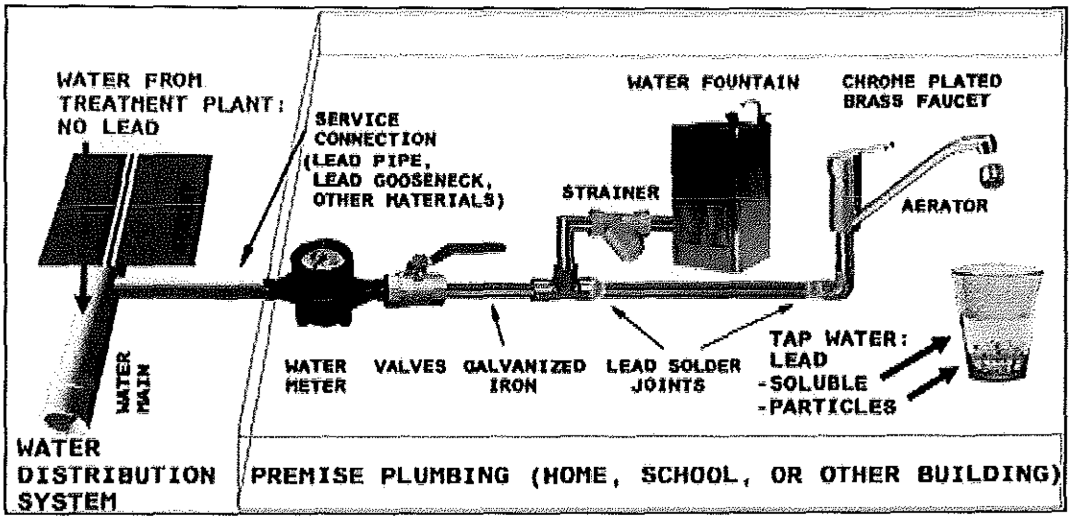
Restated, it appears as though the concentration of elevated water lead levels in Flint, Michigan[68] followed a power law distribution where a small number of locations accounted for a disproportionate amount of the elevated lead levels.[69] Whether or not Flint, Michigan ever exceeded the EPA action-level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

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

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

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

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



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

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

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

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

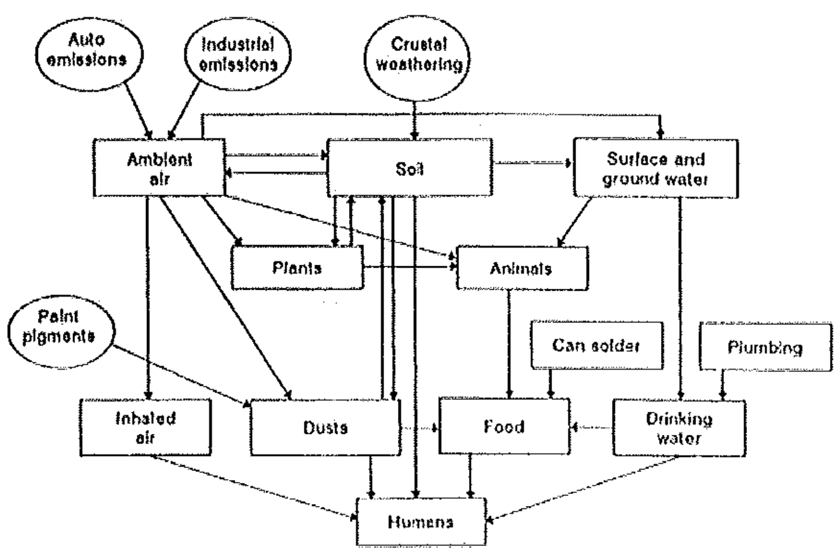
A. Intuitively it would seem to make sense, but more research is necessary to substantiate the impact.[73]For example, this line of argument (that elevated risk exposure would occur from lead service line replacement) would still be present if the full lead service line was replaced as well, at least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

Blood Lead Levels

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

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

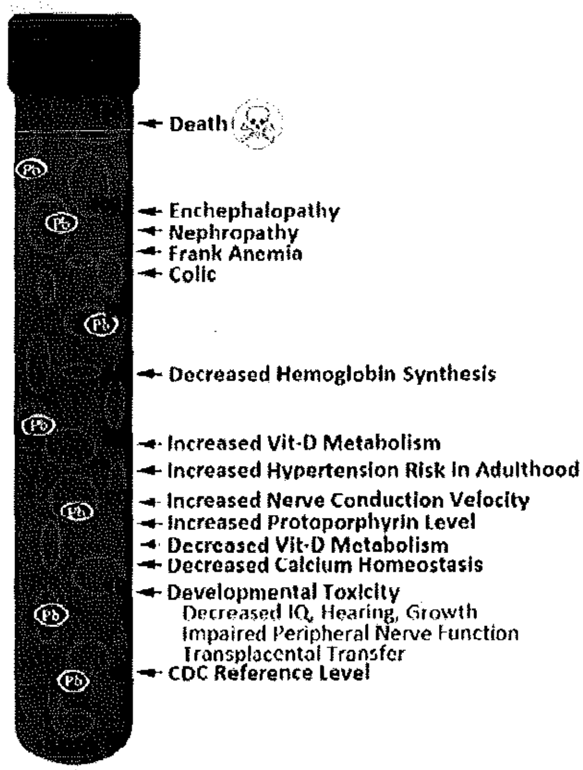
Figure 8: Sources and pathways of lead from environment to humans[74]



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

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

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



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

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

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

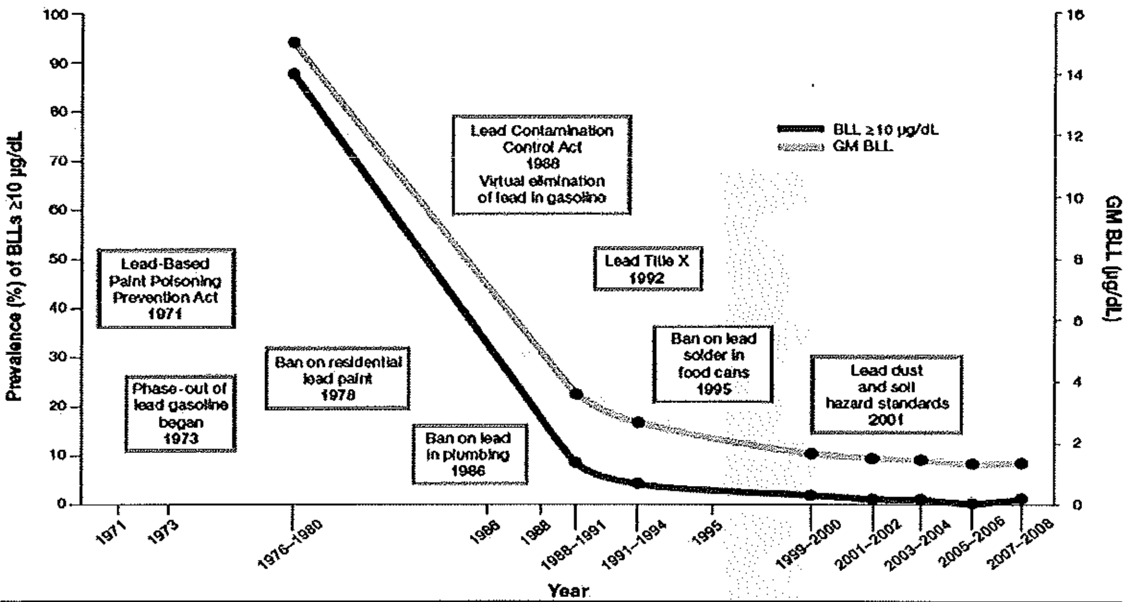
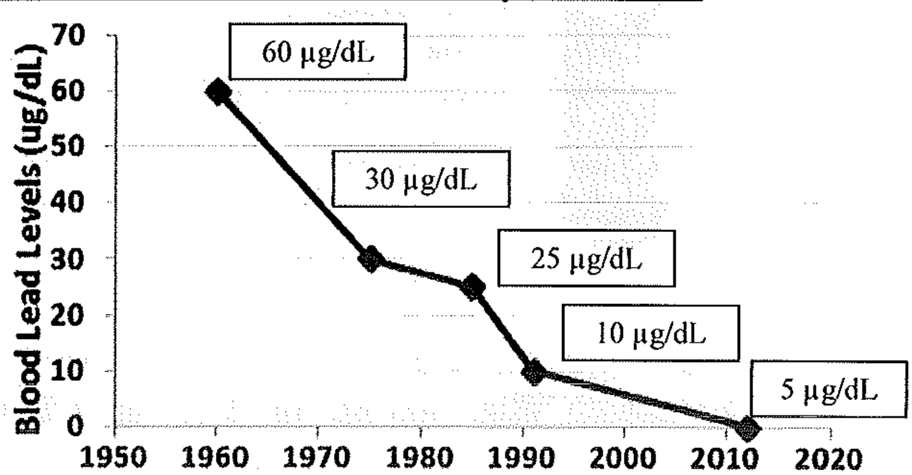


Figure 11: BLL "reference levels" considered harmful by CDC over time[77]



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Q. What should the Commission note?

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

Q. What did you find in the MDHHS results?

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

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

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

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

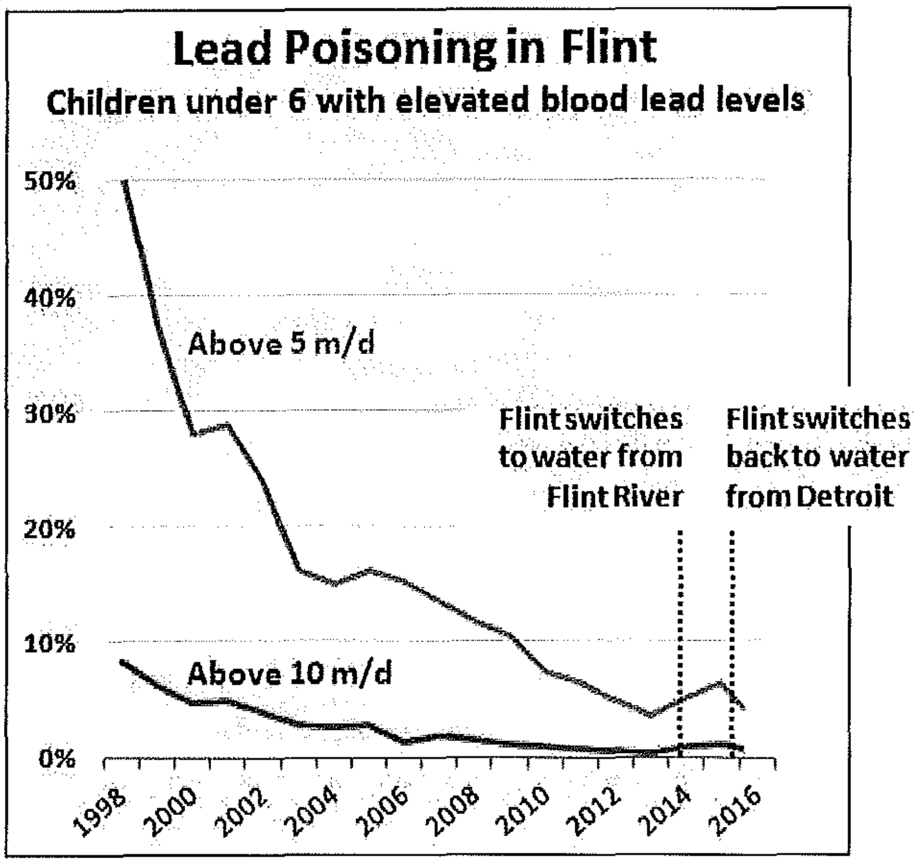
The Commission should note that the percentage of children with elevated BLL's in the city of Flint is far less than the state of Michigan as a whole during the water crisis. This is also true for BLL's at other cohort level including children 6 – 18 and adults (see GM-3).[83]

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

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

[83] With the exception of 2011 for children under

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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[89] Ibid.

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

[91] Snider, A. (2016) Flint's other water crisis: money. *Politico: Energy & Environment.* http://www.politico.com/story/2016/03/flint-lead-water-contamination-money-220391

[92] Carpenter. Z (2016) Lead poisoning in Flint is more than a health crisis: it's also an economic disaster. *The Nation.* https://www.thenation.com/article/flint-wealth/

[93] Goldstein, D. (2016) Lead poisoning crisis sends Flint real-estate market tumbling. *Market Watch.* http://www.marketwatch.com/story/lead-poisoning-crisis-sends-flint-real-estate-market-tumbling-2016-02-17

[94] Vasel, K. (2016) You can buy a house in Flint for $14,000. *CNN.Money.* http://money.cnn.com/2016/03/04/real_estate/flint-housing-water-crisis/index.html

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

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

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

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

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

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

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

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

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

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

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

Q. Does this conclude your testimony?

A. Yes.

OPC engaged with the following individuals/groups for feedback on topic of lead line replacement as of 9-14-2017:

- Pratim Biswas, Washington University Department of Energy, Environmental and Chemical Engineering
- Jeff Pinson, Missouri Department of Natural Resources, Public Drinking Water Branch
- Mark LeChevallier, Vice President, Chief Environmental Officer, American Water
- Gary A. Naumick, Vice President of Engineering, American Water
- Jill Schupp, Missouri Senator
- Christine Hoover, Office of the Consumer Advocate Pennsylvania
- Edward Kaufman, Chief Technical Advisor, Indiana Office of Utility Consumer Counselor
- Anna Davis, Director of Government Relations, National Governors Association
- Alex Schaefer, Legislative Director, Natural Resources Committee, National Governor's Association
- Bevin Ann Buchheister, Senior Policy Analyst, Environment, Energy & Transportation Division, National Governor's Association
- Dr. Eric Schwartz University of Michigan School of Business
- Dr. Jacob Abertnethy University of Michigan Department of Electrical Engineering and Computer Science
- Missouri Department of Health and Senior Services: Childhood Lead Poisoning Prevention:
    - Jeff Wenzel – Assistant Bureau Chief
    - Steve May – Environmental Specialist
    - Sharon Odom, Unit Chief, Healthy Indoor Environments
    - Scott Patterson, Research Analyst
    - Kathy Wood, Epidemiologist
- Dr. Sheldon Masters, Senior Environmental Engineer at Corona Environmental Consulting
- Dr. Mark Edwards, Virginia Tech, Department of Civil and Environmental Engineering
- Dr. Mark Powell, United States Department of Agriculture, Risk Scientist
- Jason Gunter, US. Department of Environmental Protection, Remedial Project Manager: Superfund Site: Big River Mine Tailings/St. Joe Minerals Corp., Desloge, MO.
- Gene Gunn, US Department of Environmental Protection, Chief LMSE Branch Region 7
- Michigan Department of Environmental Quality, unnamed representative
- Mark Durno, US Department of Environmental Protection, Senior Project Manager, Flint Drinking Water Response: Filter Study
- Center for Disease Controls & EPA National Hotline Center customer information

Final-Revised

Sampling and Analysis of Household Well Water in Mine Waste Areas and Selection of Point-of-Use Treatment Devices

U.S. Environmental Protection Agency
Office of Research and Development
National Risk Management Research Laboratory
26 West Martin Luther King Drive
Cincinnati, Ohio 45268

GM-2
1/323

May 27, 2010

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS AND SELECTION OF POINT-OF-USE TREATMENT DEVICES

Submitted to:
U.S. Environmental Protection Agency
National Risk Management Research Laboratory
Water Supply and Water Resources Division
26 W. Martin Luther King Drive
Cincinnati, OH 45268

Contract No. EP-C-09-041
Work Assignment No. 0-15

Prepared by:
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May 27, 2010

DISCLAIMER

Any opinions expressed in this report are those of the authors and do not, necessarily, reflect the official positions and policies of the U.S. EPA. Any mention of products or trade names does not constitute recommendation for use by the U.S. EPA.

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LIST OF ACRONYMS

AAS	Atomic Absorption Spectroscopy
AWS	Alternative Water System
BVSPC	Black & Veatch Special Projects Corp.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DO	Dissolved Oxygen
DW	Drinking Water
E. coli	*Escherichia coli*
EPA	U.S. Environmental Protection Agency
ETV	Environmental Technology Verification
gpd	Gallon per day
gpm	Gallon per minute
ICP	Inductively Coupled Plasma
MCLs	Maximum Contaminant Levels
MS	Mass Spectroscopy
NPL	National Priority List
NRMRL	National Risk Management Research Laboratory
NSF	NSF International
O&M	Operating and maintenance
ORD	Office of Research and Development
ORP	Oxidation-Reduction Potential
POU	Point-of-Use
psi	Pounds per square inch
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
RO	Reverse Osmosis
SDWA	Safe Drinking Water Act
Shaw	Shaw Environmental and Infrastructure, Inc.
SMCL	Secondary MCL
SPME	Solid phase micro-extraction cartridges
START	Superfund Technical Assessment and Response Team
SVOC	Semi-Volatile Organic Compound
T&E	EPA Test & Evaluation Facility
TDS	Total Dissolved Solids
Tetra Tech	Tetra Tech EM, Inc.
TOC	Total organic carbon
TSS	Total suspended solids
VAC	Volts Alternating Current
VOC	Volatile Organic Compound
WA	Work Assignment
WSWRD	Water Supply and Water Resources Division

1.0 Introduction

The U.S. Environmental Protection Agency (EPA) Office of Research and Development (ORD) National Risk Management Research Laboratory (NRMRL) and EPA Region VII are conducting a large-scale study to identify the prevalence of lead (Pb) and other contaminants in drinking water (DW) at four mine waste areas in Washington County, Missouri (Figure 1-1). As shown in Table 1-1, historical analyses of drinking water from private wells in these areas have shown contaminants to be present above the Maximum Contaminant Levels (MCLs) for drinking water as established by the Safe Drinking Water Act (SDWA) and subsequent amendments. The areas associated with these exceedences have been listed on the National Priority List (NPL) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund. Several households in Potosi, Richwoods, Old Mines, and Furnace Creek mine waste areas (shown in Figure 1-1) are receiving bottled water as a temporary, short-term Alternative Water System (AWS).

Table 1.1. Historical Data for Metals Exceeding Action Levels In Washington County Well Water

Analyte	Regulatory Standard	Action Level (μg/L)	Washington County Wells Maximum Concentration (μg/L)
Antimony	MCL[a]	6	10
Barium	MCL	2,000	9,290
Cadmium	MCL	5	31.5
Iron	SMCL	300	613
Lead	MCL	15	808
Manganese	SMCL[b]	50	2,800
Thallium	MCL	2	7

[a] MCL = Maximum Contaminant Level (MCL)
[b] SMCL = Secondary MCL

Homeowners with contaminated wells above the action level will receive Point-of-Use (POU) treatment units as an interim AWS until a permanent long-term AWS becomes available. To support the selection and installation of these POU devices, EPA Region VII and EPA ORD initiated a pilot program to sample private wells in representative geologic formations to determine the water quality characteristics in Washington County. A total of 27 well waters that are representative of the 348 homes in Washington County with private well sample locations were selected as representative of the hydrogeology in the area. This number includes 8 residences where EPA has installed Culligan POU adsorption filtration units at the kitchen sinks. The objectives of this project were to collect water samples from the selected households, conduct field measurements for the collected water samples, and analyze the collected water samples for total metals, dissolved metals, anions, inorganic parameters, total organic carbon (TOC), and microbiological parameters (*E. coli*). Volatile and Semi-Volatile Organic Compound (VOC and SVOC) parameters were planned for analysis in the event that high TOC levels were observed in the water samples. This report presents the analytical results from this sampling effort as well as recommendations for POU devices potentially suitable for the affected households.

Shaw Environmental and Infrastructure, Inc. (Shaw) supported the EPA NRMRL's Water Supply and Water Resources Division (WSWRD) through this Work Assignment (WA) under EPA Contract No. EP-C-09-041. Shaw provided analytical support to characterize the water quality in these sampled locations and assisted in the evaluation and selection of POU devices for the various households.

Under the Superfund Technical Assessment and Response Team (START) program, Tetra Tech EM, Inc. (Tetra Tech) was tasked by EPA Region VII to provide sampling support for this study. Tetra Tech obtained access permission from property owners to collect water samples from the 27 drinking water wells. Tetra Tech coordinated the sampling effort with homeowners as appropriate and recorded supplemental data regarding the type of water source at these facilities. Shaw provided support for the field effort by ordering and shipping sample containers and preservatives directly to the sampling locations for use by Tetra Tech.

Shaw subsequently analyzed water samples shipped by Tetra Tech for project-specific water quality parameters in accordance with the analytical methods specified in the approved Quality Assurance Project Plan (QAPP) for this project (QAPP No.W-13768-QP-1-0, approved September 18, 2009). These water samples were analyzed in the laboratories located at the EPA Test & Evaluation (T&E) Facility in Cincinnati, Ohio. Field parameters were measured by Tetra Tech at the sampling locations.

1.1 Document Organization

This document is organized into the following sections:

Section 1.0 – Introduction – This section presents a brief introduction to this report.

Section 2.0 – Sampling and Analytical Design – This section presents the criteria for selecting the sampling locations, the sampling procedures, and the analytical methodology.

Section 3.0 – Analytical Results – This section presents the analytical results from the samples collected during this pilot program.

Section 4.0 – Selection of Point-of-Use Devices – This section presents the selection criteria for POU devices and also presents operational and installation considerations.

Section 5.0 – Conclusions – This section summarizes the test results and conclusions for this pilot program.

Additionally, this report also includes the following appendices:

- Appendix A – POU Recommendations Based on Historical Monitoring
- Appendix B – Draft Trip Report and Data Summary compiled by Tetra Tech to document the field activities conducted during the sampling effort
- Appendix C – Quality Assurance Project Plan (QAPP) for this project
- Appendix D – Permeate Pump Testing at the EPA T&E Facility

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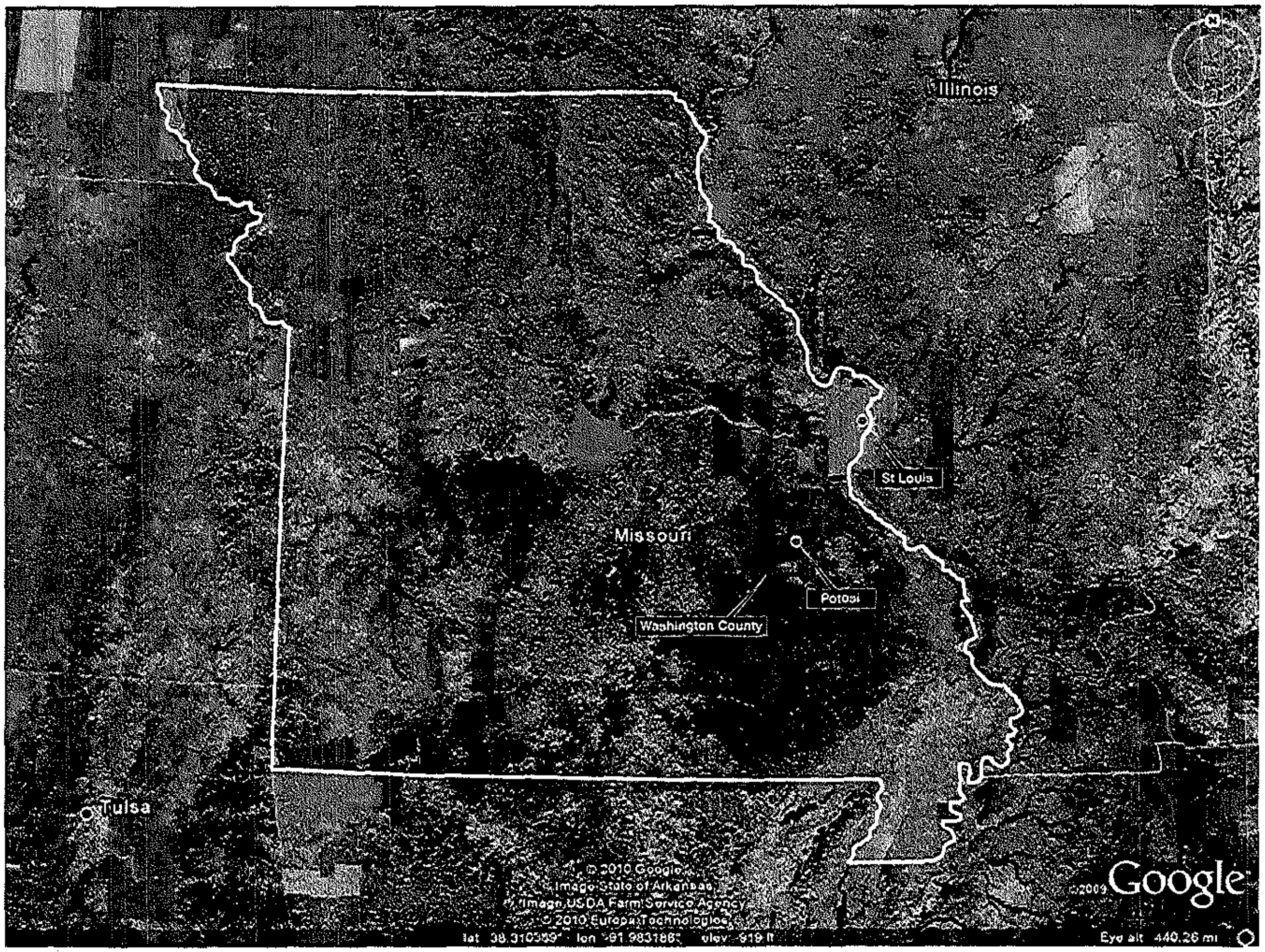

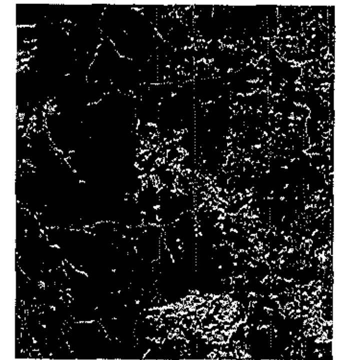

Shaw Shaw Environmental, Inc.

Figure 1-1

Location of Washington County, Missouri

GM-2
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2.0 Sampling and Analytical Design

This section presents the rationale for the sites selected for sampling during this pilot program, the sampling design, and the parameters analyzed for each sample. This section also presents the Quality Assurance (QA) criteria employed for the analyses.

2.1 Selection of Sampling Locations

Figures 2-1a through 2-1e present the locations of the homes currently receiving bottled water in Washington County and the sites sampled for this pilot study program. Each home that currently receives bottled water is a potential candidate for a POU device. The POU study area encompassed approximately 384 square miles in Washington County, Missouri. This area is the sum of the study areas previously identified by EPA as the Richwoods Sampling Area (Figure 2-1b), Old Mines Sampling Area (Figure 2-1c), Potosi Sampling Area (Figure 2-1d), and Furnace Creek Sampling Area (Figure 2-1e). These sampling areas are locations of historical, large-scale mining operations. These areas are primarily rural, with scattered residences and a few commercial businesses generally located along highways. Lead, zinc, iron ore, silver, and barite have been mined in these areas.

Details of the homes that were sampled locations are presented in Appendix B, "Draft Trip Report and Data Summary" prepared by Tetra Tech. Tetra Tech selected the sample locations for the pilot program to encompass the different geological settings for the homes, well depths, current status of POU devices in the homes, and the presence of contaminants based on historical analyses.

2.2 Field Data Sheets

A field sheet was completed for each sample collected (see Table 2-1). The completed field data sheets are included with the Tetra Tech trip report presented in Appendix B. All field sheets included the sample number, date, and time. In addition, the field sheets included the unique property identification assigned to the property during site assessment activities, property ownership information, site address, mailing address, exact location, specifics of sample collected (pre- or post-treatment filtration, unpurged, or purged), type and numbers of containers collected, and analyses to be performed. The field sheets for untreated, purged samples included purge times or estimated purge volumes.

The field sheets also documented the results of any analysis that had been performed in the field. The following water quality parameters were measured by using a field instrument (YSI556 water quality meter): pH, temperature, conductivity, Dissolved Oxygen (DO), Oxidation-Reduction Potential (ORP), and Total Dissolved Solids (TDS). Field test kits were used to measure hardness and chlorine (free and total), and these results were also recorded on the field sheet. Water quality parameters were not recorded for unpurged metals samples.

2.3 Analytical Parameters and Procedures

The collected samples from the pilot program were analyzed for the following parameters:

- Total Metals – Antimony (Sb), Barium (Ba), Manganese (Mn), Iron (Fe), Cadmium (Cd), Arsenic (As), Thallium (Tl).
- Dissolved Metals – The samples were processed in the field using a 0.45 micron filter to distinguish between total and dissolved metals for the same analytical parameters.
- Speciated Arsenic III and Arsenic V – The samples were processed by using solid phase micro-extraction (SPME) cartridges in the field to allow speciation of Arsenic (III) and Arsenic (V).
- Anions – fluoride, chloride, phosphate, sulfate
- Inorganic Parameters – alkalinity, turbidity, total suspended solids (TSS), TDS.
- TOC – Samples were analyzed for TOC in lieu of analyzing for VOCs and SVOCs. If TOC samples exceeded 5 mg/L, VOC and SVOC analyses were planned to be performed to characterize the wells containing elevated TOC. As will be discussed in Section 3, none of the well samples exceeded this limit.
- Nitrate and Nitrite
- *E. coli* bacteria
- Water Quality Parameters – pH, temperature, conductivity, DO, ORP, TDS, hardness and chlorine (free and total). These data were collected in the field.

Table 2-2 presents a summary of the analytical procedures for the pilot program.

2.4 Sampling Procedures

Tetra Tech collected samples from 27 houses for subsequent laboratory analysis at the T&E Facility in Cincinnati, Ohio. Eight of these houses represent locations where EPA Region VII has installed Culligan adsorption filter POU treatment systems. At these locations, four sets of samples were collected as follows:

- **Tap, Unpurged** - Unpurged samples representing water that has been allowed to sit in the system for at least 4 hours (overnight preferred) was collected from the treated tap water from the Culligan unit.
- **Tap, Purged** - The Culligan unit was then purged by running water for at least 5 minutes prior to collecting the purged water samples.

- **Faucet, Unpurged** - The untreated water from the kitchen sink faucet (or an outside faucet) was also collected as unpurged well water.
- **Faucet, Purged** - The kitchen sink (or an outside faucet) was then purged by running water for at least 5 minutes prior to collecting the purged well water samples.

Samples were also collected from 19 residences where no POU treatment systems have been installed and that are currently provided with bottled water by EPA. At these residences, purged and unpurged water samples from the kitchen sink faucet were collected for metals analyses.

The unpurged and purged tap samples for metals analyses from the Culligan POU units at the 8 houses were numbered ORD-1 through ORD-16. Samples of untreated well water (unpurged and purged) were labeled beginning with ORD-100, with samples ORD-100 through ORD-116 corresponding to locations where samples ORD-1 through ORD-16 were collected.

2.5 Sampling Containers, Quantities, and QC

Sample containers, quantities, and QC sample analysis are presented in the QAPP (Appendix C).

2.6 Sample Preservation and Holding Times

Sample preservation and holding times are presented in the QAPP (Appendix C).

Table 2.1. Field Parameters Datasheet

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ________________
Longitude: ________________

Sample Number: ORD-100__
Sample Date: ______________
Sample Time: ______________

Property Identification Number: ____________________ Study Area: ____________________________
Owners Name: ________________________________ Owners Phone Number:_________________
Mailing Address: ____
Tenant's Name): _________________________ Tenant's Phone Number: ____________________
Property Address: ____
Residence owner occupied: ________ Well shared with other residence(s): _________________________
Number of Occupants or persons supplied by well: _____________ Children under 6 yrs: ____________

Well Depth: _______________ Pump Depth: _______________ Well Age: ___________
Flow Rate at House: ______________________ Flow Rate at POU: ________________

Holding Tank Make/Volume: ____
Treatment System(s): ____

Sample Collection Description: ____
____

Purge Time or Volume: ____

Field Parameters:

Temperature (°C):		ORP (mV):	
Conductivity (μS/cm):		**Test Kit Results:**	
pH:		Hardness:	
TDS (mg/L):		Free Chlorine (mg/L):	
DO (mg/L):		Total Chlorine (mg/L):	

Remarks:

Photo Number: _______
Sampler's Initials: ___________

Analyses:

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered*	HNO_3 to pH <2	125 ml HDPE
Tap, Unpurged	Arsenic III/V	1	Unfiltered, SPME	HNO_3 to pH <2	125 ml HDPE
		1	Filtered, SPME	HNO_3 to pH <2	125 ml HDPE
Tap, Purged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Tap, Purged	Arsenic III/V	1	Unfiltered, SPME	HNO_3 to pH <2	125 ml HDPE
		1	Filtered, SPME	HNO_3 to pH <2	125 ml HDPE
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, Unpurged	Arsenic III/V	1	Unfiltered, SPME	HNO_3 to pH <2	125 ml HDPE
		1	Filtered, SPME	HNO_3 to pH <2	125 ml HDPE
Faucet, Purged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, Purged	Arsenic III/V	1	Unfiltered, SPME	HNO_3 to pH <2	125 ml HDPE
		1	Filtered, SPME	HNO_3 to pH <2	125 ml HDPE
Faucet, Purged	Anions (fluoride, chloride, phosphate, sulfate)	2	None	4°C	40 ml amber glass
Faucet, Purged	Inorganic Parameters (alkalinity, turbidity, total suspended solids, total dissolved solids)	2		4°C	250-ml HDPE
Faucet, Purged	Total Organic Carbon, Nitrate/Nitrite	1		H_2SO_4 to pH <2, 4°C	250-ml HDPE
Faucet, Purged	*E. coli* bacteria	2		$Na_2S_2O_3$, 4°C	100-ml fecal coliform bottle
Faucet, Purged	Volatile Organic Compounds	3	Quench chlorine with ascorbic acid if necessary, see section 4.2	HCl to pH < 2, 4°C	40 ml amber glass
Faucet, Purged	Semivolatile Organic Compounds	1	Quench chlorine with sodium sulfite if necessary, see section 4.2	HCl to pH < 2, 4°C	1 L amber glass

Tap samples are treated water samples collected after POU treatment.
Faucet samples are untreated water samples collected at the field site.
*Samples filtered through a 0.45-μm syringe filter prior to preservation.

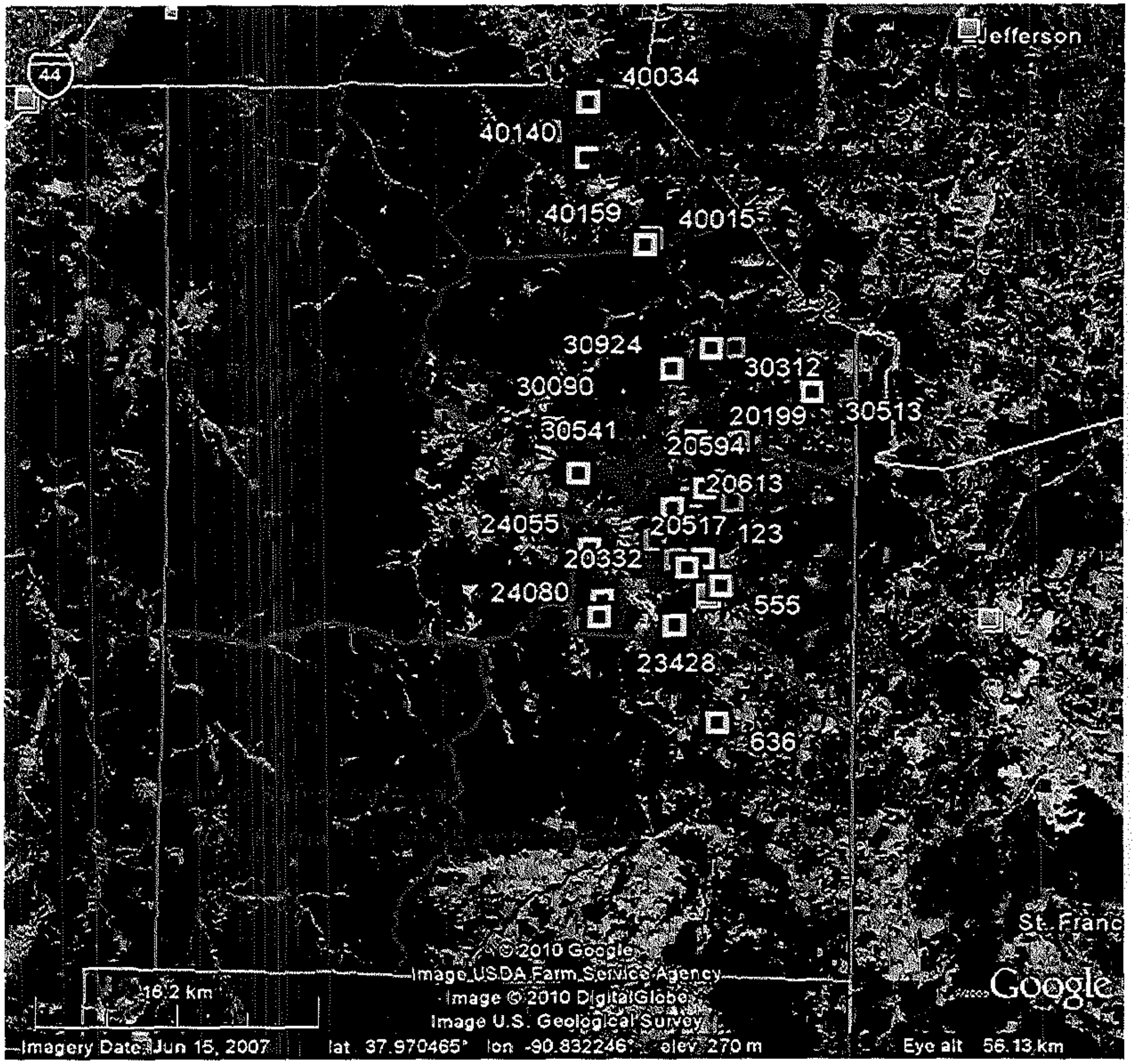
Table 2.2. Summary of Proposed Analytical Procedures for Pilot Program

Matrix	Measurement	Sampling ([1]Faucet, [2]Tap)/ Measurement Method	Analysis Method	Sample Container/ Quantity of Sample	Preservation/ Storage	Holding Time(s)
Water	pH	[1]Faucet	EPA Region 7 4230.10 using YSI 556 MPS	Field Sample	NA	NA
Water	ORP	Faucet	EPA Region 7 4230.10 using YSI 556 MPS	Field Sample	NA	NA
Water	Conductivity	Faucet	EPA Region 7 4230.10 using YSI 556 MPS	Field Sample	NA	NA
Water	D.O.	Faucet	EPA Region 7 4230.10 using YSI 556 MPS	Field Sample	NA	NA
Water	Free chlorine	Faucet	DPD 8021, Standard Method 4500-CLG	Field Sample	NA	NA
Water	Total chlorine	Faucet	DPD 8167	Field Sample	NA	NA
Water	Hardness	Faucet	Standard method 2340C	Field Sample	NA	NA
Water	Total Metals	Purged faucet (*filtered and unfiltered)/ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) (EPA 6010B) (Shaw SOP 402)	125 mL in HDPE bottles	HNO_3 to pH<2.0, store at Room Temperature (RT)	6 months
Water	Total Metals	Faucet without purging (*filtered and unfiltered) /ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) (EPA 6010B) (Shaw SOP 402)	125 mL in HDPE bottles	HNO_3 to pH<2.0, store at RT	6 months
Water	Total Metals	Purged tap (*filtered and unfiltered) /ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) (EPA 6010B) (Shaw SOP 402)	125 mL in HDPE bottles	HNO_3 to pH<2.0, store at RT	6 months
Water	Total Metals	Tap without purging (*filtered and unfiltered) /ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) (EPA 6010B) (Shaw SOP 402)	125 mL in HDPE bottles	HNO_3 to pH<2.0, store at RT	6 months
Water	Arsenic(III) and Arsenic(V) speciated	Faucet samples filtered through SPME ion-exchange cartridges for speciation at field site (*filtered and unfiltered) /ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) (EPA 6010B) (Shaw SOP 402 & 403)	50 mL in 125-mL HDPE bottles	HNO_3 to pH<2.0, store at RT	6 months

Matrix	Measurement	Sampling ([1]Faucet, [2]Tap)/ Measurement Method	Analysis Method	Sample Container/ Quantity of Sample	Preservation/ Storage	Holding Time(s)
Water	*E coli* analysis	Purged faucet	Shaw SOP 305 (Hach Method 10029)	100 mL in EPA fecal coliform sampling bottles	Sample bottles come with sodium thiosulfate pellet, store at 4°C	24 hours
Water	Alkalinity	Purged faucet	EPA 310.1 (Shaw SOP 502)	250 mL polypropylene bottles	4 ±2°C	14 days
Water	VOC	Purged faucet	EPA 524.2		Quenched with 25 mgs ascorbic/vial and then preserved at pH<2.0 using HCl	14 days
Water	SVOC	Purged faucet	EPA 525.2	1 L amber glass	Preserved with 40-50 mg sodium sulfite, pH<2.0 using HCl	14 days
Water	TOC	Purged faucet	EPA 9060A (Shaw SOP 401)	1 x 250 mL polypropylene	4 ±2°C at pH<2.0 with H_2SO_4	28 days
Water	Turbidity, TSS and TDS	Purged faucet	EPA 180.1 for turbidity (Shaw SOP 507) EPA 160.2 for TSS (Shaw SOP 509) EPA 160.1 for TDS (Shaw SOP 510)	2 x 250 mL HDPE bottles	4 ±2°C	48 hours for turbidity, 7 days for TSS TDS
Water	Anions fluoride, chloride, nitrite, nitrate, bromide, phosphate and sulfate	Purged faucet	EPA 300.0 (Shaw SOP 405)	125 mL HDPE bottles	4 ±2°C	48 hours

[1] Faucet samples are untreated water samples collected at the field site
[2] Tap samples are treated water samples collected after POU treatment
* Samples filtered through 0.45μm syringe filter

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/6/10	JS	JS	KB	RS	s-136277-2/10-W



Property sampled during Point of Use Study

Homes receiving bottled water

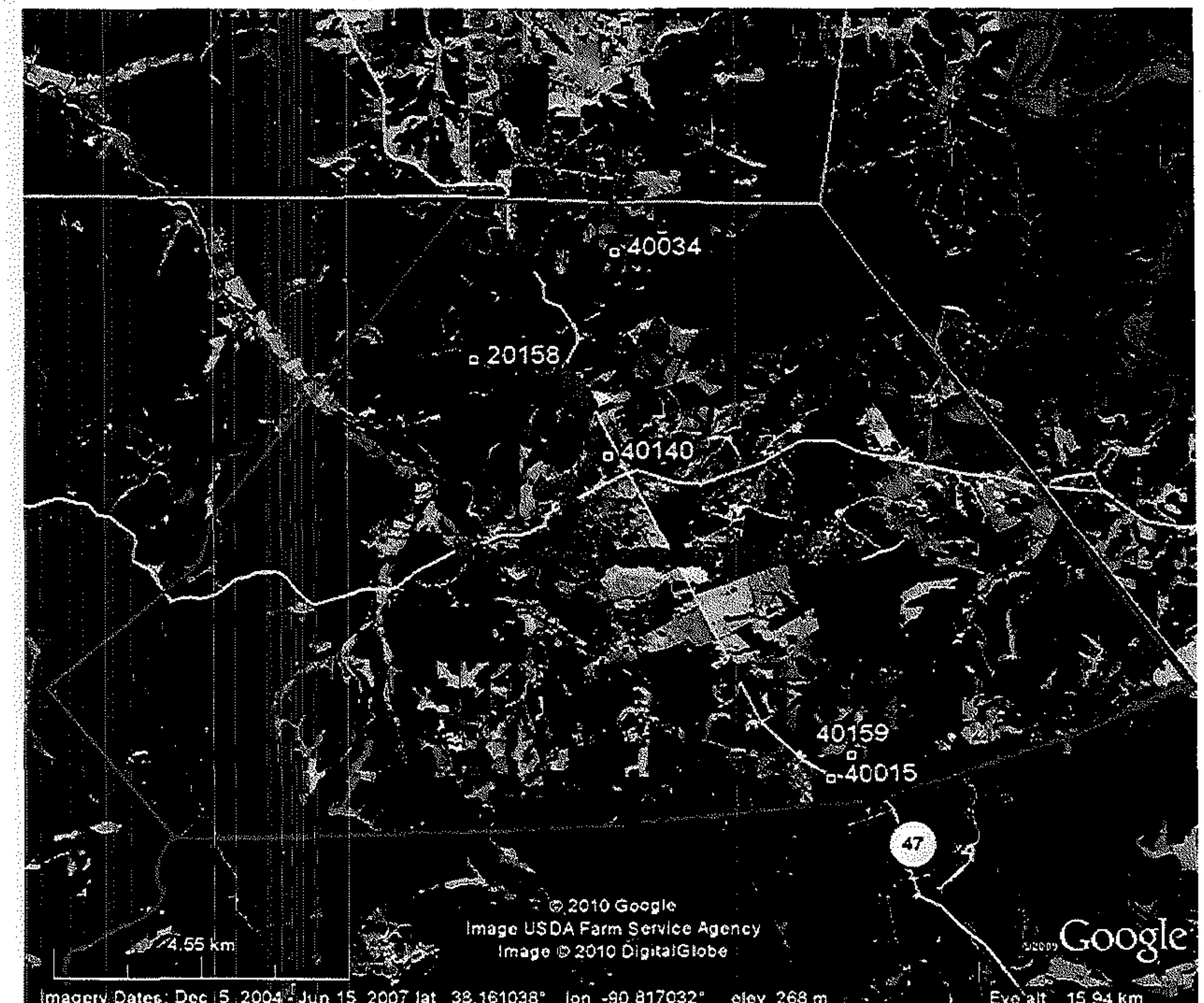
Shaw Shaw Environmental, Inc.

Figure 2-1a

Washington County Missouri
Homes Receiving Bottled Water
Washington County

GM-2
19/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati OH	2/25/10	JS	JS	KB	RS	s-136277-2/10-w



N

Property sampled during Point of Use Study

Homes receiving bottled water

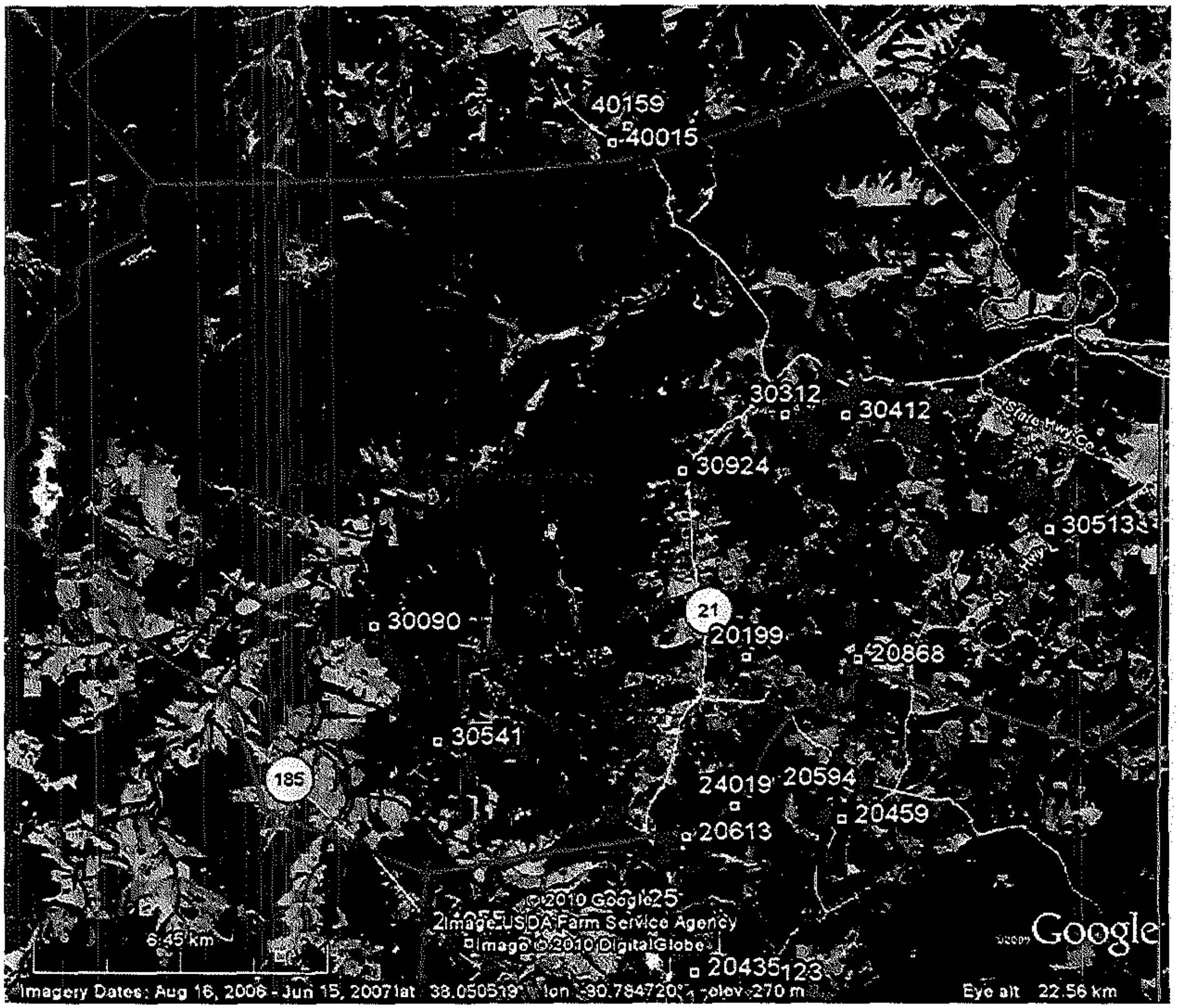
Shaw® Shaw Environmental, Inc.

Figure 2-1b

Washington County Missouri
Homes Receiving Bottled Water
Richwoods Sampling Area

GM-2
20/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati OH	2/16/10	JS	JS	KB	RS	s-136277-2/10-w



N

Property sampled during Point of Use Study

Homes receiving bottled water

Shaw Shaw Environmental, Inc.

Figure 2-1c

Washington County Missouri
Homes Receiving Bottled Water
Old Mines Sampling Area

GM-2
21/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati OH	2/4/10	JS	JS	KB	KS	s-136277-2/10-w

Property sampled during Point of Use Study

Homes receiving bottled water

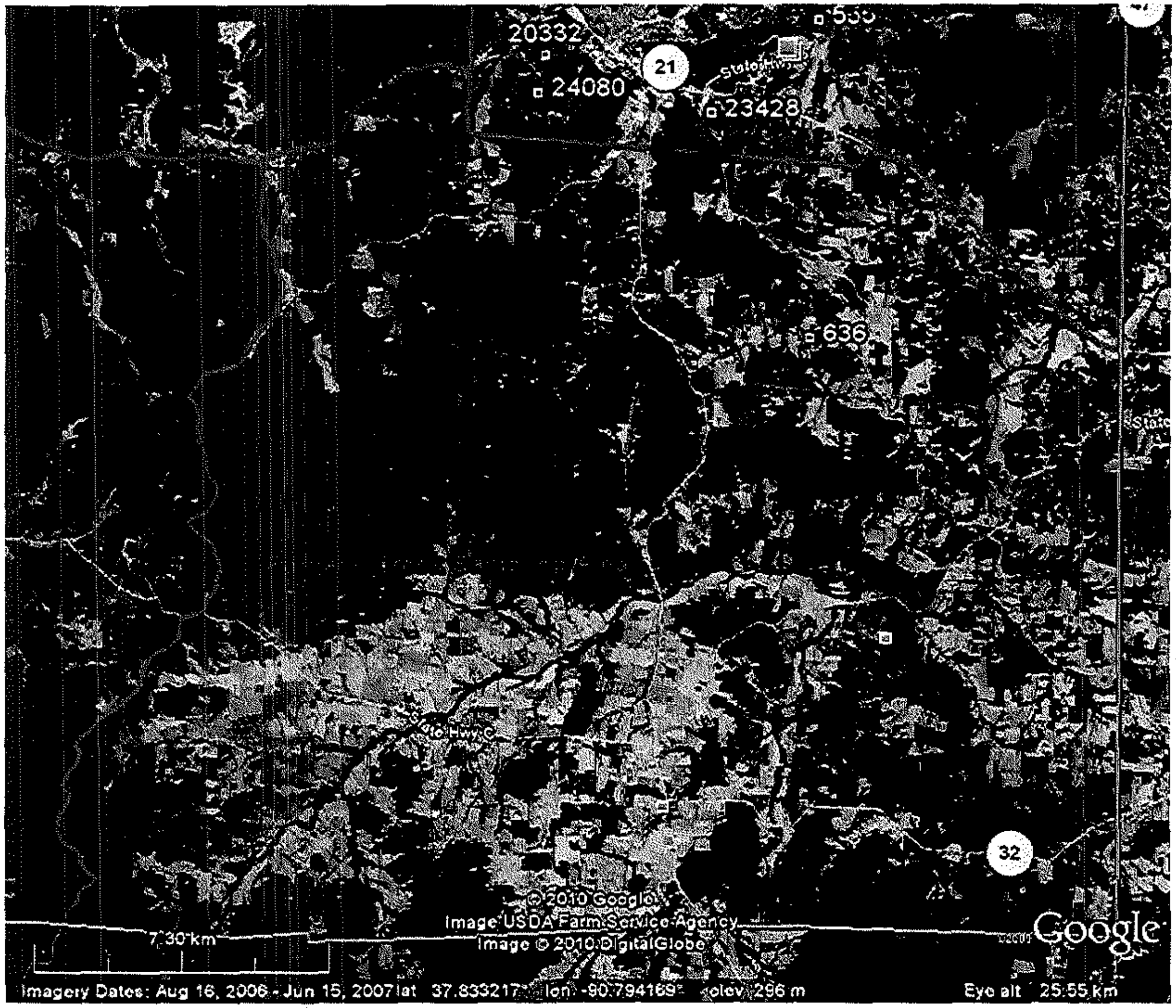
Shaw Environmental, Inc.

Figure 2-1d

Washington County Missouri
Homes Receiving Bottled Water
Potosi Sampling Area

GM-2
22/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/16/10	JS	JS	KB	KB	s-136277-2/10-w



Property sampled during Point of Use Study

Homes receiving bottled water

Shaw Shaw Environmental, Inc.

Figure 2-1e

Washington County Missouri
Homes Receiving Bottled Water
Furnace Creek Sampling Area

GM-2
23/323

3.0 Analytical Results

This section summarizes the analytical results for the samples collected for this effort and analyzed at the T&E Facility.

3.1 Pilot Program Samples

Table 3-1 presents the sample number, property ID and a description of the samples collected for analysis for this pilot program. This table links the sample IDs to the property IDs used in subsequent tables to identify the analytical results.

3.2 Analytical Results for Metals Samples

Tables 3.2.1 through 3.2.8 present the analytical results for the following metals:

- Lead (Pb) – Table 3.2.1
- Arsenic (As) – Table 3.2.2
- Barium (Ba – Table 3.2.3
- Cadmium (Cd) – Table 3.2.4
- Antimony (Sb) – Table 3.2.5
- Iron (Fe) – Table 3.2.6
- Manganese (Mn) – Table 3.2.7
- Thallium (Tl) – Table 3.2.8.

As presented in Section 2, the samples were analyzed using ICP. However, during the analytical program it was discovered that other metals potentially present in these samples was interfering with the wavelength for Lead. Accordingly, all the samples were re-analyzed for lead using Atomic Absorption Spectroscopy (AAS) and it is the results from these analyses that are presented in Tables 3.2.1.

Figures 3-1a through 3-1e show the homes with arsenic levels above the MCL in each sampling area. Similarly, Figures 3-2 (a – e) through 3-4 (a – e) show the homes with barium, cadmium, and lead above the MCL in each sampling area, respectively. Based on the results presented in these tables, the majority of the sites (21 out of 27sites) will require treatment for lead. Two sites showed an exceedence for antimony and only one site each showed an exceedence for barium and cadmium.

3.3 Analytical Results for Anions, Ammonia, and Alkalinity

Tables 3.3.1 through 3.3.3 show the analytical results for anions, ammonia, and alkalinity, respectively. Two sites showed an exceedence for nitrate, and one site showed an exceedence for sulfate.

3.4 Analytical Results for Solids, TOC, and Turbidity

Tables 3.4.1 through 3.4.3 show the analytical results for solids (TSS and TDS), TOC, and turbidity. Only 3 sites showed an exceedence for TDS.

3.5 Analytical Results for E. coli

Table 3.5 shows the analytical results for *E. coli*. Two sites showed an exceedence for *E. coli*.

3.6 Comparative Results from Region VII Laboratory and External Laboratory

Table 3.6.1 show a comparison of results from the pilot study data to seven duplicate samples analyzed by Region VII for metals using ICP followed by Mass Spectroscopy (MS). A close agreement can be observed between these two sets of analytical data, thus confirming the accuracy of the analytical data for the samples analyzed at the T&E Facility.

To confirm the lead results from the ICP runs at the T&E Facility, five samples were selected for analysis by ICP-MS at an offsite, commercial laboratory. These five samples were also analyzed for arsenic and lead using AA at the T&E Facility. Table 3.6.2 shows the analytical results from these samples. Lead levels using ICP-MS were lower than the levels reported by the ICP but nevertheless are above the MCL for two samples, both of which are untreated water. The lead levels reported by AA show very close agreement with the levels reported by ICP-MS. Barium levels reported by the ICP and ICP-MS are comparable and close to the MCL in two samples. Thallium and arsenic levels were reported as non-detectable by both the ICP and the ICP-MS

3.7 Comparison of Pilot Study Analytical Data to Historical Data

Table 3.7.1 through 3.7.4 show a comparison of the pilot study data to data from historical sampling events conducted in Washington County for lead, arsenic, barium, and cadmium, respectively. These tables show good agreement between the analytical results obtained from this pilot study to that obtained historically. Thus, future decisions about the placement of POU devices in homes could be based on the available historical data in most cases.

Table 3.1
Pilot Program for Selection of POU Devices
Sample ID's by Property Identification Number, Site Name, and Field Description

Site Name	Property Identification #	Sample ID	Sample Date	Description on Field Sheet
Richwoods	20158	ORD-135	10/27/2009	Faucet Purged
Richwoods	20158	ORD-134	10/27/2009	Faucet Unpurged
Richwoods	40015	ORD-15	10/29/2009	Tap Unpurged
Richwoods	40015	ORD-16	10/29/2009	Tap Purged
Richwoods	40015	ORD-146	10/29/2009	Faucet Unpurged
Richwoods	40015	ORD-147	10/29/2009	Faucet Purged
Richwoods	40034	ORD-148	10/29/2009	Faucet Unpurged
Richwoods	40034	ORD-149	10/29/2009	Faucet Purged
Richwoods	40140	ORD-139	10/28/2009	Faucet Purged
Richwoods	40140	ORD-139-FD	10/28/2009	Faucet Purged
Richwoods	40140	ORD-138	10/28/2009	Faucet Unpurged
Richwoods	40159	ORD-143S	10/28/2009	Faucet Purged
Richwoods	40159	ORD-142	10/28/2009	Faucet Unpurged
Richwoods	40159	ORD-143US	10/28/2009	Faucet Purged
Richwoods	40159	ORD-143USUF	10/28/2009	Faucet Purged
Old Mines	20199	ORD-150	10/30/2009	Faucet Unpurged
Old Mines	20199	ORD-151	10/30/2009	Faucet Purged
Old Mines	30090	ORD-121	10/23/2009	Faucet Purged
Old Mines	30090	ORD-120	10/23/2009	Faucet Unpurged
Old Mines	30312	ORD-111	10/21/2009	Faucet Purged
Old Mines	30312	ORD-110	10/21/2009	Faucet Unpurged
Old Mines	30412	ORD-123(Inside)	10/23/2009	Faucet Purged
Old Mines	30412	ORD-123(Outside)	10/23/2009	Faucet Purged
Old Mines	30412	ORD-122	10/23/2009	Faucet Unpurged
Old Mines	30513	ORD-144	10/29/2009	Faucet Unpurged
Old Mines	30513	ORD-145	10/29/2009	Faucet Purged
Old Mines	30541	ORD-140	10/28/2009	Faucet Unpurged
Old Mines	30541	ORD-141	10/28/2009	Faucet Purged
Old Mines	30924	ORD-131	10/27/2009	Faucet Purged
Old Mines	30924	ORD-131UF	10/27/2009	Faucet Purged
Old Mines	30924	ORD-130	10/27/2009	Faucet Unpurged
Potosi	123	ORD-13	10/27/2009	Tap Unpurged
Potosi	123	ORD-14	10/27/2009	Tap Purged
Potosi	123	ORD-133	10/27/2009	Faucet Purged
Potosi	123	ORD-132	10/27/2009	Faucet Unpurged
Potosi	555	ORD-1	10/20/2009	Tap Unpurged
Potosi	555	ORD-102	10/20/2009	Faucet Unpurged
Potosi	555	ORD-103	10/20/2009	Faucet Purged
Potosi	555	ORD-2	10/20/2009	Tap Purged
Potosi	20332	ORD-113	10/22/2009	Faucet Purged
Potosi	20332	ORD-112	10/22/2009	Faucet Unpurged
Potosi	20425	ORD-115	10/22/2009	Faucet Purged
Potosi	20425	ORD-114	10/22/2009	Faucet Unpurged
Potosi	20435	ORD-100	10/20/2009	Faucet Unpurged
Potosi	20435	ORD-101	10/20/2009	Faucet Purged
Potosi	20459	ORD-117	10/22/2009	Faucet Purged
Potosi	20459	ORD-116	10/22/2009	Faucet Unpurged
Potosi	20517	ORD-152	10/30/2009	Faucet Unpurged
Potosi	20517	ORD-153	10/30/2009	Faucet Purged
Potosi	20594	ORD-109	10/21/2009	Faucet Purged
Potosi	20594	ORD-108	10/21/2009	Faucet Unpurged
Potosi	20594	ORD-109FD	10/21/2009	Faucet Purged
Potosi	20594	ORD-108FD	10/21/2009	Faucet Unpurged
Potosi	20594	ORD-7	10/21/2009	Tap Unpurged
Potosi	20594	ORD-7FD	10/21/2009	Tap Unpurged
Potosi	20594	ORD-8	10/21/2009	Tap Purged
Potosi	20594	ORD-8FD	10/21/2009	Tap Purged
Potosi	20613	ORD-10	10/24/2009	Tap Purged
Potosi	20613	ORD-125	10/24/2009	Faucet Purged
Potosi	20613	ORD-124	10/24/2009	Faucet Unpurged
Potosi	20613	ORD-9	10/24/2009	Tap Unpurged
Potosi	20868	ORD-104	10/20/2009	Faucet Unpurged
Potosi	20868	ORD-105	10/20/2009	Faucet Purged
Potosi	20868	ORD-3	10/20/2009	Tap Unpurged
Potosi	20868	ORD-4	10/20/2009	Tap Purged
Potosi	23428	ORD-137	10/28/2009	Faucet Purged
Potosi	23428	ORD-137-FD	10/28/2009	Faucet Purged
Potosi	23428	ORD-136	10/28/2009	Faucet Unpurged
Potosi	24019	ORD-106	10/21/2009	Faucet Unpurged
Potosi	24019	ORD-107	10/21/2009	Faucet Purged
Potosi	24019	ORD-5	10/21/2009	Tap Unpurged
Potosi	24019	ORD-6	10/21/2009	Tap Purged
Potosi	24055	ORD-11	10/24/2009	Tap Unpurged
Potosi	24055	ORD-12	10/24/2009	Tap Purged
Potosi	24055	ORD-129	10/24/2009	Faucet Purged
Potosi	24055	ORD-128	10/24/2009	Faucet Unpurged
Potosi	24080	ORD-119	10/22/2009	Faucet Purged
Potosi	24080	ORD-118	10/22/2009	Faucet Unpurged
Potosi	QAQC	ORD-159FB	10/24/2009	Field Blank
Furnace Creek	636	ORD-127	10/24/2009	Faucet Purged
Furnace Creek	636	ORD-126	10/24/2009	Faucet Unpurged

Table 3.2.1
Pilot Program for Selection of POU Devices
Analytical Results for Lead (µg/L)

Property ID	Property Location	Analysis	Analyte	Faucet Purged	Faucet Unpurged	Faucet Purged	Faucet Unpurged	Tap Purged	Tap Unpurged	Tap Purged	Tap Unpurged
				Dissolved		Total		Dissolved		Total	
20158	Richwoods	Metals (Lead) by AA	Lead	**37**	**40**	**39**	**36**	--	--	--	--
40015	Richwoods	Metals (Lead) by AA	Lead	<0.2	<0.2	<0.2	<0.2	<0.2	1	<0.2	<0.2
40034	Richwoods	Metals (Lead) by AA	Lead	8	9	7	12	--	--	--	--
40140	Richwoods	Metals (Lead) by AA	Lead	**25**	**22**	**22**	**23**	--	--	--	--
40140 [1]	Richwoods	Metals (Lead) by AA	Lead	**23**	--	**25**	--	--	--	--	--
40159	Richwoods	Metals (Lead) by AA	Lead	--	<0.2	--	<0.2	--	--	--	--
40159 [2]	Richwoods	Metals (Lead) by AA	Lead	<0.2	--	<0.2	--	--	--	--	--
40159 [3]	Richwoods	Metals (Lead) by AA	Lead	<0.2	--	<0.2	--	--	--	--	--
40159 [4]	Richwoods	Metals (Lead) by AA	Lead	<0.2	--	<0.2	--	--	--	--	--
20199	Old Mines	Metals (Lead) by AA	Lead	14	14	**15**	14	--	--	--	--
30090	Old Mines	Metals (Lead) by AA	Lead	**20**	**21**	**22**	**19**	--	--	--	--
30312	Old Mines	Metals (Lead) by AA	Lead	**35**	**32**	**35**	**33**	--	--	--	--
30412	Old Mines	Metals (Lead) by AA	Lead	<0.2	<0.2	<0.2	<0.2	--	--	--	--
30412 [5]	Old Mines	Metals (Lead) by AA	Lead	11	--	**17**	--	--	--	--	--
30513	Old Mines	Metals (Lead) by AA	Lead	**25**	**28**	**26**	**28**	--	--	--	--
30541	Old Mines	Metals (Lead) by AA	Lead	**34**	**36**	**36**	**37**	--	--	--	--
30924	Old Mines	Metals (Lead) by AA	Lead	3	3	2	6	--	--	--	--
30924 [6]	Old Mines	Metals (Lead) by AA	Lead	7	--	2	--	--	--	--	--
123	Potosi	Metals (Lead) by AA	Lead	**27**	**29**	**32**	**43**	<0.2	3	<0.2	2
555	Potosi	Metals (Lead) by AA	Lead	**80**	**86**	**91**	**87**	<0.2	<0.2	<0.2	2
20332	Potosi	Metals (Lead) by AA	Lead	**21**	**32**	**28**	**32**	--	--	--	--
20425	Potosi	Metals (Lead) by AA	Lead	14	**15**	**16**	**18**	--	--	--	--
20435	Potosi	Metals (Lead) by AA	Lead	**27**	**23**	**35**	**23**	--	--	--	--
20459	Potosi	Metals (Lead) by AA	Lead	10	0.2	5	4	--	--	--	--
20517	Potosi	Metals (Lead) by AA	Lead	**34**	**34**	**37**	**40**	--	--	--	--
20594	Potosi	Metals (Lead) by AA	Lead	**77**	**72**	**76**	**63**	<0.2	2	<0.2	<0.2
20594 [1]	Potosi	Metals (Lead) by AA	Lead	**59**	**53**	**55**	**48**	<0.2	<0.2	<0.2	2
20613	Potosi	Metals (Lead) by AA	Lead	7	13	10	11	<0.2	<0.2	<0.2	<0.2
20868	Potosi	Metals (Lead) by AA	Lead	**38**	**54**	**45**	**29**	<0.2	<0.2	<0.2	<0.2
23428	Potosi	Metals (Lead) by AA	Lead	**32**	**41**	**30**	**36**	--	--	--	--
23428 [1]	Potosi	Metals (Lead) by AA	Lead	**30**	--	**31**	--	--	--	--	--
24019	Potosi	Metals (Lead) by AA	Lead	**62**	**61**	**99**	**66**	<0.2	<0.2	<0.2	1
24055	Potosi	Metals (Lead) by AA	Lead	**40**	**45**	**47**	**41**	1	1	<0.2	<0.2
24055 [7]	Potosi	Metals (Lead) by AA	Lead	<0.2	--	<0.2	--	--	--	--	--
24080	Potosi	Metals (Lead) by AA	Lead	**25**	**29**	**29**	**29**	--	--	--	--
636	Furnace Creek	Metals (Lead) by AA	Lead	**48**	**48**	**48**	**69**	--	--	--	--

National Drinking Water Regulations MCL for Lead: 15
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.2.2
Pilot Program for Selection of POU Devices
Analytical Results for Arsenic (µg/L)

Property ID	Property Location	Analysis	Analyte	Faucet Purged	Faucet Unpurged	Faucet Purged	Faucet Unpurged	Tap Purged	Tap Unpurged	Tap Purged	Tap Unpurged
				Dissolved		Total		Dissolved		Total	
20158	Richwoods	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
40015	Richwoods	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
40034	Richwoods	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
40140	Richwoods	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
40140 [1]	Richwoods	Metals by ICP	Arsenic	<0.2	--	<0.2	--	--	--	--	--
40159	Richwoods	Metals by ICP	Arsenic	--	<0.2	--	<0.2	--	--	--	--
40159 [2]	Richwoods	Metals by ICP	Arsenic	<0.2	--	<0.2	--	--	--	--	--
40159 [3]	Richwoods	Metals by ICP	Arsenic	<0.2	--	<0.2	--	--	--	--	--
40159 [4]	Richwoods	Metals by ICP	Arsenic	<0.2	--	<0.2	--	--	--	--	--
20199	Old Mines	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
30090	Old Mines	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
30312	Old Mines	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
30412	Old Mines	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
30412 [5]	Old Mines	Metals by ICP	Arsenic	<0.2	--	<0.2	--	--	--	--	--
30513	Old Mines	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
30541	Old Mines	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
30924	Old Mines	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
30924 [6]	Old Mines	Metals by ICP	Arsenic	<0.2	--	2	--	--	--	--	--
123	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
555	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
20332	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
20425	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
20435	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
20459	Potosi	Metals by ICP	Arsenic	1	<0.2	<0.2	<0.2	--	--	--	--
20517	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
20594	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	1	<0.2	<0.2
20594 [1]	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
20613	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
20868	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	1	<0.2	<0.2	<0.2
23428	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
23428 [1]	Potosi	Metals by ICP	Arsenic	<0.2	--	<0.2	--	--	--	--	--
24019	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
24055	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
24055 [7]	Potosi	Metals by ICP	Arsenic	<0.2	--	<0.2	--	--	--	--	--
24080	Potosi	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--
636	Furnace Creek	Metals by ICP	Arsenic	<0.2	<0.2	<0.2	<0.2	--	--	--	--

National Drinking Water Regulations MCL for Arsenic: 10
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.2.3
Pilot Program for Selection of POU Devices
Analytical Results for Barium (µg/L)

Property ID	Property Location	Analysis	Analyte	Faucet Purged	Faucet Unpurged	Faucet Purged	Faucet Unpurged	Tap Purged	Tap Unpurged	Tap Purged	Tap Unpurged
				Dissolved		Total		Dissolved		Total	
20158	Richwoods	Metals by ICP	Barium	999	996	992	994	--	--	--	--
40015	Richwoods	Metals by ICP	Barium	59	56	59	59	13	9	13	9
40034	Richwoods	Metals by ICP	Barium	463	466	463	444	--	--	--	--
40140	Richwoods	Metals by ICP	Barium	1748	1751	1745	1755	--	--	--	--
40140 [1]	Richwoods	Metals by ICP	Barium	1757		1723		--	--	--	--
40159	Richwoods	Metals by ICP	Barium	--	<0.2	--	<0.2	--	--	--	--
40159 [2]	Richwoods	Metals by ICP	Barium	<0.2	--	<0.2	--	--	--	--	--
40159 [3]	Richwoods	Metals by ICP	Barium	520	--	520	--	--	--	--	--
40159 [4]	Richwoods	Metals by ICP	Barium	445	--	439	--	--	--	--	--
20199	Old Mines	Metals by ICP	Barium	**2127**	**2145**	**2122**	**2140**	--	--	--	--
30090	Old Mines	Metals by ICP	Barium	1087	1154	1092	1109	--	--	--	--
30312	Old Mines	Metals by ICP	Barium	406	409	415	412	--	--	--	--
30412	Old Mines	Metals by ICP	Barium	1	1	1	2	--	--	--	--
30412 [5]	Old Mines	Metals by ICP	Barium	53	--	53	--	--	--	--	--
30513	Old Mines	Metals by ICP	Barium	234	242	231	247	--	--	--	--
30541	Old Mines	Metals by ICP	Barium	806	805	800	803	--	--	--	--
30924	Old Mines	Metals by ICP	Barium	1027	961	1032	953	--	--	--	--
30924 [6]	Old Mines	Metals by ICP	Barium	1043	--	1048	--	--	--	--	--
123	Potosi	Metals by ICP	Barium	391	450	394	455	15	5	15	5
555	Potosi	Metals by ICP	Barium	1430	1413	1425	1404	532	406	536	432
20332	Potosi	Metals by ICP	Barium	395	400	392	398	--	--	--	--
20425	Potosi	Metals by ICP	Barium	181	177	183	183	--	--	--	--
20435	Potosi	Metals by ICP	Barium	131	131	133	131	--	--	--	--
20459	Potosi	Metals by ICP	Barium	11	11	10	11	--	--	--	--
20517	Potosi	Metals by ICP	Barium	208	203	207	206	--	--	--	--
20594	Potosi	Metals by ICP	Barium	233	233	229	238	94	37	93	38
20594 [1]	Potosi	Metals by ICP	Barium	232	241	229	240	93	36	91	38
20613	Potosi	Metals by ICP	Barium	463	488	467	489	166	63	167	59
20868	Potosi	Metals by ICP	Barium	86	92	90	92	29	27	28	27
23428	Potosi	Metals by ICP	Barium	277	273	277	272	--	--	--	--
23428 [1]	Potosi	Metals by ICP	Barium	279	--	276	--	--	--	--	--
24019	Potosi	Metals by ICP	Barium	244	244	244	243	9	6	9	7
24055	Potosi	Metals by ICP	Barium	1185	1187	1181	1179	1002	892	989	875
24055 [7]	Potosi	Metals by ICP	Barium	4	--	4	--	--	--	--	--
24080	Potosi	Metals by ICP	Barium	1321	1307	1314	1306	--	--	--	--
636	Furnace Creek	Metals by ICP	Barium	448	436	445	434	--	--	--	--

National Drinking Water Regulations MCL for Barium: 2000
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.2.4
Pilot Program for Selection of POU Devices
Analytical Results for Cadmium (µg/L)

Property ID	Property Location	Analysis	Analyte	Faucet Purged	Faucet Unpurged	Faucet Purged	Faucet Unpurged	Tap Purged	Tap Unpurged	Tap Purged	Tap Unpurged
				Dissolved		Total		Dissolved		Total	
20158	Richwoods	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	--	--	--	--
40015	Richwoods	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
40034	Richwoods	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	--	--	--	--
40140	Richwoods	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	--	--	--	--
40140 [1]	Richwoods	Metals by ICP	Cadmium	<0.4	--	<0.4	--	--	--	--	--
40159	Richwoods	Metals by ICP	Cadmium	--	<0.4	--	<0.4	--	--	--	--
40159 [2]	Richwoods	Metals by ICP	Cadmium	<0.4	--	<0.4	--	--	--	--	--
40159 [3]	Richwoods	Metals by ICP	Cadmium	<0.4	--	<0.4	--	--	--	--	--
40159 [4]	Richwoods	Metals by ICP	Cadmium	<0.4	--	<0.4	--	--	--	--	--
20199	Old Mines	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	--	--	--	--
30090	Old Mines	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	--	--	--	--
30312	Old Mines	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	--	--	--	--
30412	Old Mines	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	--	--	--	--
30412 [5]	Old Mines	Metals by ICP	Cadmium	<0.4	--	<0.4	--	--	--	--	--
30513	Old Mines	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	--	--	--	--
30541	Old Mines	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	--	--	--	--
30924	Old Mines	Metals by ICP	Cadmium	4	3	4	3	--	--	--	--
30924 [6]	Old Mines	Metals by ICP	Cadmium	3	--	3	--	--	--	--	--
123	Potosi	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	1	<0.4	<0.4	<0.4	<0.4
555	Potosi	Metals by ICP	Cadmium	1	1	1	1	1	1	<0.4	1
20332	Potosi	Metals by ICP	Cadmium	1	1	1	1	--	--	--	--
20425	Potosi	Metals by ICP	Cadmium	1	1	1	1	--	--	--	--
20435	Potosi	Metals by ICP	Cadmium	**6**	**6**	**6**	**5**	--	--	--	--
20459	Potosi	Metals by ICP	Cadmium	2	2	2	1	--	--	--	--
20517	Potosi	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	--	--	--	--
20594	Potosi	Metals by ICP	Cadmium	1	1	1	1	1	1	<0.4	1
20594 [1]	Potosi	Metals by ICP	Cadmium	<0.4	3	1	1	<0.4	1	<0.4	1
20613	Potosi	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
20868	Potosi	Metals by ICP	Cadmium	1	1	1	2	1	1	<0.4	1
23428	Potosi	Metals by ICP	Cadmium	1	1	1	1	--	--	--	--
23428 [1]	Potosi	Metals by ICP	Cadmium	1	--	1	--	--	--	--	--
24019	Potosi	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	2	1	<0.4	2
24055	Potosi	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
24055 [7]	Potosi	Metals by ICP	Cadmium	1	--	1	--	--	--	--	--
24080	Potosi	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	--	--	--	--
636	Furnace Creek	Metals by ICP	Cadmium	<0.4	<0.4	<0.4	<0.4	--	--	--	--

National Drinking Water Regulations MCL for Cadmium: 5
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect. Result less than the Reporting Limit
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.2.5
Pilot Program for Selection of POU Devices
Analytical Results for Antimony (µg/L)

Property ID	Property Location	Analysis	Analyte	Faucet Purged	Faucet Unpurged	Faucet Purged	Faucet Unpurged	Tap Purged	Tap Unpurged	Tap Purged	Tap Unpurged
				Dissolved		Total		Dissolved		Total	
20158	Richwoods	Metals by ICP	Antimony	<2.1	2	1	<2.1	--	--	--	--
40015	Richwoods	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1
40034	Richwoods	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--
40140	Richwoods	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--
40140 [1]	Richwoods	Metals by ICP	Antimony	<2.1	--	<2.1	--	--	--	--	--
40159	Richwoods	Metals by ICP	Antimony	--	<2.1	--	1	--	--	--	--
40159 [2]	Richwoods	Metals by ICP	Antimony	<2.1	--	<2.1	--	--	--	--	--
40159 [3]	Richwoods	Metals by ICP	Antimony	<2.1	--	<2.1	--	--	--	--	--
40159 [4]	Richwoods	Metals by ICP	Antimony	<2.1	--	<2.1	--	--	--	--	--
20199	Old Mines	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--
30090	Old Mines	Metals by ICP	Antimony	5	4	5	4	--	--	--	--
30312	Old Mines	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--
30412	Old Mines	Metals by ICP	Antimony	4	4	4	5	--	--	--	--
30412 [5]	Old Mines	Metals by ICP	Antimony	**6**	--	5	--	--	--	--	--
30513	Old Mines	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--
30541	Old Mines	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--
30924	Old Mines	Metals by ICP	Antimony	<2.1	<2.1	<2.1	1	--	--	--	--
30924 [6]	Old Mines	Metals by ICP	Antimony	<2.1	--	2	--	--	--	--	--
123	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1
555	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1
20332	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--
20425	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--
20435	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--
20459	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--
20517	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--
20594	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	1	1	<2.1	<2.1
20594 [1]	Potosi	Metals by ICP	Antimony	<2.1	4	<2.1	<2.1	4	<2.1	<2.1	<2.1
20613	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	2	<2.1	<2.1	<2.1	<2.1
20868	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1
23428	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--
23428 [1]	Potosi	Metals by ICP	Antimony	<2.1	--	<2.1	--	--	--	--	--
24019	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1
24055	Potosi	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1
24055 [7]	Potosi	Metals by ICP	Antimony	<2.1	--	<2.1	--	--	--	--	--
24080	Potosi	Metals by ICP	Antimony	5	**9**	4	<2.1	--	--	--	--
636	Furnace Creek	Metals by ICP	Antimony	<2.1	<2.1	<2.1	<2.1	--	--	--	--

National Drinking Water Regulations MCL for Antimony: 6
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.2.6
Pilot Program for Selection of POU Devices
Analytical Results for Iron (µg/L)

Property ID	Property Location	Analysis	Analyte	Faucet Purged	Faucet Unpurged	Faucet Purged	Faucet Unpurged	Tap Purged	Tap Unpurged	Tap Purged	Tap Unpurged
				Dissolved		Total		Dissolved		Total	
20158	Richwoods	Metals by ICP	Iron	3	2	2	3	--	--	--	--
40015	Richwoods	Metals by ICP	Iron	<0.7	<0.7	<0.7	43	<0.7	1	<0.7	<0.7
40034	Richwoods	Metals by ICP	Iron	<0.7	<0.7	<0.7	<0.7	--	--	--	--
40140	Richwoods	Metals by ICP	Iron	4	2	3	3	--	--	--	--
40140 [1]	Richwoods	Metals by ICP	Iron	4	--	4	--	--	--	--	--
40159	Richwoods	Metals by ICP	Iron	--	<0.7	--	<0.7	--	--	--	--
40159 [2]	Richwoods	Metals by ICP	Iron	<0.7	--	<0.7	--	--	--	--	--
40159 [3]	Richwoods	Metals by ICP	Iron	<0.7	--	<0.7	--	--	--	--	--
40159 [4]	Richwoods	Metals by ICP	Iron	<0.7	--	<0.7	--	--	--	--	--
20199	Old Mines	Metals by ICP	Iron	<0.7	<0.7	<0.7	<0.7	--	--	--	--
30090	Old Mines	Metals by ICP	Iron	1	1	2	7	--	--	--	--
30312	Old Mines	Metals by ICP	Iron	<0.7	<0.7	<0.7	<0.7	--	--	--	--
30412	Old Mines	Metals by ICP	Iron	2	2	2	6	--	--	--	--
30412 [5]	Old Mines	Metals by ICP	Iron	196	--	175	--	--	--	--	--
30513	Old Mines	Metals by ICP	Iron	<0.7	<0.7	<0.7	<0.7	--	--	--	--
30541	Old Mines	Metals by ICP	Iron	3	2	4	2	--	--	--	--
30924	Old Mines	Metals by ICP	Iron	2	1	2	<0.7	--	--	--	--
30924 [6]	Old Mines	Metals by ICP	Iron	3	--	3	--	--	--	--	--
123	Potosi	Metals by ICP	Iron	2	2	3	2	2	2	2	2
555	Potosi	Metals by ICP	Iron	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
20332	Potosi	Metals by ICP	Iron	2	1	2	1	--	--	--	--
20425	Potosi	Metals by ICP	Iron	2	2	2	1	--	--	--	--
20435	Potosi	Metals by ICP	Iron	6	<0.7	6	6	--	--	--	--
20459	Potosi	Metals by ICP	Iron	55	3	99	61	--	--	--	--
20517	Potosi	Metals by ICP	Iron	<0.7	<0.7	<0.7	4	--	--	--	--
20594	Potosi	Metals by ICP	Iron	<0.7	<0.7	3	1	<0.7	1	<0.7	<0.7
20594 [1]	Potosi	Metals by ICP	Iron	<0.7	2	2	1	<0.7	<0.7	<0.7	<0.7
20613	Potosi	Metals by ICP	Iron	3	4	3	2	3	4	3	3
20868	Potosi	Metals by ICP	Iron	<0.7	ND	3	5	<0.7	<0.7	<0.7	<0.7
23428	Potosi	Metals by ICP	Iron	2	1	1	<0.7	--	--	--	--
23428 [1]	Potosi	Metals by ICP	Iron	1	--	1	--	--	--	--	--
24019	Potosi	Metals by ICP	Iron	<0.7	<0.7	<0.7	<0.7	2	<0.7	2	2
24055	Potosi	Metals by ICP	Iron	4	3	6	4	4	3	3	3
24055 [7]	Potosi	Metals by ICP	Iron	3	--	5	--	--	--	--	--
24080	Potosi	Metals by ICP	Iron	1	58	2	3	--	--	--	--
636	Furnace Creek	Metals by ICP	Iron	3	2	3	2	--	--	--	--

National Drinking Water Regulations MCL for Iron: 300
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.2.7
Pilot Program for Selection of POU Devices
Analytical Results for Manganese (µg/L)

Property ID	Property Location	Analysis	Analyte	Faucet Purged	Faucet Unpurged	Faucet Purged	Faucet Unpurged	Tap Purged	Tap Unpurged	Tap Purged	Tap Unpurged
				Dissolved		Total		Dissolved		Total	
20158	Richwoods	Metals by ICP	Manganese	2	2	2	2	--	--	--	--
40015	Richwoods	Metals by ICP	Manganese	1	1	1	1	2	2	2	2
40034	Richwoods	Metals by ICP	Manganese	<0.5	<0.5	<0.5	<0.5	--	--	--	--
40140	Richwoods	Metals by ICP	Manganese	2	2	2	2	--	--	--	--
40140 [1]	Richwoods	Metals by ICP	Manganese	3	--	3	--	--	--	--	--
40159	Richwoods	Metals by ICP	Manganese	--	<0.5	--	<0.5	--	--	--	--
40159 [2]	Richwoods	Metals by ICP	Manganese	<0.5	--	<0.5	--	--	--	--	--
40159 [3]	Richwoods	Metals by ICP	Manganese	<0.5	--	<0.5	--	--	--	--	--
40159 [4]	Richwoods	Metals by ICP	Manganese	<0.5	--	<0.5	--	--	--	--	--
20199	Old Mines	Metals by ICP	Manganese	<0.5	<0.5	<0.5	1	--	--	--	--
30090	Old Mines	Metals by ICP	Manganese	<0.5	<0.5	<0.5	<0.5	--	--	--	--
30312	Old Mines	Metals by ICP	Manganese	1	1	1	1	--	--	--	--
30412	Old Mines	Metals by ICP	Manganese	<0.5	<0.5	<0.5	<0.5	--	--	--	--
30412 [5]	Old Mines	Metals by ICP	Manganese	9	--	8	--	--	--	--	--
30513	Old Mines	Metals by ICP	Manganese	<0.5	<0.5	<0.5	<0.5	--	--	--	--
30541	Old Mines	Metals by ICP	Manganese	3	2	3	2	--	--	--	--
30924	Old Mines	Metals by ICP	Manganese	2	2	2	2	--	--	--	--
30924 [6]	Old Mines	Metals by ICP	Manganese	2	--	2	--	--	--	--	--
123	Potosi	Metals by ICP	Manganese	2	2	2	2	2	2	2	2
555	Potosi	Metals by ICP	Manganese	19	20	19	19	19	19	19	19
20332	Potosi	Metals by ICP	Manganese	2	2	2	2	--	--	--	--
20425	Potosi	Metals by ICP	Manganese	2	2	2	2	--	--	--	--
20435	Potosi	Metals by ICP	Manganese	21	21	21	21	--	--	--	--
20459	Potosi	Metals by ICP	Manganese	10	3	9	3	--	--	--	--
20517	Potosi	Metals by ICP	Manganese	3	4	3	4	--	--	--	--
20594	Potosi	Metals by ICP	Manganese	1	1	1	1	1	1	1	1
20594 [1]	Potosi	Metals by ICP	Manganese	1	2	1	1	1	1	1	1
20613	Potosi	Metals by ICP	Manganese	1	1	1	1	1	1	1	1
20868	Potosi	Metals by ICP	Manganese	19	19	19	19	19	19	19	19
23428	Potosi.	Metals by ICP	Manganese	2	2	2	2	--	--	--	--
23428 [1]	Potosi	Metals by ICP	Manganese	2	--	2	--	--	--	--	--
24019	Potosi	Metals by ICP	Manganese	1	1	1	1	2	1	2	2
24055	Potosi	Metals by ICP	Manganese	1	1	1	1	1	1	1	1
24055 [7]	Potosi	Metals by ICP	Manganese	1	--	1	--	--	--	--	--
24080	Potosi	Metals by ICP	Manganese	<0.5	18	<0.5	2	--	--	--	--
636	Furnace Creek	Metals by ICP	Manganese	1	<0.5	1	<0.5	--	--	--	--

National Drinking Water Regulations MCL for Manganese: 50
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.2.8
Pilot Program for Selection of POU Devices
Analytical Results for Thallium (µg/L)

Property ID	Property Location	Analysis	Analyte	Faucet Purged	Faucet Unpurged	Faucet Purged	Faucet Unpurged	Tap Purged	Tap Unpurged	Tap Purged	Tap Unpurged
				Dissolved		Total		Dissolved		Total	
20158	Richwoods	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
40015	Richwoods	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
40034	Richwoods	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
40140	Richwoods	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
40140[1]	Richwoods	Metals by ICP	Thallium	<1.8	<1.8	--	--	--	--	--	--
40159	Richwoods	Metals by ICP	Thallium	--	--	<1.8	<1.8	--	--	--	--
40159[2]	Richwoods	Metals by ICP	Thallium	<1.8	<1.8	--	--	--	--	--	--
40159[3]	Richwoods	Metals by ICP	Thallium	<1.8	<1.8	--	--	--	--	--	--
40159[4]	Richwoods	Metals by ICP	Thallium	<1.8	<1.8	--	--	--	--	--	--
20199	Old Mines	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
30090	Old Mines	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
30312	Old Mines	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
30412	Old Mines	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
30412[5]	Old Mines	Metals by ICP	Thallium	<1.8	<1.8	--	--	--	--	--	--
30513	Old Mines	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
30541	Old Mines	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
30924	Old Mines	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
30924[6]	Old Mines	Metals by ICP	Thallium	<1.8	<1.8	--	--	--	--	--	--
123	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
555	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
20332	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
20425	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
20435	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
20459	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
20517	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
20594	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
20594[1]	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
20613	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
20868	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
23428	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
23428[1]	Potosi	Metals by ICP	Thallium	<1.8	<1.8	--	--	--	--	--	--
24019	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
24055	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
24055[7]	Potosi	Metals by ICP	Thallium	<1.8	<1.8	--	--	--	--	--	--
24080	Potosi	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--
636	Furnace Creek	Metals by ICP	Thallium	<1.8	<1.8	<1.8	<1.8	--	--	--	--

National Drinking Water Regulations MCL for Thallium: 2
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.3.1
Pilot Program for Selection of POU Devices
Analytical Results for Anions (mg/L)

Property ID	Property Location	Analysis	Fluoride	Chloride	Nitrite	Bromide	Nitrate	Phosphate	Sulfate
National Drinking Water Regulations MCL:			**2**	**250**	**1**	**NA**	**10**	**NA**	**250**
20158	Richwoods	Anions by IC	0.079	2.854	0.351	0.203	1.006	<0.087	4.209
40015	Richwoods	Anions by IC	0.099	2.773	<0.045	<0.036	0.050	<0.087	150.865
40034	Richwoods	Anions by IC	0.084	15.941	<0.045	0.235	5.510	<0.087	12.658
40140	Richwoods	Anions by IC	0.036	3.968	<0.045	0.048	1.297	<0.087	6.187
40140 [1]	Richwoods	Anions by IC	0.047	4.017	<0.045	0.042	1.299	<0.087	6.180
40159 [2]	Richwoods	Anions by IC	0.085	6.530	<0.045	0.048	1.656	<0.087	11.379
40159 [3]	Richwoods	Anions by IC	0.084	4.536	<0.045	0.047	2.257	<0.087	11.853
40159 [4]	Richwoods	Anions by IC	--	--	--	--	--	--	--
20199	Old Mines	Anions by IC	0.100	3.555	<0.045	<0.036	4.985	<0.087	5.650
30090	Old Mines	Anions by IC	0.063	5.642	<0.045	<0.036	0.484	<0.087	5.746
30312	Old Mines	Anions by IC	0.105	9.465	<0.045	<0.036	6.491	<0.087	10.692
30412	Old Mines	Anions by IC	0.085	10.413	<0.045	0.051	<0.038	0.586	84.565
30412 [5]	Old Mines	Anions by IC	--	--	--	--	--	--	--
30513	Old Mines	Anions by IC	0.167	8.552	<0.045	0.072	**13.939**	<0.087	31.283
30541	Old Mines	Anions by IC	0.063	21.304	<0.045	0.219	0.992	<0.087	5.097
30924	Old Mines	Anions by IC	0.073	4.329	<0.045	0.065	2.081	<0.087	10.931
30924 [6]	Old Mines	Anions by IC	0.079	4.321	<0.045	0.061	2.076	<0.087	11.131
123	Potosi	Anions by IC	0.066	9.927	<0.045	0.059	3.489	<0.087	12.894
555	Potosi	Anions by IC	0.060	6.839	<0.045	<0.036	0.963	<0.087	10.916
20332	Potosi	Anions by IC	0.099	4.654	<0.045	0.102	0.920	<0.087	6.765
20425	Potosi	Anions by IC	0.069	11.679	<0.045	0.116	6.978	<0.087	10.197
20435	Potosi	Anions by IC	0.074	2.573	<0.045	<0.036	0.055	<0.087	22.078
20459	Potosi	Anions by IC	0.075	5.170	<0.045	0.066	0.498	<0.087	**522.706**
20517	Potosi	Anions by IC	0.264	50.450	<0.045	0.077	3.331	<0.087	24.931
20594	Potosi	Anions by IC	0.089	2.814	<0.045	<0.036	0.555	<0.087	7.370
20594 [1]	Potosi	Anions by IC	0.081	2.101	<0.045	<0.036	0.498	<0.087	7.222
20613	Potosi	Anions by IC	0.086	3.691	<0.045	<0.036	0.872	<0.087	7.256
20868	Potosi	Anions by IC	0.066	29.955	<0.045	0.434	**17.352**	<0.087	42.901
23428	Potosi	Anions by IC	0.037	9.776	<0.045	0.142	5.034	<0.087	26.158
23428 [1]	Potosi	Anions by IC	0.050	9.765	<0.045	0.153	5.022	<0.087	26.377
24019	Potosi	Anions by IC	0.060	1.634	<0.045	<0.036	0.590	<0.087	6.363
24055	Potosi	Anions by IC	0.119	10.090	<0.045	0.074	1.723	<0.087	11.644
24055 [7]	Potosi	Anions by IC	<0.011	0.119	<0.045	<0.036	<0.038	<0.087	0.289
24080	Potosi	Anions by IC	0.167	1.839	<0.045	<0.036	1.020	<0.087	6.248
636	Furnace Creek	Anions by IC	0.125	6.393	<0.045	<0.036	0.897	<0.087	13.869

20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Softened
3: Unsoftened
4: Unsoftened, unfiltered
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.3.2
Pilot Program for Selection of POU Devices
Analytical Results for Ammonia

Property ID	Property Location	Ammonia
		mg/L
20158	Richwoods	<.021
40015	Richwoods	<.021
40034	Richwoods	0.024
40140	Richwoods	0.082
40140 [1]	Richwoods	0.081
40159 [2]	Richwoods	0.069
40159 [3]	Richwoods	--
40159 [4]	Richwoods	--
20199	Old Mines	<.021
30090	Old Mines	<.021
30312	Old Mines	<.021
30412	Old Mines	<.021
30412 [5]	Old Mines	--
30513	Old Mines	<.021
30541	Old Mines	0.026
30924	Old Mines	0.030
30924 [6]	Old Mines	<.021
123	Potosi	0.024
555	Potosi	<.021
20332	Potosi	<.021
20425	Potosi	<.021
20435	Potosi	<.021
20459	Potosi	<.021
20517	Potosi	<.021
20594	Potosi	0.030
20594 [1]	Potosi	0.037
20613	Potosi	<.021
20868	Potosi	0.021
23428	Potosi	0.081
23428 [1]	Potosi	0.076
24019	Potosi	0.023
24055	Potosi	<.021
24055 [7]	Potosi	<.021
24080	Potosi	<.021
636	Furnace Creek	<.021

National Drinking Water Regulations MCL for Ammonia: NA
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Softened
3: Unsoftened
4: Unsoftened, unfiltered
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.3.3
Pilot Program for Selection of POU Devices
Analytical Results for Alkalinity

Property ID	Property Location	Alkalinity	pH
		CaCO3/L	s.u.
20158	Richwoods	315	7.81
40015	Richwoods	384	7.27
40034	Richwoods	371	7.54
40140	Richwoods	324	7.73
40140 [1]	Richwoods	322	7.71
40159 [2]	Richwoods	351	7.8
40159 [3]	Richwoods	308	7.7
40159 [4]	Richwoods	--	--
20199	Old Mines	350	7.17
30090	Old Mines	355	7.4
30312	Old Mines	332	7.62
30412	Old Mines	474	7.42
30412 [5]	Old Mines	--	--
30513	Old Mines	372	7.15
30541	Old Mines	270	7.64
30924	Old Mines	369	7.48
30924 [6]	Old Mines	369	7.46
123	Potosi	332	7.7
555	Potosi	249	7.52
20332	Potosi	450	7.35
20425	Potosi	389	7.88
20435	Potosi	330	7.5
20459	Potosi	313	7.55
20517	Potosi	393	7.23
20594	Potosi	357	7.45
20594 [1]	Potosi	360	7.45
20613	Potosi	209	7.84
20868	Potosi	380	7.38
23428	Potosi	379	7.44
23428 [1]	Potosi	376	8.2
24019	Potosi	290	7.5
24055	Potosi	326	7.75
24055 [7]	Potosi	20*	5.5
24080	Potosi	266	7.79
636	Furnace Creek	373	8.11
	Maximum:	**474**	**8.2**
	Average:	**345**	**7.5**
	Minimum:	**209**	**5.5**

National Drinking Water Regulations MCL for Alkalinity: NA
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Softened
3: Unsoftened
4: Unsoftened, unfiltered
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank
* Field blank pH measurements would not stabilize

Table 3.4.1
Pilot Program for Selection of POU Devices
Analytical Results for Total Suspended and Total Dissolved Solids (mg/L)

Property ID	Property Location	Total Suspended Solids	Total Dissolved Solids
20158	Richwoods	0.505	284.343
40015	Richwoods	0.518	**593.264**
40034	Richwoods	1.064	175.532
40140	Richwoods	0.851	300.851
40140 [1]	Richwoods	0.889	296.444
40159 [2]	Richwoods	0.000	408.368
40159 [3]	Richwoods	0.000	303.279
40159 [4]	Richwoods	--	--
20199	Old Mines	0.407	335.366
30090	Old Mines	0.000	333.071
30312	Old Mines	0.000	349.796
30412	Old Mines	0.000	**626.459**
30412 [5]	Old Mines	--	--
30513	Old Mines	0.000	431.500
30541	Old Mines	0.403	295.968
30924	Old Mines	0.658	342.105
30924 [6]	Old Mines	1.010	346.465
123	Potosi	2.577	332.990
555	Potosi	1.562	262.500
20332	Potosi	0.000	435.060
20425	Potosi	0.000	405.534
20435	Potosi	2.008	334.940
20459	Potosi	0.000	**734.500**
20517	Potosi	0.403	489.110
20594	Potosi	0.781	351.172
20594 [1]	Potosi	0.787	345.276
20613	Potosi	1.181	187.402
20868	Potosi	2.429	493.927
23428	Potosi	1.626	399.593
23428 [1]	Potosi	1.653	402.479
24019	Potosi	1.709	281.624
24055	Potosi	0.000	316.000
24055 [7]	Potosi	1.695	0.000
24080	Potosi	1.195	262.151
636	Furnace Creek	0.000	380.328

National Drinking Water Regulations MCL for TSS (NA), TDS (500)
20: Result exceeds the MCL
--: Sample not analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Softened
3: Unsoftened
4: Unsoftened, unfiltered
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.4.2
Pilot Program for Selection of POU Devices
Analytical Results for Total Organic Carbon

Property ID	Property Location	TOC mg/L C
20158	Richwoods	0.2885
40015	Richwoods	0.3272
40034	Richwoods	0.4092
40140	Richwoods	0.5999
40140 [1]	Richwoods	0.5704
40159 [2]	Richwoods	0.5227
40159 [3]	Richwoods	0.3661
40159 [4]	Richwoods	--
20199	Old Mines	0.5385
30090	Old Mines	0.4253
30312	Old Mines	0.4924
30412	Old Mines	0.8368
30412 [5]	Old Mines	--
30513	Old Mines	0.5546
30541	Old Mines	0.4102
30924	Old Mines	0.3717
30924 [6]	Old Mines	0.5131
123	Potosi	0.3584
555	Potosi	0.6992
20332	Potosi	0.5777
20425	Potosi	0.5168
20435	Potosi	0.5077
20459	Potosi	0.3530
20517	Potosi	0.8998
20594	Potosi	0.4929
20594 [1]	Potosi	0.4793
20613	Potosi	0.1730
20868	Potosi	0.7228
23428	Potosi	0.5311
23428 [1]	Potosi	0.5333
24019	Potosi	0.3086
24055	Potosi	0.4735
24055 [7]	Potosi	0.2503
24080	Potosi	0.4085
636	Furnace Creek	0.4708

National Drinking Water Regulations MCL for TOC: NA
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Softened
3: Unsoftened
4: Unsoftened, unfiltered
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.4.3
Pilot Program for Selection of POU Devices
Analytical Results for Turbidity

Property ID	Property Location	Turbidity NTU
20158	Richwoods	0.11
40015	Richwoods	0.10
40034	Richwoods	0.11
40140	Richwoods	0.12
40140 [1]	Richwoods	0.12
40159 [2]	Richwoods	0.13
40159 [3]	Richwoods	0.17
40159 [4]	Richwoods	--
20199	Old Mines	0.13
30090	Old Mines	0.20
30312	Old Mines	0.19
30412	Old Mines	0.16
30412 [5]	Old Mines	--
30513	Old Mines	0.14
30541	Old Mines	0.17
30924	Old Mines	0.16
30924 [6]	Old Mines	0.32
123	Potosi	0.13
555	Potosi	0.13
20332	Potosi	0.18
20425	Potosi	0.11
20435	Potosi	0.16
20459	Potosi	1.95
20517	Potosi	0.17
20594	Potosi	0.39
20594 [1]	Potosi	0.34
20613	Potosi	0.09
20868	Potosi	0.19
23428	Potosi	0.11
23428 [1]	Potosi	0.13
24019	Potosi	0.18
24055	Potosi	0.14
24055 [7]	Potosi	0.11
24080	Potosi	0.15
636	Furnace Creek	0.15

National Drinking Water Regulations MCL for Turbidity: NA
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Softened
3: Unsoftened
4: Unsoftened, unfiltered
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.5
Pilot Program for Selection of POU Devices
Analytical Results for E-Coli

Property ID	Property Location	E-Coli	E-Coli (Duplicate)
		e-coli per 100 mL	
20158	Richwoods	0	0
40015	Richwoods	0	0
40034	Richwoods	0	0
40140	Richwoods	0	0
40140 [1]	Richwoods	0	0
40159 [2]	Richwoods	0	0
40159 [3]	Richwoods	0	0
40159 [4]	Richwoods	--	--
20199	Old Mines	0	0
30090	Old Mines	0	0
30312	Old Mines	0	0
30412	Old Mines	0	0
30412 [5]	Old Mines	--	--
30513	Old Mines	0	0
30541	Old Mines	0	0
30924	Old Mines	0	0
30924 [6]	Old Mines	0	0
123	Potosi	0	0
555	Potosi	0	0
20332	Potosi	0	0
20425	Potosi	**70**	**20**
20435	Potosi	0	0
20459	Potosi	0	0
20517	Potosi	**5**	0
20594	Potosi	0	0
20594 [1]	Potosi	0	0
20613	Potosi	0	0
20868	Potosi	0	0
23428	Potosi	0	0
23428 [1]	Potosi	0	0
24019	Potosi	0	0
24055	Potosi	0	0
24055 [7]	Potosi	0	0
24080	Potosi	0	0
636	Furnace Creek	0	0

National Drinking Water Regulations MCL for e-coli: 0
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Softened
3: Unsoftened
4: Unsoftened, unfiltered
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 3.6.1
Pilot Program for Selection of POU Devices
Analytical Results for Metals, Comparison to Region 7 Analytical Results (µg/L)

Property ID	Property Location		Dissolved Metals (Faucet)				Total Metals (Faucet)				National Drinking Water Regulations MCL
		Event ID:	POU Pilot Study		Region 7 Samples		POU Pilot Study		Region 7 Samples		
		Analysis:	ICP *		ICP/MS		ICP *		ICP/MS		
		Analyte	Purged	Unpurged	Purged	Unpurged	Purged	Unpurged	Purged	Unpurged	
30412	Old Mines	Lead	<0.2	<0.2	<1	<1.11	<0.2	<0.2	<1	<1	15
30412 [1]	Old Mines	Lead	11	--	**17.4**	--	**17**	--	--	--	
20613	Potosi	Lead	7	13	8.73	10.6	10	11	9.46	11.3	
24055	Potosi	Lead	**40**	**45**	**44.2**	**46.1**	**47**	**41**	**44.3**	**46**	
636	Furnace Creek	Lead	**48**	**48**	**51.7**	**49.2**	**48**	**69**	**54.2**	**52.6**	
30412	Old Mines	Arsenic	<0.2	<0.2	<1	<1	<0.2	<0.2	<1	<1	10
30412 [1]	Old Mines	Arsenic	<0.2	--	<1	--	<0.2	--	--	--	
20613	Potosi	Arsenic	<0.2	<0.2	<1	<1	<0.2	<0.2	<1	<1	
24055	Potosi	Arsenic	<0.2	<0.2	<1	<1	<0.2	<0.2	<1	<1	
636	Furnace Creek	Arsenic	<0.2	<0.2	<1	<1	<0.2	<0.2	<1	<1	
30412	Old Mines	Barium	1	1	<10	<10	1	2	<10	<10	2000
30412 [1]	Old Mines	Barium	53	--	53	--	53	--	--	--	
20613	Potosi	Barium	463	488	477	504	467	489	504	510	
24055	Potosi	Barium	1185	1187	1230	1240	1181	1179	1220	1260	
636	Furnace Creek	Barium	448	436	459	453	445	434	479	473	
30412	Old Mines	Cadmium	<0.4	<0.4	<1	<1	<0.4	<0.4	<1	<1	5
30412 [1]	Old Mines	Cadmium	<0.4	--	<1	--	<0.4	--	--	--	
20613	Potosi	Cadmium	<0.4	<0.4	<1	<1	<0.4	<0.4	<1	<1	
24055	Potosi	Cadmium	<0.4	<0.4	1.08	1.11	<0.4	<0.4	1.07	1.18	
636	Furnace Creek	Cadmium	<0.4	<0.4	<1	<1	<0.4	<0.4	<1	<1	
30412	Old Mines	Antimony	4	4	<2	<2	4	5	<2	<2	6
30412 [1]	Old Mines	Antimony	6	--	<2	--	5	--	--	--	
20613	Potosi	Antimony	<2.1	<2.1	<2	<2	<2.1	2	<2	<2	
24055	Potosi	Antimony	<2.1	<2.1	<2	<2	<2.1	<2.1	<2	<2	
636	Furnace Creek	Antimony	<2.1	<2.1	<2	<2	<2.1	<2.1	<2	<2	
30412	Old Mines	Manganese	<0.5	<0.5	<1	<1	<0.5	<0.5	<1	<1	50
30412 [1]	Old Mines	Manganese	9	--	8.97	--	8	--	--	--	
20613	Potosi	Manganese	1	1	<1	<1	1	1	<1	<1	
24055	Potosi	Manganese	1	1	<1	<1	1	1	<1	<1	
636	Furnace Creek	Manganese	1	<0.5	<1	<1	1	<0.5	<1	<1	
30412	Old Mines	Thallium	<1.8	<1.8	<1	<1	<1.8	<1.8	<1	<1	6
30412 [1]	Old Mines	Thallium	<1.8	--	<1		<1.8	--	--	--	
20613	Potosi	Thallium	<1.8	<1.8	<1	<1	<1.8	<1.8	<1	<1	
24055	Potosi	Thallium	<1.8	<1.8	<1	<1	<1.8	<1.8	<1	<1	
636	Furnace Creek	Thallium	<1.8	<1.8	<1	<1	<1.8	<1.8	<1	<1	

*: Lead analysis by AA
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Samples taken from the outside faucet

Table 3.6.2
Pilot Program for Selection of POU Devices
QA/QC (µg/L)

Property ID	Property Location	Sample Number	Faucet or Tap	Analysis:	ICP		ICP/MS		AA		MCL
				Analyte	Total Metals		Total Metals		Total Metals		
					Purged	Unpurged	Purged	Unpurged	Purged	Unpurged	
20199	Old Mines	ORD-150	Faucet	Lead	--	**43**	--	**15**	--	14	15
30541	Old Mines	ORD-140	Faucet	Lead	--	**87**	--	**51**	--	**36**	
123	Potosi	ORD-14	Tap	Lead	**26**	--	<5.0	--	<0.2	--	
555	Potosi	ORD-103	Faucet	Lead	**78**	--	**77**	--	**80**	--	
24055	Potosi	ORD-11	Tap	Lead	--	**26**	--	0.38	--	<0.2	
20199	Old Mines	ORD-150	Faucet	Arsenic	--	<5.0	--	<5.0	--	ND	10
30541	Old Mines	ORD-140	Faucet	Arsenic	--	<5.0	--	<5.0	--	ND	
123	Potosi	ORD-14	Tap	Arsenic	<5.0	--	<5.0	--	ND	--	
555	Potosi	ORD-103	Faucet	Arsenic	<5.0	--	<5.0	--	ND	--	
24055	Potosi	ORD-11	Tap	Arsenic	--	<5.0	--	<5.0	--	ND	
20199	Old Mines	ORD-150	Faucet	Barium	--	**2140**	--	1900	--	--	2000
30541	Old Mines	ORD-140	Faucet	Barium	--	803	--	780	--	--	
123	Potosi	ORD-14	Tap	Barium	15	--	12	--	--	--	
555	Potosi	ORD-103	Faucet	Barium	1430	--	1300	--	--	--	
24055	Potosi	ORD-11	Tap	Barium	--	892	--	839	--	--	
20199	Old Mines	ORD-150	Faucet	Cadmium	--	<0.20	--	0.62	--	--	5
30541	Old Mines	ORD-140	Faucet	Cadmium	--	<0.20	--	0.45	--	--	
123	Potosi	ORD-14	Tap	Cadmium	<0.20	--	0.096	--	--	--	
555	Potosi	ORD-103	Faucet	Cadmium	1	--	0.071	--	--	--	
24055	Potosi	ORD-11	Tap	Cadmium	--	<0.20	--	0.35	--	--	
20199	Old Mines	ORD-150	Faucet	Antimony	--	<5.0	--	0.092	--	--	6
30541	Old Mines	ORD-140	Faucet	Antimony	--	<5.0	--	0.09	--	--	
123	Potosi	ORD-14	Tap	Antimony	<5.0	--	0.12	--	--	--	
555	Potosi	ORD-103	Faucet	Antimony	<5.0	--	0.12	--	--	--	
24055	Potosi	ORD-11	Tap	Antimony	--	<5.0	--	0.2	--	--	
20199	Old Mines	ORD-150	Faucet	Iron	--	<80	--	32	--	--	300
30541	Old Mines	ORD-140	Faucet	Iron	--	2	--	34	--	--	
123	Potosi	ORD-14	Tap	Iron	2	--	45	--	--	--	
555	Potosi	ORD-103	Faucet	Iron	<80	--	34	--	--	--	
24055	Potosi	ORD-11	Tap	Iron	--	3	--	47	--	--	
20199	Old Mines	ORD-150	Faucet	Manganese	--	<5.0	--	0.38	--	--	50
30541	Old Mines	ORD-140	Faucet	Manganese	--	2	--	<5.0	--	--	
123	Potosi	ORD-14	Tap	Manganese	<5.0	--	<5.0	--	--	--	
555	Potosi	ORD-103	Faucet	Manganese	19	--	<5.0	--	--	--	
24055	Potosi	ORD-11	Tap	Manganese	--	1	--	<5.0	--	--	
20199	Old Mines	ORD-150	Faucet	Thallium	--	<1.0	--	<1.0	--	--	2
30541	Old Mines	ORD-140	Faucet	Thallium	--	<1.0	--	<1.0	--	--	
123	Potosi	ORD-14	Tap	Thallium	<1.0	--	0.15	--	--	--	
555	Potosi	ORD-103	Faucet	Thallium	<1.0	--	0.1	--	--	--	
24055	Potosi	ORD-11	Tap	Thallium	--	<1.0	--	0.48	--	--	

--: Sample Not Analyzed
<2.0: Non-Detect, Sample is less than the Reporting Limit
ND: Non-Detect
20: Sample exceeds the MCL

Table 3.7.1
Pilot Program for Selection of POU Devices Comparison to Historic Data
Analytical Results for Lead (µg/L)

Property ID	Property Location		Dissolved Metals (Faucet)			Total Metals (Faucet)						Dissolved Metals (Tap)		Total Metals (Tap)						
		Event ID:	POU Pilot Study		1	POU Pilot Study		091305_121705	2	1	Carbon Filter	POU Pilot Study		POU Pilot Study		Carbon Filter				
		Analysis:	AA		ICP/MS	AA		ICP/MS	ICP	ICP/MS	ICP/MS	AA		AA		ICP/MS				
		Year:	2009		2006	2009		2005	2005	2006-2007	2008	2009		2009		2008	2008	2008	2008	2009
		Analyte	Purged	Unpurged	Purged	Purged	Unpurged	Purged	Purged	Purged	Purged	Purged	Unpurged	Purged	Unpurged	Purged (2008)	Purged [8]	Unpurged	Unpurged [8]	
20158	Richwoods	Lead	37	40	31.2	39	36	--	--	28.4 **/ 33.3	--	--	--	--	--	--	--	--	--	--
40015	Richwoods	Lead	<0.2	<0.2	--	<0.2	<0.2	--	--	23.4	--	<0.2	1	<0.2	<0.2	--	--	--	--	1
40034	Richwoods	Lead	8	9	10.3	7	12	--	--	32.8	--	--	--	--	--	--	--	--	--	--
40140	Richwoods	Lead	25	22	--	22	23	--	--	25.2	--	--	--	--	--	--	--	--	--	--
40140 [1]	Richwoods	Lead	23	--	--	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--
40159	Richwoods	Lead	--	<0.2	--	--	<0.2	--	--	39.6	--	--	--	--	--	--	--	--	--	--
40159 [2]	Richwoods	Lead	<0.2	--	--	<0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
40159 [3]	Richwoods	Lead	<0.2	--	--	<0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
40159 [4]	Richwoods	Lead	<0.2	--	--	<0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
20199	Old Mines	Lead	14	14	--	15	14	15.2	--	--	--	--	--	--	--	--	--	--	--	--
30090	Old Mines	Lead	20	21	23.4	22	19	--	--	21.4	--	--	--	--	--	--	--	--	--	--
30312	Old Mines	Lead	35	32	18	35	33	--	--	18.9	--	--	--	--	--	--	--	--	--	--
30412	Old Mines	Lead	<0.2	<0.2	--	<0.2	<0.2	--	--	23.5	--	--	--	--	--	--	--	--	--	--
30412 [5]	Old Mines	Lead	11	--	--	17	--	--	--	--	--	--	--	--	--	--	--	--	--	--
30513	Old Mines	Lead	25	28	--	26	28	--	--	25.5	--	--	--	--	--	--	--	--	--	--
30541	Old Mines	Lead	34	36	--	36	37	--	--	52.8/ 68.8 [1]	--	--	--	--	--	--	--	--	--	--
30924	Old Mines	Lead	3	3	--	2	6	--	--	7.95	--	--	--	--	--	--	--	--	--	--
30924 [6]	Old Mines	Lead	7	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
123	Potosi	Lead	27	29	--	32	43	--	43.7	--	59.6	<0.2	3	<0.2	2	1	1	1	1	2.3
555	Potosi	Lead	80	86	--	91	87	--	92.8	--	--	<0.2	<0.2	<0.2	2	1	--	1	--	--
20332	Potosi	Lead	21	32	--	28	32	17.2	--	--	--	--	--	--	--	--	--	--	--	--
20425	Potosi	Lead	14	15	--	16	18	16.9	--	--	--	--	--	--	--	--	--	--	--	--
20435	Potosi	Lead	27	23	--	35	23	38.2	--	--	--	--	--	--	--	--	--	--	--	--
20459	Potosi	Lead	10	0.2	--	5	4	73.7	--	--	--	--	--	--	--	--	--	--	--	--
20517	Potosi	Lead	34	34	--	37	40	44.2	--	--	--	--	--	--	--	--	--	--	--	--
20594	Potosi	Lead	77	72	--	76	63	83.9	--	--	--	<0.2	2	<0.2	<0.2	1	1	1.49	1.1	1.3
20594 [1]	Potosi	Lead	59	53	--	55	48	--	--	--	--	<0.2	<0.2	<0.2	2	--	--	--	--	--
20613	Potosi	Lead	7	13	--	10	11	110	--	--	--	<0.2	<0.2	<0.2	<0.2	1	1	1	1	1
20868	Potosi	Lead	38	54	--	45	29	--	--	31.7	--	<0.2	<0.2	<0.2	<0.2	1	1	1	1	1
23428	Potosi	Lead	32	41	--	30	36	--	--	30.5	--	--	--	--	--	--	--	--	--	--
23428 [1]	Potosi	Lead	30	--	--	31	--	--	--	--	--	--	--	--	--	--	--	--	--	--
24019	Potosi	Lead	62	61	--	99	66	--	--	48	--	<0.2	<0.2	<0.2	1	1	1	1.28	1	1
24055	Potosi	Lead	40	45	--	47	41	--	--	47.2	--	1	1	<0.2	<0.2	1	1.1	1	1	1.8
24055 [7]	Potosi	Lead	<0.2	--	--	<0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
24080	Potosi	Lead	25	29	--	29	29	--	--	37.9	--	--	--	--	--	--	--	--	--	--
636	Furnace Creek	Lead	48	48	--	48	69	--	--	--	--	--	--	--	--	--	--	--	--	--

National Drinking Water Regulations MCL for Lead: 15
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank
8: Region 7 EPA Laboratory
**: Metals by ICP
Events presented include all available historic data related to the 27 Property IDs sampled during the POU Pilot Study.

Table 3.7.2
Pilot Program for Selection of POU Devices Comparison to Historic Data
Analytical Results for Arsenic (µg/L)

Property ID	Property Location		Dissolved Metals (Faucet)			Total Metals (Faucet)				Dissolved Metals (Tap)		Total Metals (Tap)	
		Event ID:	POU Pilot Study		1	POU Pilot Study		091305_121705	1	POU Pilot Study		POU Pilot Study	
		Analysis:	ICP		ICP/MS	ICP		ICP/MS	ICP/MS	ICP		ICP	
		Year:	2009		2006	2009		2005	2006-2007	2009		2009	
		Analyte	Purged	Unpurged	Purged	Purged	Unpurged	Purged	Purged	Tap Purged	Tap Unpurged	Tap Purged	Tap Unpurged
20158	Richwoods	Arsenic	<0.2	<0.2	1	<0.2	<0.2	--	10**/1	--	--	--	--
40015	Richwoods	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	1	<0.2	<0.2	<0.2	<0.2
40034	Richwoods	Arsenic	<0.2	<0.2	1	<0.2	<0.2	--	1	--	--	--	--
40140	Richwoods	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	1	--	--	--	--
40140 [1]	Richwoods	Arsenic	<0.2	--	--	<0.2	--	--	--	--	--	--	--
40159	Richwoods	Arsenic	--	<0.2	--	--	<0.2	--	1	--	--	--	--
40159 [2]	Richwoods	Arsenic	<0.2	--	--	<0.2	--	--	--	--	--	--	--
40159 [3]	Richwoods	Arsenic	<0.2	--	--	<0.2	--	--	--	--	--	--	--
40159 [4]	Richwoods	Arsenic	<0.2	--	--	<0.2	--	--	--	--	--	--	--
20199	Old Mines	Arsenic	<0.2	<0.2	--	<0.2	<0.2	1	--	--	--	--	--
30090	Old Mines	Arsenic	<0.2	<0.2	1	<0.2	<0.2	--	1	--	--	--	--
30312	Old Mines	Arsenic	<0.2	<0.2	1	<0.2	<0.2	--	1	--	--	--	--
30412	Old Mines	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	2.15	--	--	--	--
30412 [3]	Old Mines	Arsenic	<0.2	--	--	<0.2	--	--	--	--	--	--	--
30513	Old Mines	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	1	--	--	--	--
30541	Old Mines	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	1/1 [1]	--	--	--	--
30924	Old Mines	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	1	--	--	--	--
30924 [6]	Old Mines	Arsenic	<0.2	--	--	2	--	--	--	--	--	--	--
123	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	--	<0.2	<0.2	<0.2	<0.2
555	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	--	<0.2	<0.2	<0.2	<0.2
20332	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	1	1	--	--	--	--
20425	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	1	1	--	--	--	--
20435	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	1	1	--	--	--	--
20459	Potosi	Arsenic	1	<0.2	--	<0.2	<0.2	1	1	--	--	--	--
20517	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	1	1	--	--	--	--
20594	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	1	1	<0.2	1	<0.2	<0.2
20594 [1]	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	--	<0.2	<0.2	<0.2	<0.2
20613	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	1	1	<0.2	<0.2	<0.2	<0.2
20868	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	--	1	<0.2	<0.2	<0.2
23428	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	--	--	--	--	--
23428 [1]	Potosi	Arsenic	<0.2	--	--	<0.2	--	--	--	--	--	--	--
24019	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	--	<0.2	<0.2	<0.2	<0.2
24055	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	--	<0.2	<0.2	<0.2	<0.2
24055 [1]	Potosi	Arsenic	<0.2	--	--	<0.2	--	--	--	--	--	--	--
24080	Potosi	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	--	--	--	--	--
636	Furnace Creek	Arsenic	<0.2	<0.2	--	<0.2	<0.2	--	--	--	--	--	--

National Drinking Water Regulations MCL for Barium: 2000
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
**: Metals by ICP
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank
8: Region 7 EPA Laboratory
Events presented include all historic data available related to the 27 Property IDs sampled during the POU Pilot Study

Table 3.7.3
Pilot Program for Selection of POU Devices Comparison to Historic Data
Analytical Results for Barium (µg/L)

Property ID	Property Location		Dissolved Metals (Faucet)			Total Metals (Faucet)						Dissolved Metals (Tap)		Total Metals (Tap)						
		Event ID:	POU Pilot Study		1	POU Pilot Study		091305_121705	2	1	Carbon Filter	POU Pilot Study		POU Pilot Study		Carbon Filter				
		Analysis:	ICP		ICP/MS	ICP		ICP/MS	ICP	ICP/MS	ICP/MS	ICP		ICP		ICP/MS				
		Year:	2009		2006	2009		2005	2005	2006-2007	2008	2009		2009		2008	2008	2008	2008	2009
		Analyte	Purged	Unpurged	Purged	Purged	Unpurged	Purged	Purged	Purged	Purged	Tap Purged	Tap Unpurged	Tap Purged	Tap Unpurged	Purged	Purged [8]	Unpurged	Unpurged [8]	
20158	Richwoods	Barium	999	996	993	992	994	--	--	980**/1010	--	--	--	--	--	--	--		--	--
40015	Richwoods	Barium	59	56	--	59	59	--	--	71.4	--	13	9	13	9	--	--		--	32.8
40034	Richwoods	Barium	463	466	425	463	444	--	--	436	--	--	--	--	--	--	--		--	--
40140	Richwoods	Barium	1748	1751	--	1745	1755	--	--	1790	--	--	--	--	--	--	--		--	--
40140 [1]	Richwoods	Barium	1757		--	1723		--	--	--	--	--	--	--	--	--	--		--	--
40159	Richwoods	Barium	--	<0.2	--	--	<0.2	--	--	783	--	--	--	--	--	--	--		--	--
40159 [2]	Richwoods	Barium	<0.2	--	--	<0.2	--	--	--	--	--	--	--	--	--	--	--		--	--
40159 [3]	Richwoods	Barium	520	--	--	520	--	--	--	--	--	--	--	--	--	--	--		--	--
40159 [4]	Richwoods	Barium	445	--	--	439	--	--	--	--	--	--	--	--	--	--	--		--	--
20199	Old Mines	Barium	**2127**	**2145**	--	**2122**	**2140**	1770	--	--	--	--	--	--	--	--	--		--	--
30090	Old Mines	Barium	1087	1154	1070	1092	1109	--	--	984	--	--	--	--	--	--	--		--	--
30312	Old Mines	Barium	406	409	817	415	412	--	--	863	--	--	--	--	--	--	--		--	--
30412	Old Mines	Barium	1	1	--	1	2	--	--	50.3	--	--	--	--	--	--	--		--	--
30412 [5]	Old Mines	Barium	53	--	--	53	--	--	--	--	--	--	--	--	--	--	--		--	--
30513	Old Mines	Barium	234	242	--	231	247	--	--	217	--	--	--	--	--	--	--		--	--
30541	Old Mines	Barium	806	805	--	800	803	--	--	787	--	--	--	--	--	--	--		--	--
30924	Old Mines	Barium	1027	961	--	1032	953	--	--	311	--	--	--	--	--	--	--		--	--
30924 [6]	Old Mines	Barium	1043	--	--	1048	--	--	--	--	--	--	--	--	--	--	--		--	--
123	Potosi	Barium	391	450	--	394	455	--	442	--	394	15	5	15	5	52.8	58.9	10	28.9	83.4
555	Potosi	Barium	1430	1413	--	1425	1404	--	1400	--	--	532	406	536	432	602	--	464	--	--
20332	Potosi	Barium	395	400	--	392	398	887	--	--	--	--	--	--	--	--	--		--	--
20425	Potosi	Barium	181	177	--	183	183	486	--	--	--	--	--	--	--	--	--		--	--
20435	Potosi	Barium	131	131	--	133	131	118	--	--	--	--	--	--	--	--	--		--	--
20459	Potosi	Barium	11	11	--	10	11	30	--	--	--	--	--	--	--	--	--		--	--
20517	Potosi	Barium	208	203	--	207	206	265	--	--	--	--	--	--	--	--	--		--	--
20594	Potosi	Barium	233	233	--	229	238	650	--	--	--	94	37	93	38	101	318	41	244	339
20594 [1]	Potosi	Barium	232	241	--	229	240	--	--	--	--	93	36	91	38	--	--		--	--
20613	Potosi	Barium	463	488	--	467	489	511	--	--	--	166	63	167	59	142	320	88.3	355	308
20868	Potosi	Barium	86	92	--	90	92	--	--	74.7	--	29	27	28	27	10	12.4	10	12.1	50.6
23428	Potosi	Barium	277	273	--	277	272	--	--	303	--	--	--	--	--	--	--		--	--
23428 [1]	Potosi	Barium	279	--	--	276	--	--	--	--	--	--	--	--	--	--	--		--	--
24019	Potosi	Barium	244	244	--	244	243	--	--	623	--	9	6	9	7	10	5	10	5	5
24055	Potosi	Barium	1185	1187	--	1181	1179	--	--	1150	--	1002	892	989	875	395	964	558	895	968
24055 [7]	Potosi	Barium	4	--	--	4	--	--	--	--	--	--	--	--	--	--	--		--	--
24080	Potosi	Barium	1321	1307	--	1314	1306	--	--	1210	--	--	--	--	--	--	--		--	--
636	Furnace Creek	Barium	448	436	--	445	434	--	--	--	--	--	--	--	--	--	--		--	--

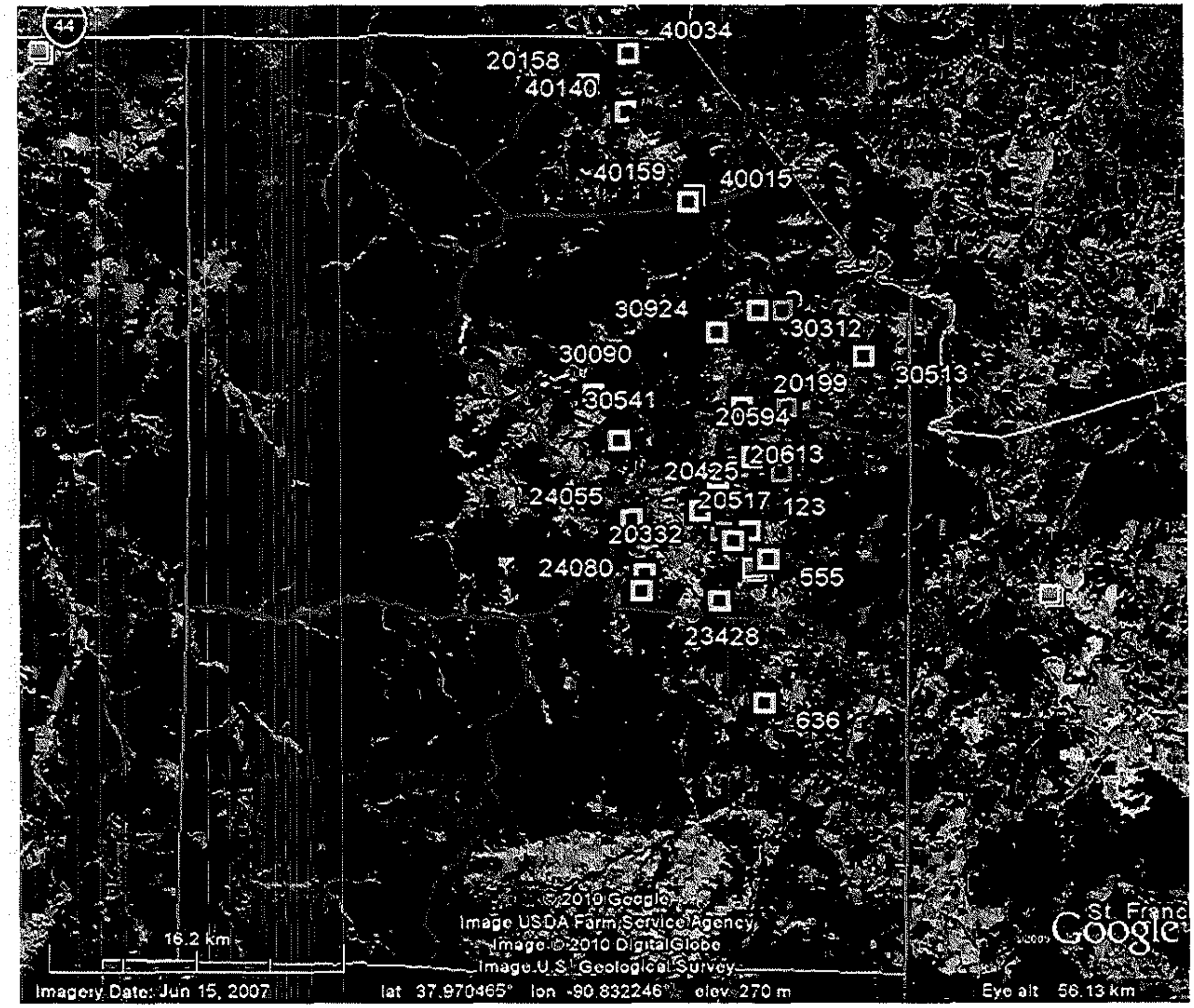
National Drinking Water Regulations MCL for Barium: 2000
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
**: Metals by ICP
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank
8: Region 7 EPA Laboratory
Events presented include all historic data available related to the 27 Property IDs sampled during the POU Pilot Study

Table 3.7.4
Pilot Program for Selection of POU Devices Comparison to Historic Data
Analytical Results for Cadmium (µg/L)

Property ID	Property Location		Dissolved Metals (Faucet)			Total Metals (Faucet)					Dissolved Metals (Tap)		Total Metals (Tap)						
		Event ID:	POU Pilot Study		1	POU Pilot Study		091305_121705	1	Carbon Filter	POU Pilot Study		POU Pilot Study		Carbon Filter				
		Analysis:	ICP		ICP/MS	ICP		ICP/MS	ICP/MS	ICP/MS	ICP		ICP		ICP/MS				
		Year:	2009		2006	2009		2005	2006-2007	2008	2009		2009		2008	2008	2008	2008	2009
		Analyte	Purged	Unpurged	Purged	Purged	Unpurged	Purged	Purged	Purged	Tap Purged	Tap Unpurged	Tap Purged	Tap Unpurged	Purged	Purged [8]	Unpurged	Unpurged [8]	
20158	Richwoods	Cadmium	<0.4	<0.4	1	<0.4	<0.4	--	5**/1	--	--	--	--	--	--	--	--	--	--
40015	Richwoods	Cadmium	<0.4	<0.4	--	<0.4	<0.4	--	1	--	<0.4	<0.4	<0.4	<0.4	--	--	--	--	1
40034	Richwoods	Cadmium	<0.4	<0.4	1	<0.4	<0.4	--	1	--	--	--	--	--	--	--	--	--	--
40140	Richwoods	Cadmium	<0.4	<0.4	--	<0.4	<0.4	--	1	--	--	--	--	--	--	--	--	--	--
40140 [1]	Richwoods	Cadmium	<0.4	--	--	<0.4	--	--		--	--	--	--	--	--	--	--	--	--
40159	Richwoods	Cadmium	--	<0.4	--	--	<0.4	--	1	--	--	--	--	--	--	--	--	--	--
40159 [2]	Richwoods	Cadmium	<0.4	--	--	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--
40159 [3]	Richwoods	Cadmium	<0.4	--	--	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--
40159 [4]	Richwoods	Cadmium	<0.4	--	--	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--
20199	Old Mines	Cadmium	<0.4	<0.4	--	<0.4	<0.4	1	--	--	--	--	--	--	--	--	--	--	--
30090	Old Mines	Cadmium	<0.4	<0.4	1.59	<0.4	<0.4	--	1.39	--	--	--	--	--	--	--	--	--	--
30312	Old Mines	Cadmium	<0.4	<0.4	1	<0.4	<0.4	--	1	--	--	--	--	--	--	--	--	--	--
30412	Old Mines	Cadmium	<0.4	<0.4	--	<0.4	<0.4	--	1	--	--	--	--	--	--	--	--	--	--
30412 [3]	Old Mines	Cadmium	<0.4	--	--	<0.4	--	--	--	--	--	--	--	--	--	--	--	--	--
30513	Old Mines	Cadmium	<0.4	<0.4	--	<0.4	<0.4	--	1	--	--	--	--	--	--	--	--	--	--
30541	Old Mines	Cadmium	<0.4	<0.4	--	<0.4	<0.4	--	1/1 [5]	--	--	--	--	--	--	--	--	--	--
30924	Old Mines	Cadmium	4	3	--	4	3	--	6.41	--	--	--	--	--	--	--	--	--	--
30924 [6]	Old Mines	Cadmium	3	--	--	3	--	--	--	--	--	--	--	--	--	--	--	--	--
123	Potosi	Cadmium	<0.4	<0.4	--	<0.4	1	--	--	2.13	<0.4	<0.4	<0.4	<0.4	1	1	1	1	1
555	Potosi	Cadmium	1	1	--	1	1	--	--	--	1	1	<0.4	1	1	--	1	--	--
20332	Potosi	Cadmium	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	--
20425	Potosi	Cadmium	1	1	--	1	1	1	--	--	--	--	--	--	--	--	--	--	--
20435	Potosi	Cadmium	6	6	--	6	5	7.58	--	--	--	--	--	--	--	--	--	--	--
20459	Potosi	Cadmium	2	2	--	2	1	1	--	--	--	--	--	--	--	--	--	--	--
20517	Potosi	Cadmium	<0.4	<0.4	--	<0.4	<0.4	2.69	--	--	--	--	--	--	--	--	--	--	--
20594	Potosi	Cadmium	1	1	--	1	1	2.42	--	--	1	1	<0.4	1	1	1	1	1	1
20594 [1]	Potosi	Cadmium	<0.4	3	--	1	1	--	--	--	<0.4	1	<0.4	1	--	--	--	--	--
20613	Potosi	Cadmium	<0.4	<0.4	--	<0.4	<0.4	1	--	--	<0.4	<0.4	<0.4	<0.4	1	1	1	1	1
20868	Potosi	Cadmium	1	1	--	1	2	--	1	--	1	1	<0.4	1	1	1	1	1	1
23428	Potosi	Cadmium	1	1	--	1	1	--	2.69	--	--	--	--	--	--	--	--	--	--
23428 [1]	Potosi	Cadmium	1	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--
24019	Potosi	Cadmium	<0.4	<0.4	--	<0.4	<0.4	--	1	--	2	1	<0.4	2	1	1	1	1	1
24055	Potosi	Cadmium	<0.4	<0.4	--	<0.4	<0.4	--	1	--	<0.4	<0.4	<0.4	<0.4	1	1	1	1	1
24055 [7]	Potosi	Cadmium	1	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--
24080	Potosi	Cadmium	<0.4	<0.4	--	<0.4	<0.4	--	2.98	--	--	--	--	--	--	--	--	--	--
636	Furnace Creek	Cadmium	<0.4	<0.4	--	<0.4	<0.4	--	--	--	--	--	--	--	--	--	--	--	--

National Drinking Water Regulations MCL for Cadmium: 5
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
**: Metals by ICP
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank
8: Region 7 EPA Laboratory
Events presented include all historic data available related to the 27 Property IDs sampled during the POU Pilot Study

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati OH	2/8/10	JS	JS	KB	KB	s-136277-2/10-w



Property sampled during Point of Use Study

Wells Above Arsenic MCL

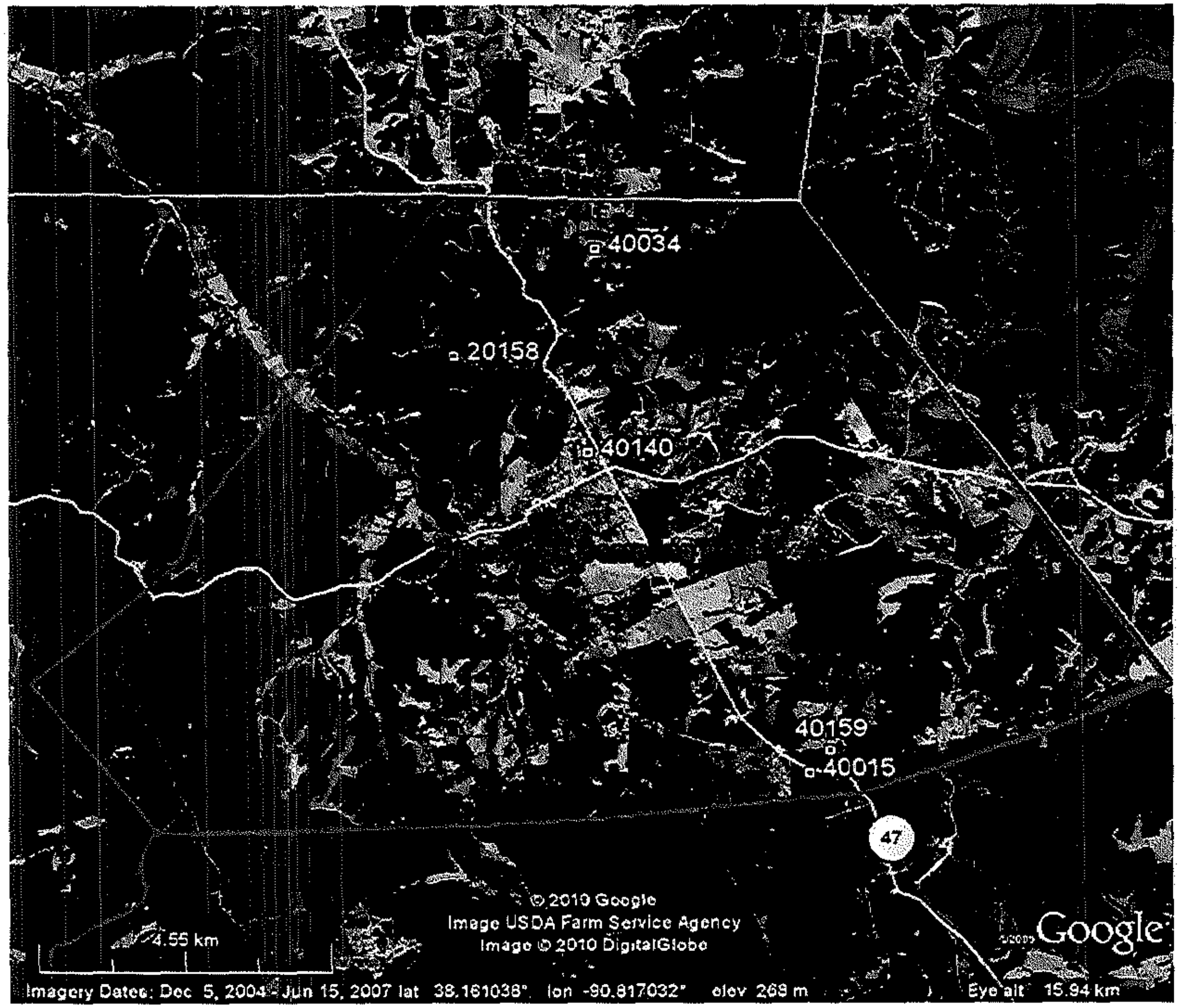
Shaw Environmental, Inc.

Figure 3-1a

Washington County Missouri
Wells with Arsenic Levels above the MCL
Washington County

GM-2
48/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/18/10	JS	JS	FB	RS	s-136277-2/10-w



N

Property sampled during Point of Use Study

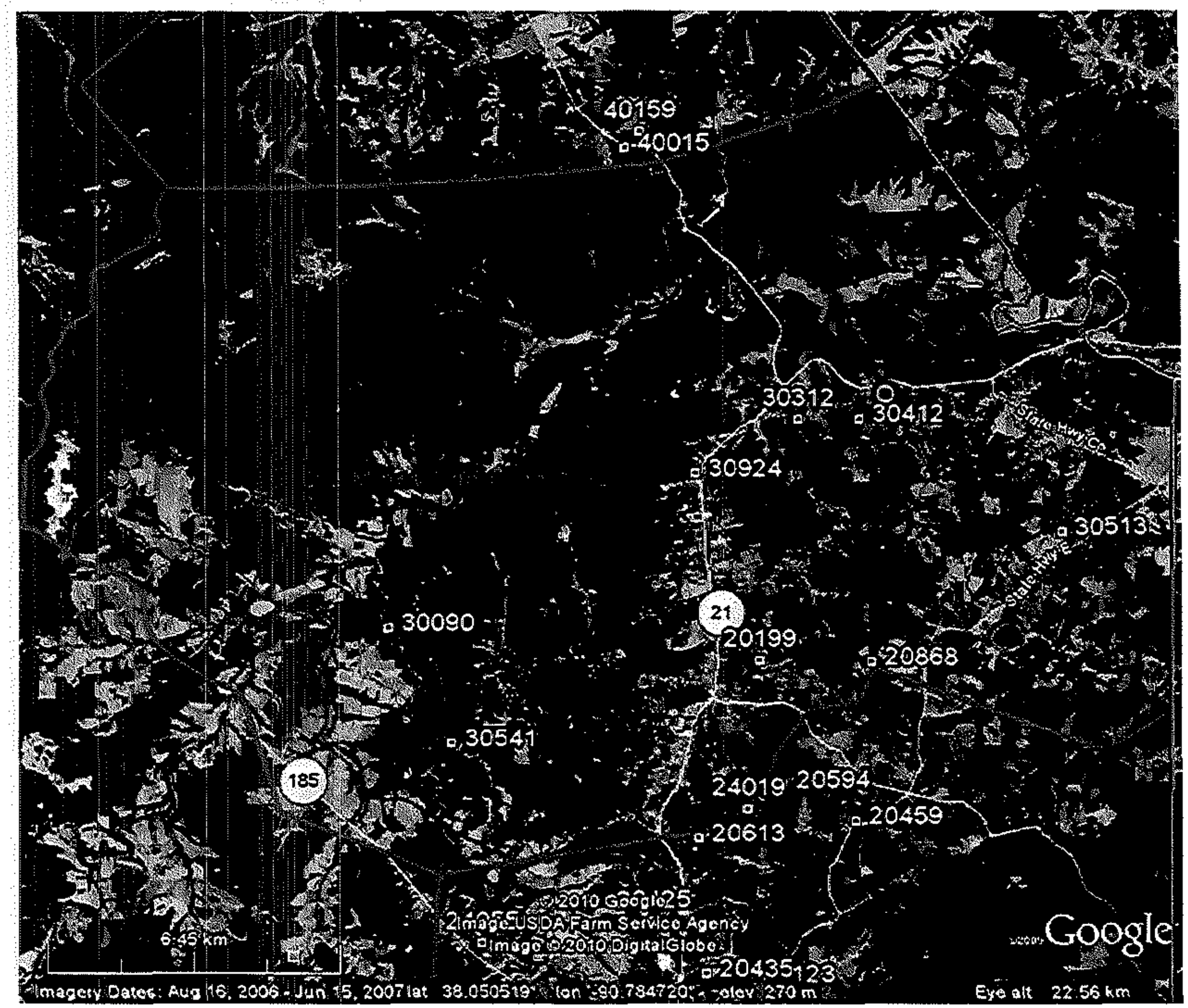
Wells Above Arsenic MCL

Shaw® Shaw Environmental, Inc.

Figure 3-1b

Washington County Missouri
Wells with Arsenic Levels above the MCL
Richwoods Sampling Area

GM-2
49/323



OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/10/10	JS	JS	KB	RS	s-136277-2/10-w

Property sampled during Point of Use Study

Wells Above Arsenic MCL

Shaw Environmental, Inc.

Figure 3-1c

Washington County Missouri
Wells with Arsenic Levels above the MCL
Old Mines Sampling Area

GM-2
50/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/18/10	JS	JS	KB	RS	s-136277-2/10-w

Property sampled during Point of Use Study

Wells Above Arsenic MCL

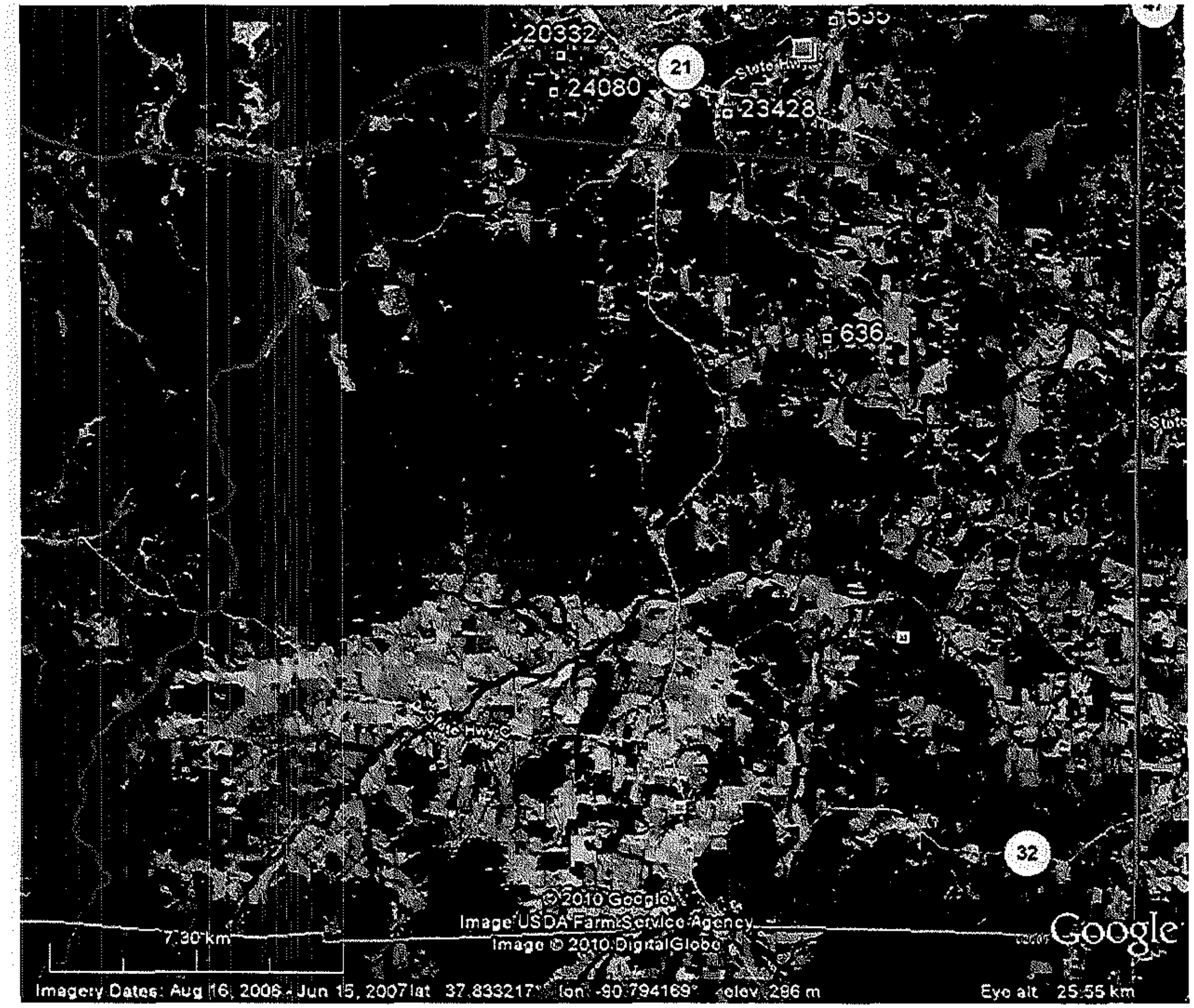
Shaw Environmental, Inc.

Figure 3-1d

Washington County Missouri
Wells with Arsenic Levels above the MCL
Potosi Sampling Area

GM-2
51/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati OH	2/3/10	JS	JS	KB	RS	s-136277-2/10-w



N

Property sampled during Point of Use Study

Wells Above Arsenic MCL

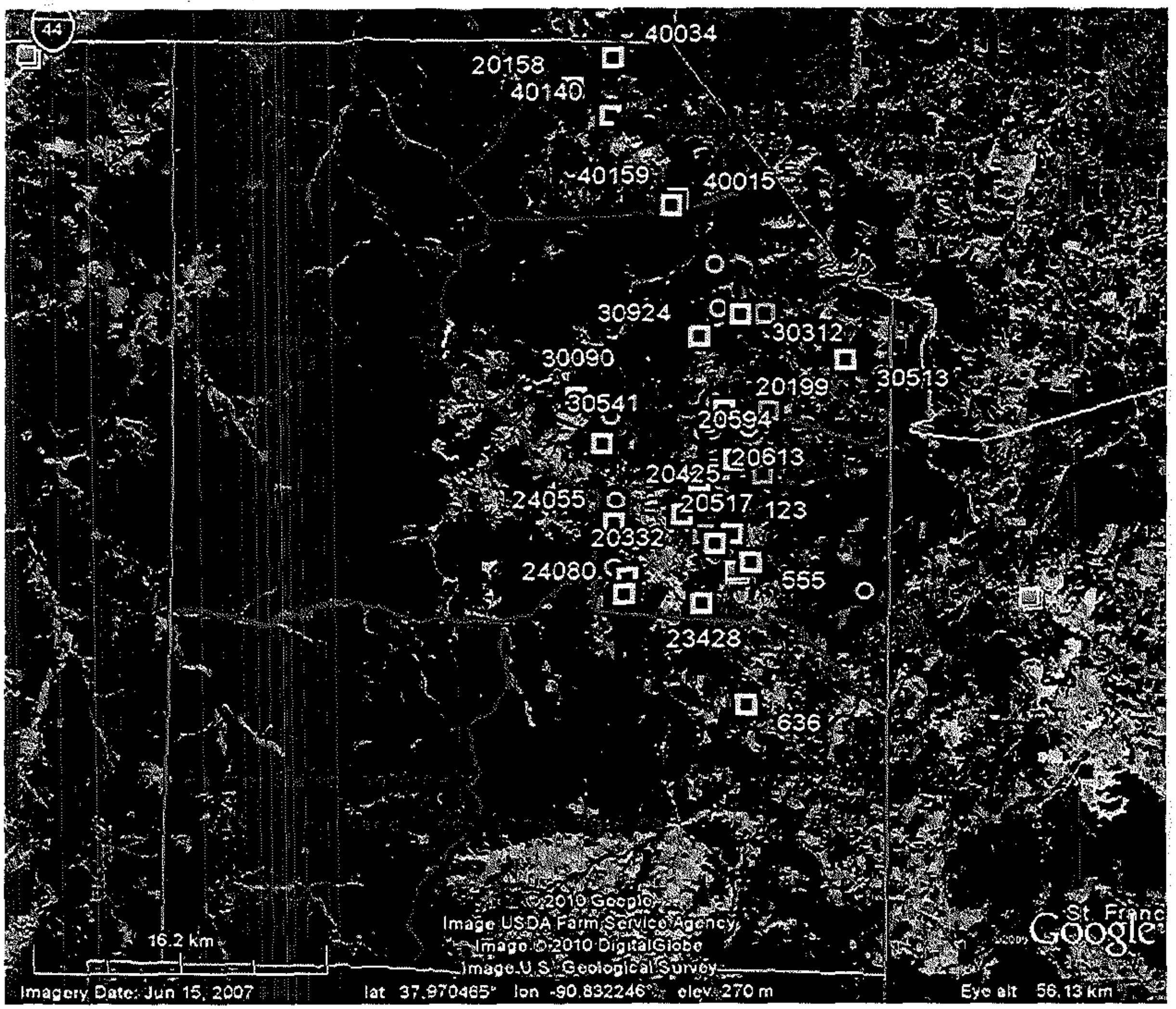
Shaw Environmental, Inc.

Figure 3-1e

Washington County Missouri
Wells with Arsenic Levels above the MCL
Furnace Creek Sampling Area

GM-2
52/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/5/10	JS	JS	KB	RS	s-136277-2/10-W



N

Property sampled during Point of Use Study

Wells Above Barium MCL

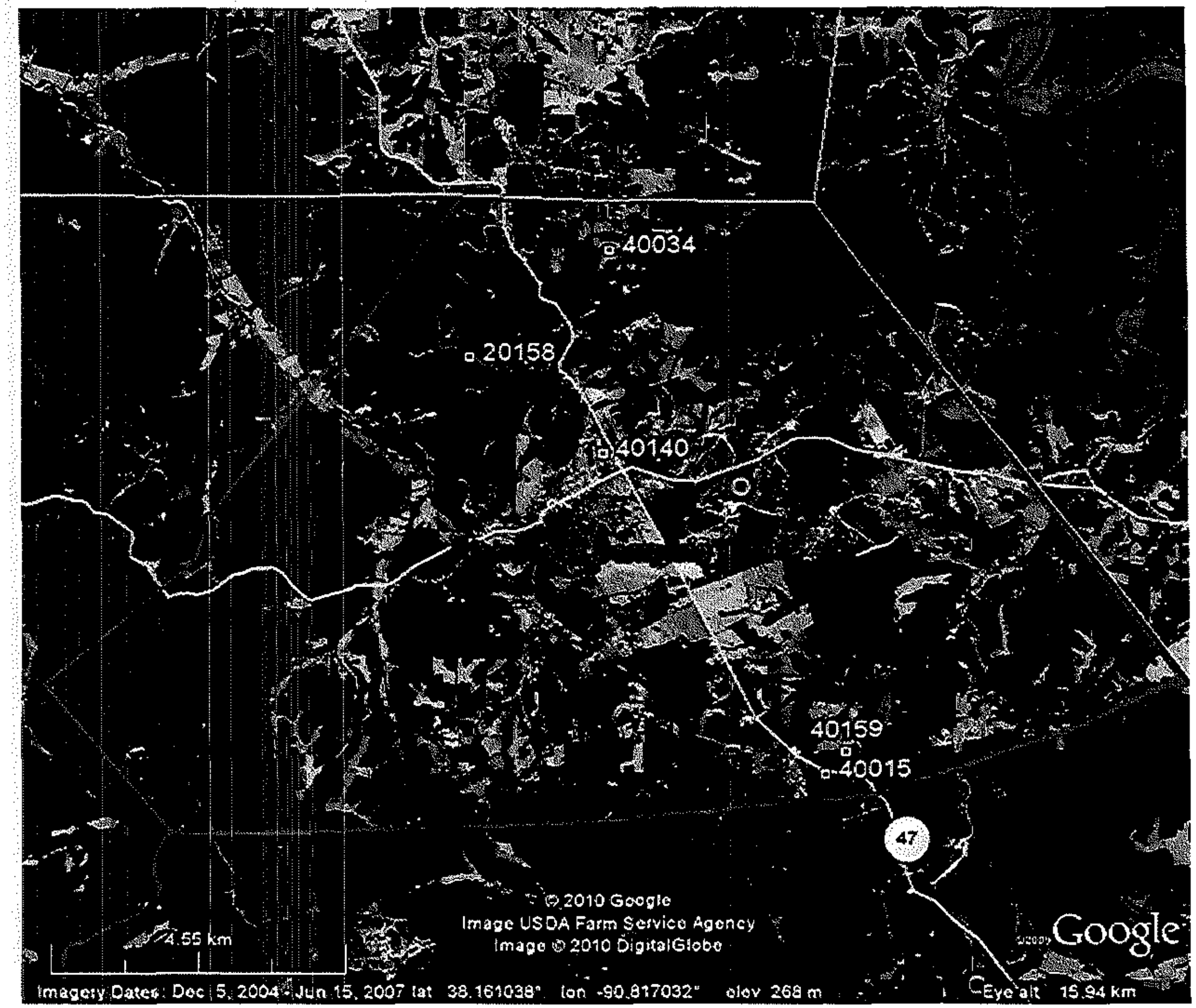
Shaw Environmental, Inc.

Figure 3-2a

Washington County Missouri
Wells with Barium Levels above the MCL
Washington County

GM-2
53/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/6/10	JS	JS	KB	KS	s-136277-2/10-w



N

Property sampled during Point of Use Study

Wells Above Barium MCL

Shaw Environmental, Inc.

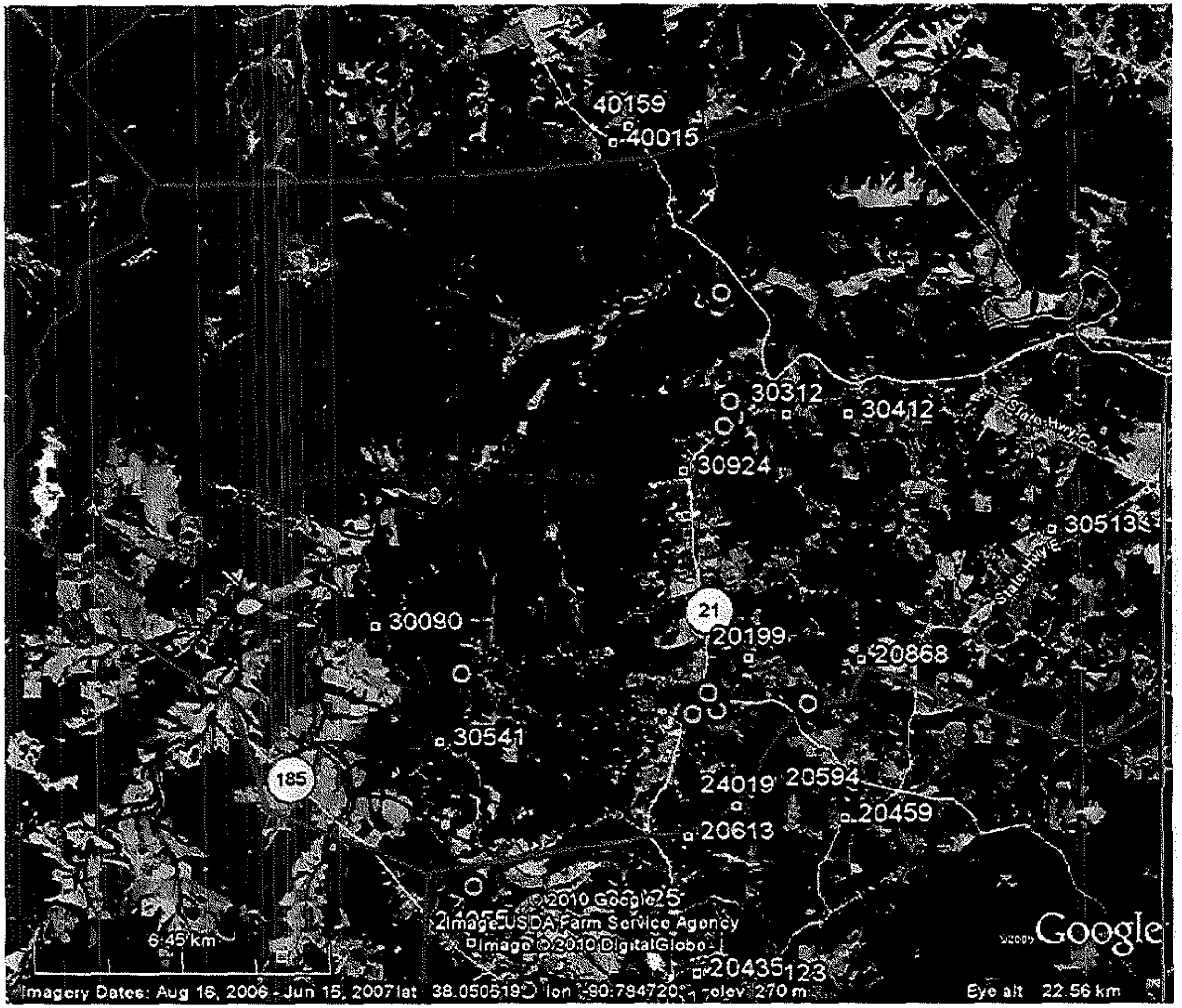
Figure 3-2b

Washington County Missouri
Wells with Barium Levels above the MCL
Richwoods Sampling Area

GM-2

54/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/8/10	JS	JS	KB	KS	s-136277-2/10-w



N

Property sampled during Point of Use Study

Wells Above Barium MCL

Shaw Environmental, Inc.

Figure 3-2c

Washington County Missouri
Wells with Barium Levels above the MCL
Old Mines Sampling Area

GM-2
55/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/16/10	JS	JS	RS	RS	s-136277-2/10-w

N

Property sampled during Point of Use Study

Wells Above Barium MCL

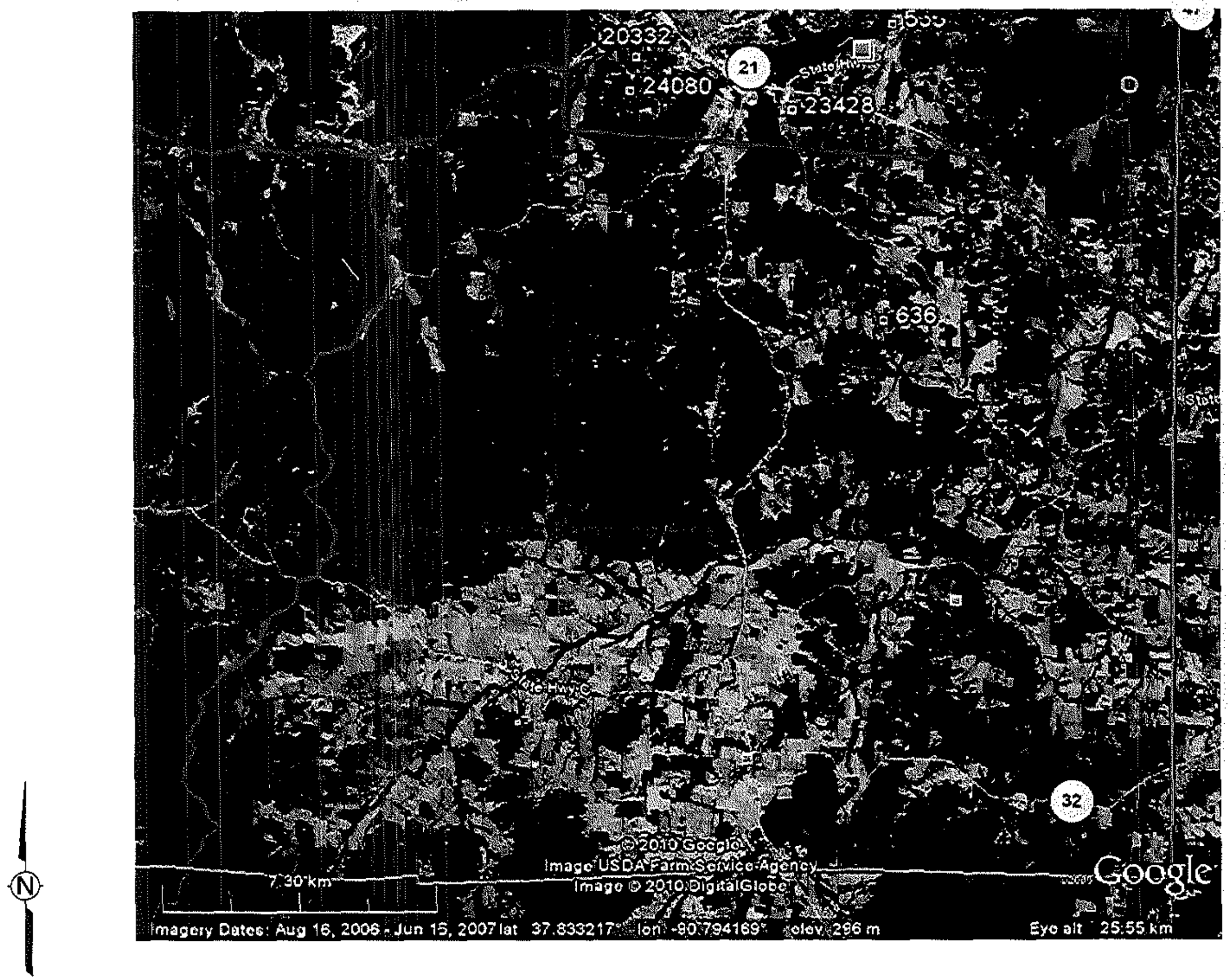
Shaw Environmental, Inc.

Figure 3-2d

Washington County Missouri
Wells with Barium Levels above the MCL
Potosi Sampling Area

GM-2
56/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/8/10	JS	JS	KB	KS	s-136277-2/10-w



Property sampled during Point of Use Study

Wells Above Barium MCL

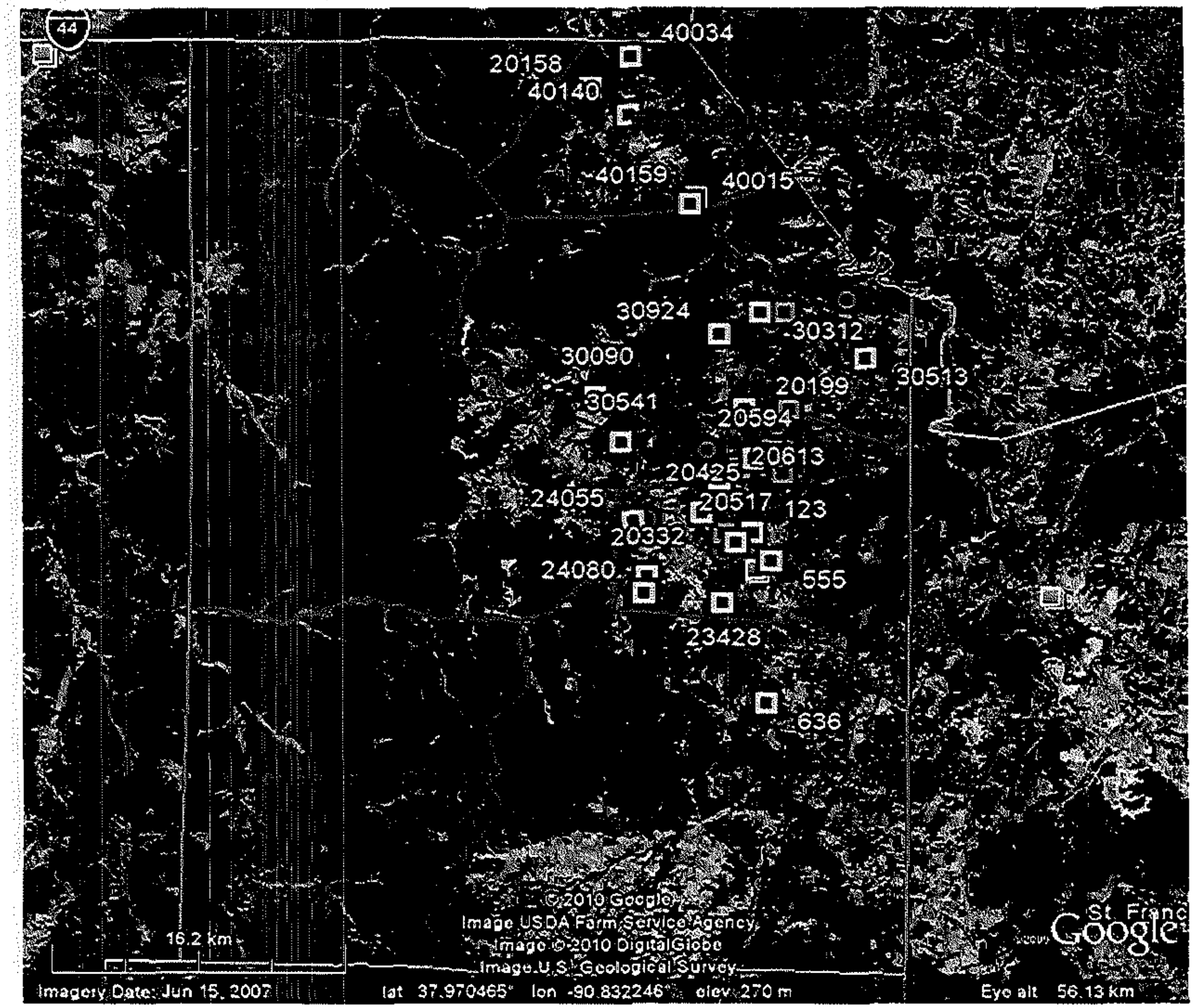
Shaw® Shaw Environmental, Inc.

Figure 3-2e

Washington County Missouri
Wells with Barium Levels above the MCL
Furnace Creek Sampling Area

GM-2
57/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/18/10	JS	JS	KB	RS	s-136277-2/10-w



N

Property sampled during Point of Use Study

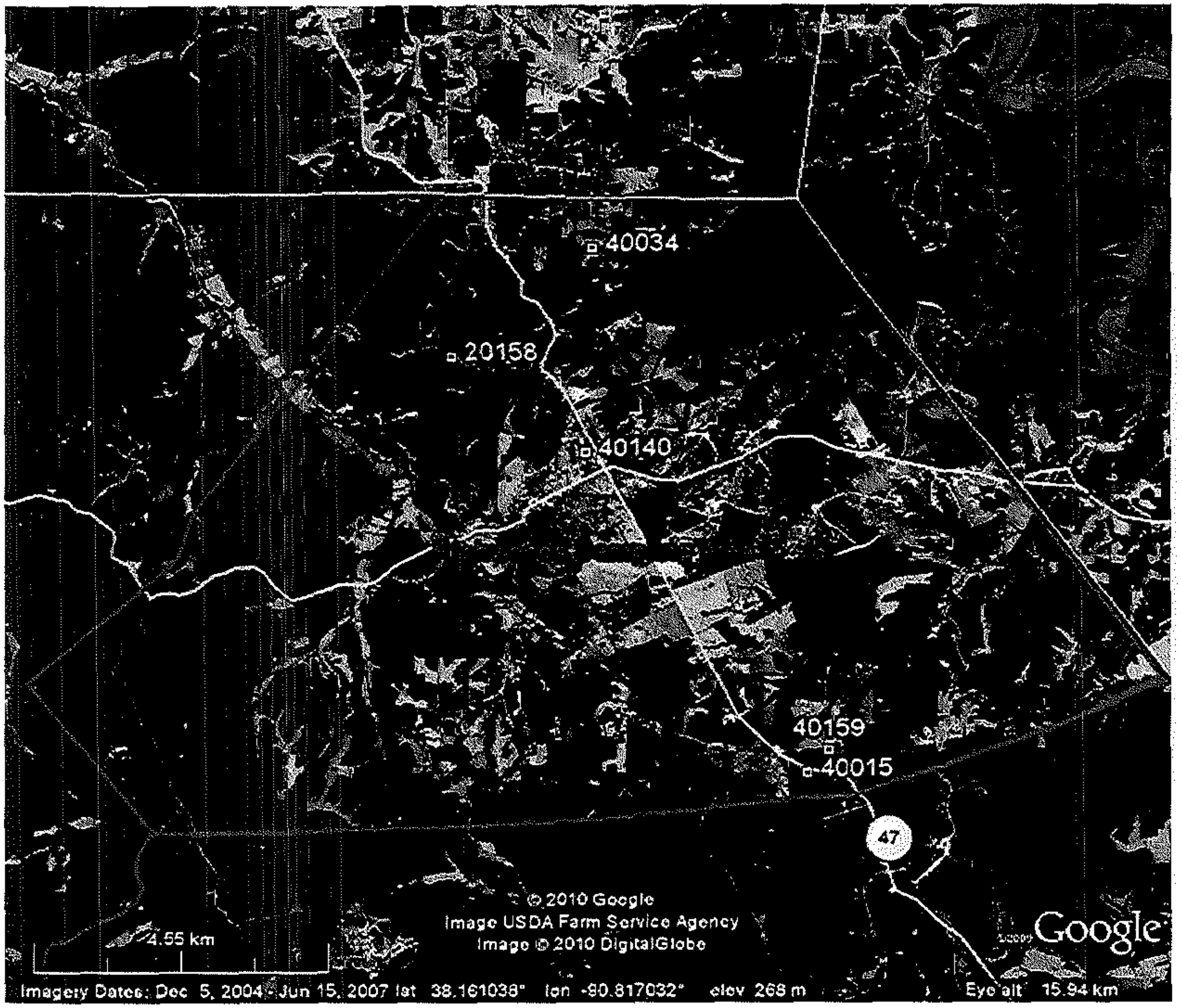
Wells Above Cadmium MCL

Shaw Shaw Environmental, Inc.

Figure 3-3a

Washington County Missouri
Wells with Cadmium Levels above the MCL
Washington County

GM-2
58/323



Property sampled during Point of Use Study

Wells Above Cadmium MCL

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/16/10	JS	JS	KB	ES	s-136277-2/10-w

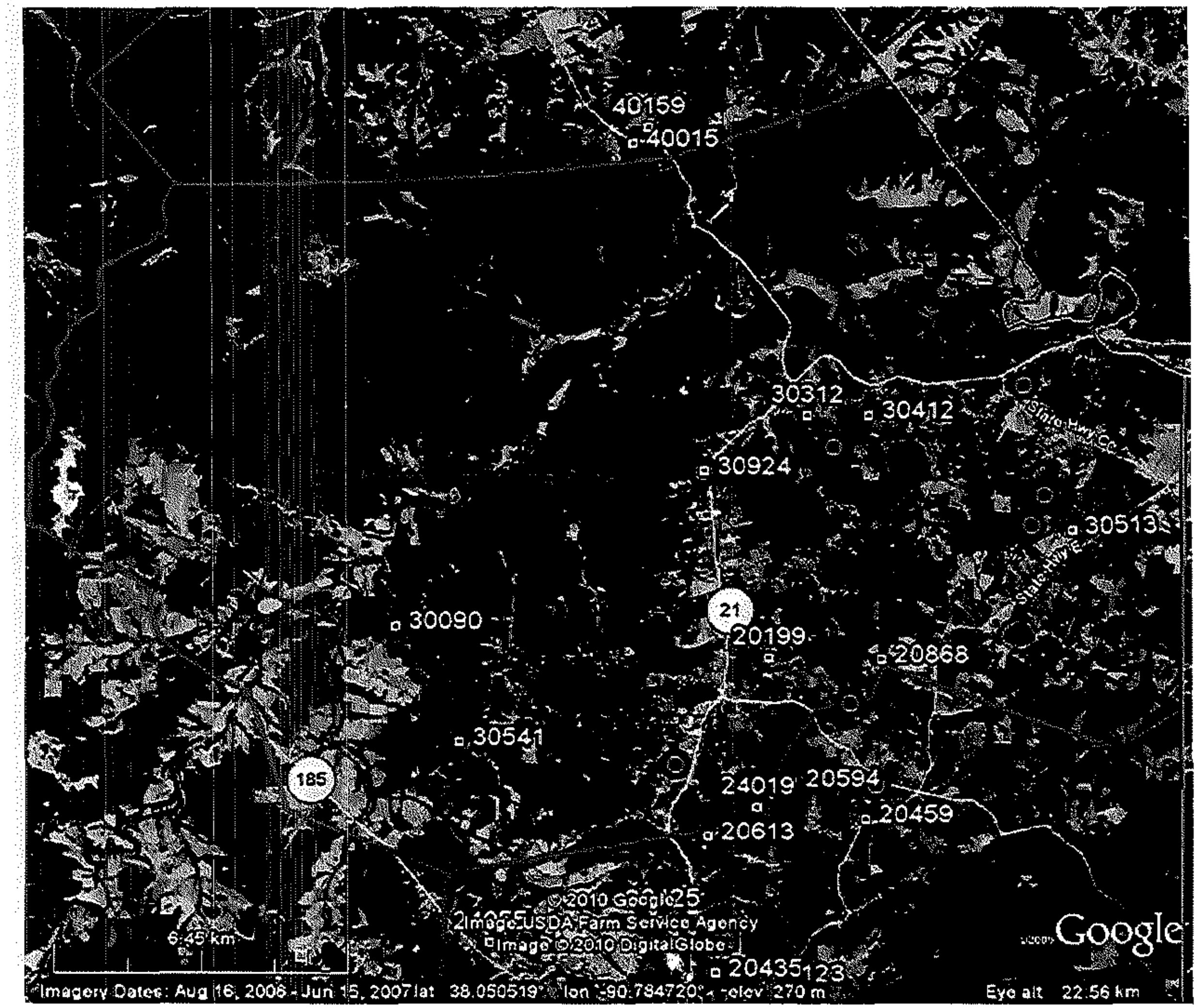
Shaw Environmental, Inc.

Figure 3-3b

Washington County Missouri
Wells with Cadmium Levels above the MCL
Richwoods Sampling Area

GM-2
59/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/3/10	JS	JS	KB	KS	s-136277-2/10-w



N

Property sampled during Point of Use Study

Wells Above Cadmium MCL

Shaw Shaw Environmental, Inc.

Figure 3-3c

Washington County Missouri
Wells with Cadmium Levels above the MCL
Old Mines Sampling Area

GM-2
60/323

N

Property sampled during Point of Use Study

Wells Above Cadmium MCL

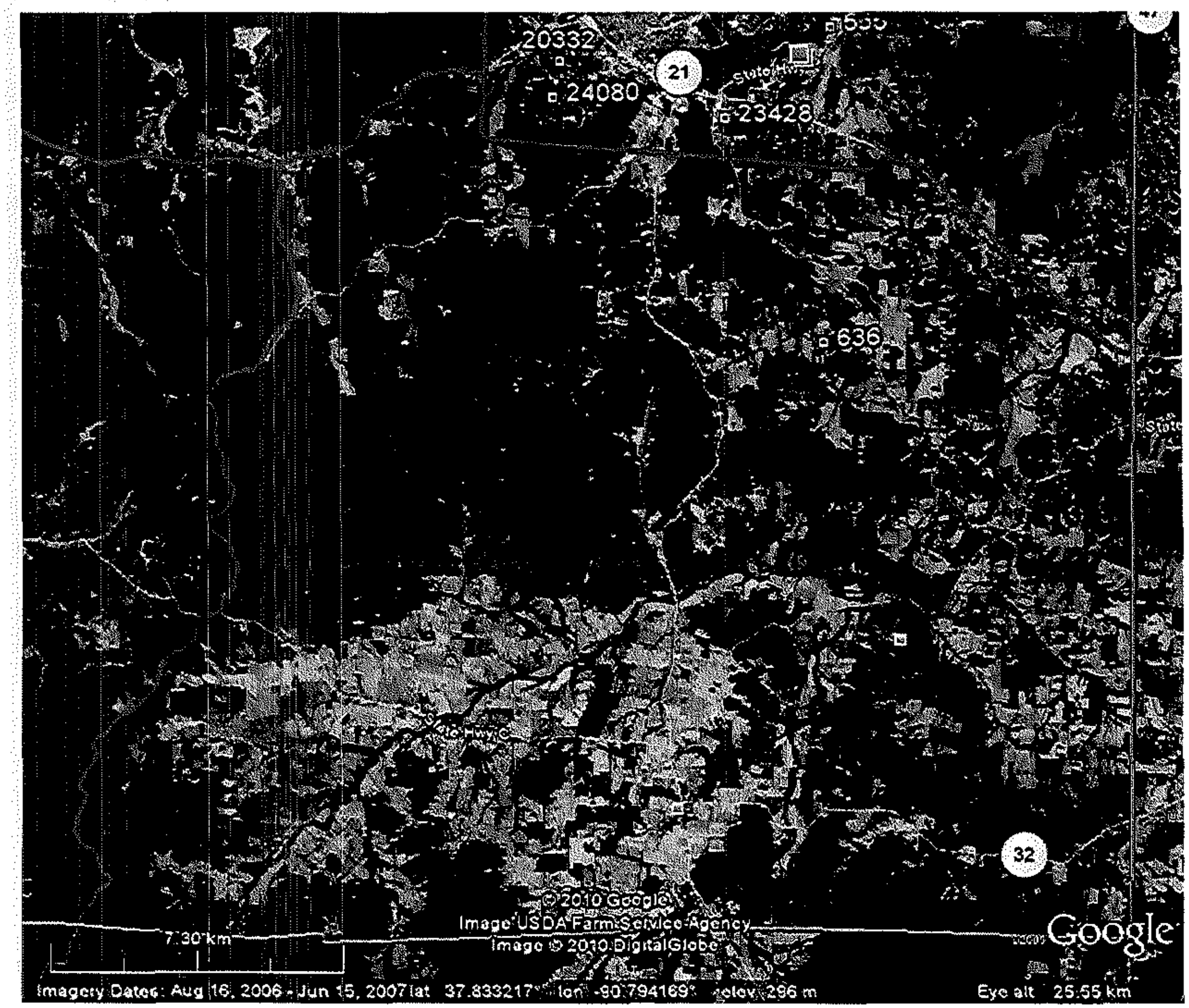
Shaw Shaw Environmental, Inc.

Figure 3-3d

Washington County Missouri
Wells with Cadmium Levels above the MCL
Potosi Sampling Area

GM-2
61/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/18/10	JS	JS	KB	RS	s-136277-2/10-w



Property sampled during Point of Use Study

Wells Above Cadmium MCL

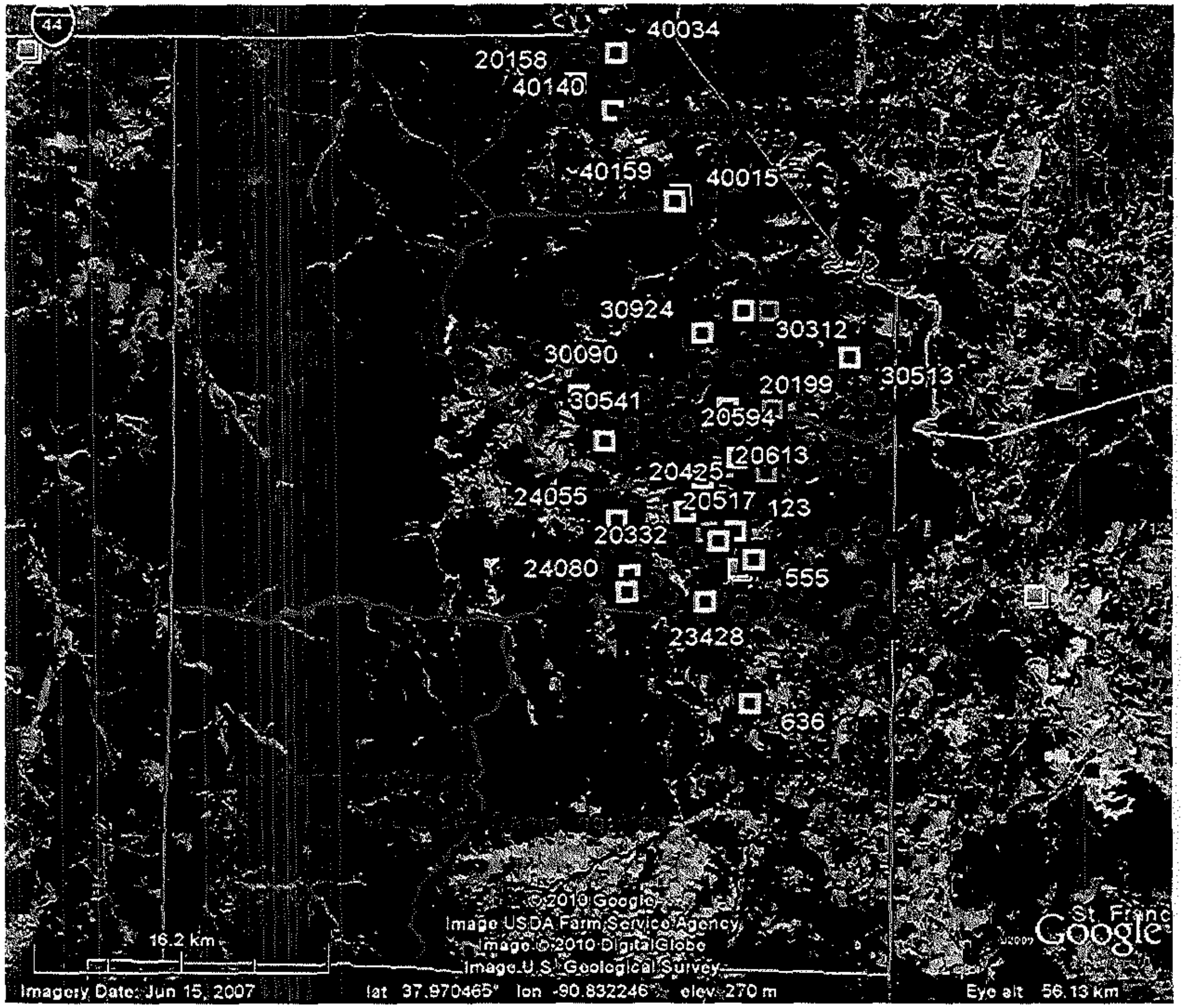
Shaw Environmental, Inc.

Figure 3-3e

Washington County Missouri
Wells with Cadmium Levels above the MCL
Furnace Creek Sampling Area

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/18/10	JS	JS	KB	KS	s-136277-2/10-w

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/18/10	JS	JS	FB	RS	s-135277-2/10-w



N

Property sampled during Point of Use Study

Wells Above Lead MCL

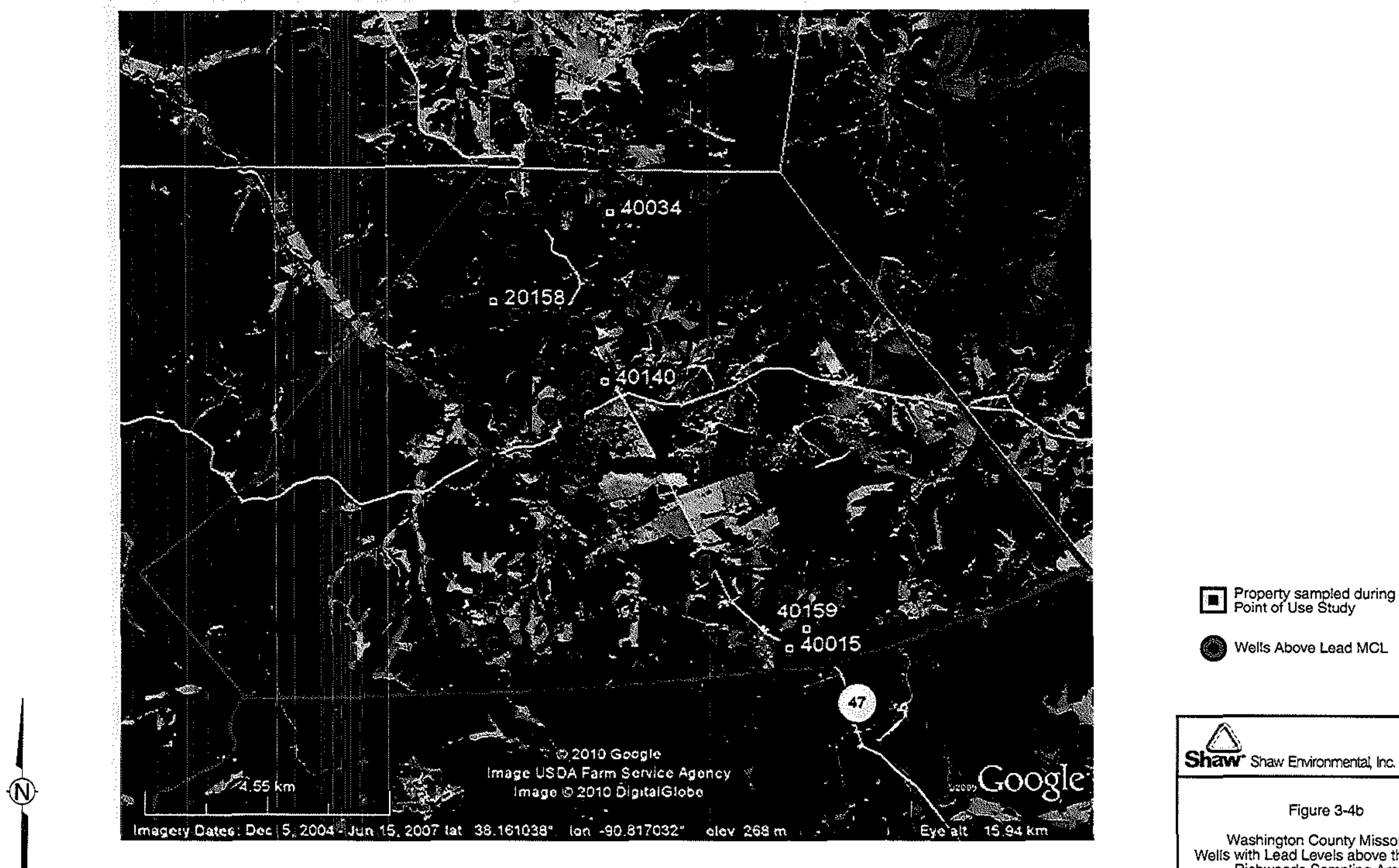
Shaw Environmental, Inc.

Figure 3-4a

Washington County Missouri
Wells with Lead Levels above the MCL
Washington County

GM-2
63/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/15/10	JS	JS	KB	KS	s-136277-2/10-w



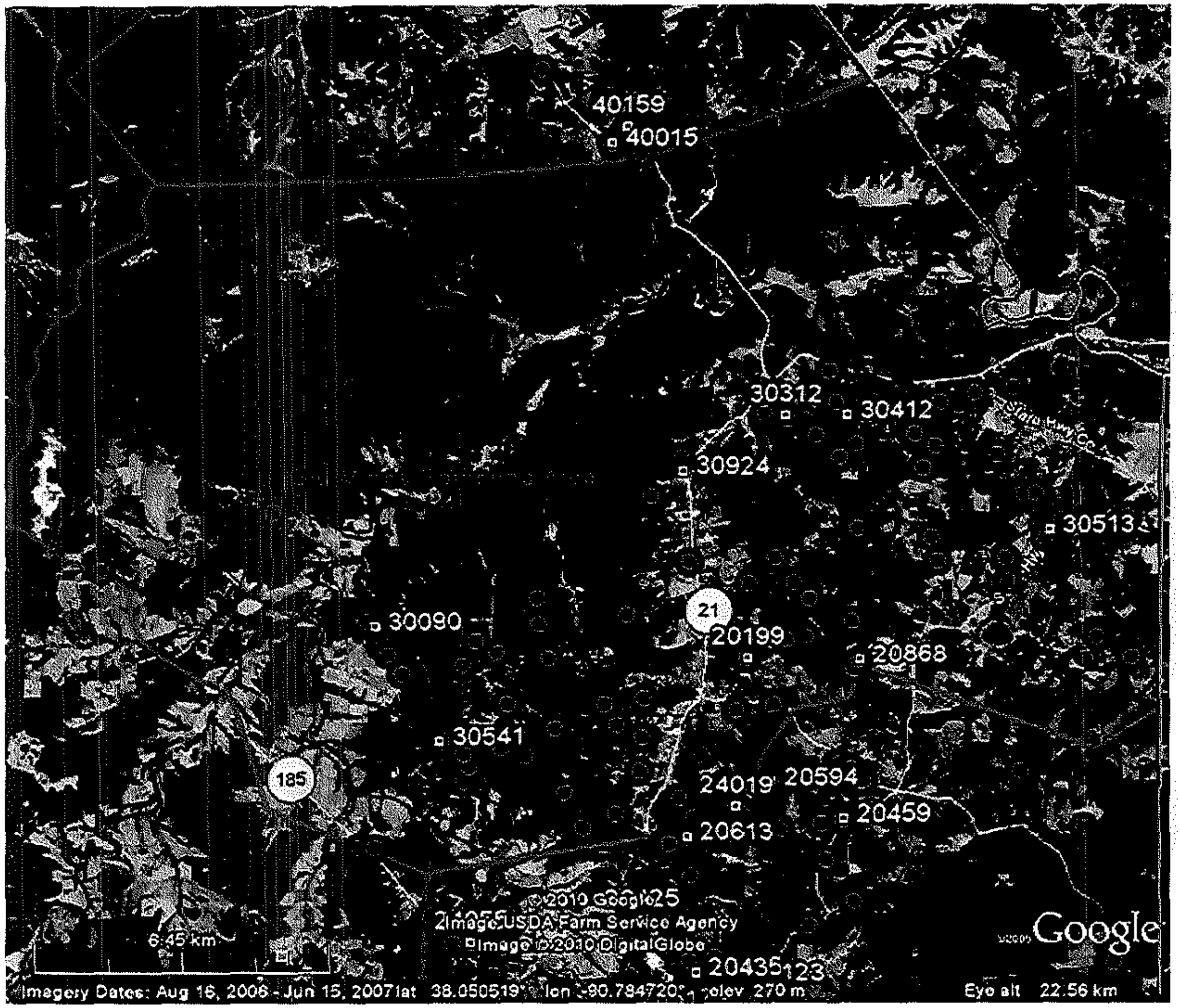
Shaw Environmental, Inc.

Figure 3-4b

Washington County Missouri
Wells with Lead Levels above the MCL
Richwoods Sampling Area

GM-2
64/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/18/10	JS	JS	KB	KS	s-136277-2/10-w



N

Property sampled during Point of Use Study

Wells Above Lead MCL

Shaw® Shaw Environmental, Inc.

Figure 3-4c

Washington County Missouri
Wells with Lead Levels above the MCL
Old Mines Sampling Area

GM-2
65/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/8/10	JS	JS	KB	FS	s-136277-2/10-w

N

Property sampled during Point of Use Study

Wells Above Lead MCL

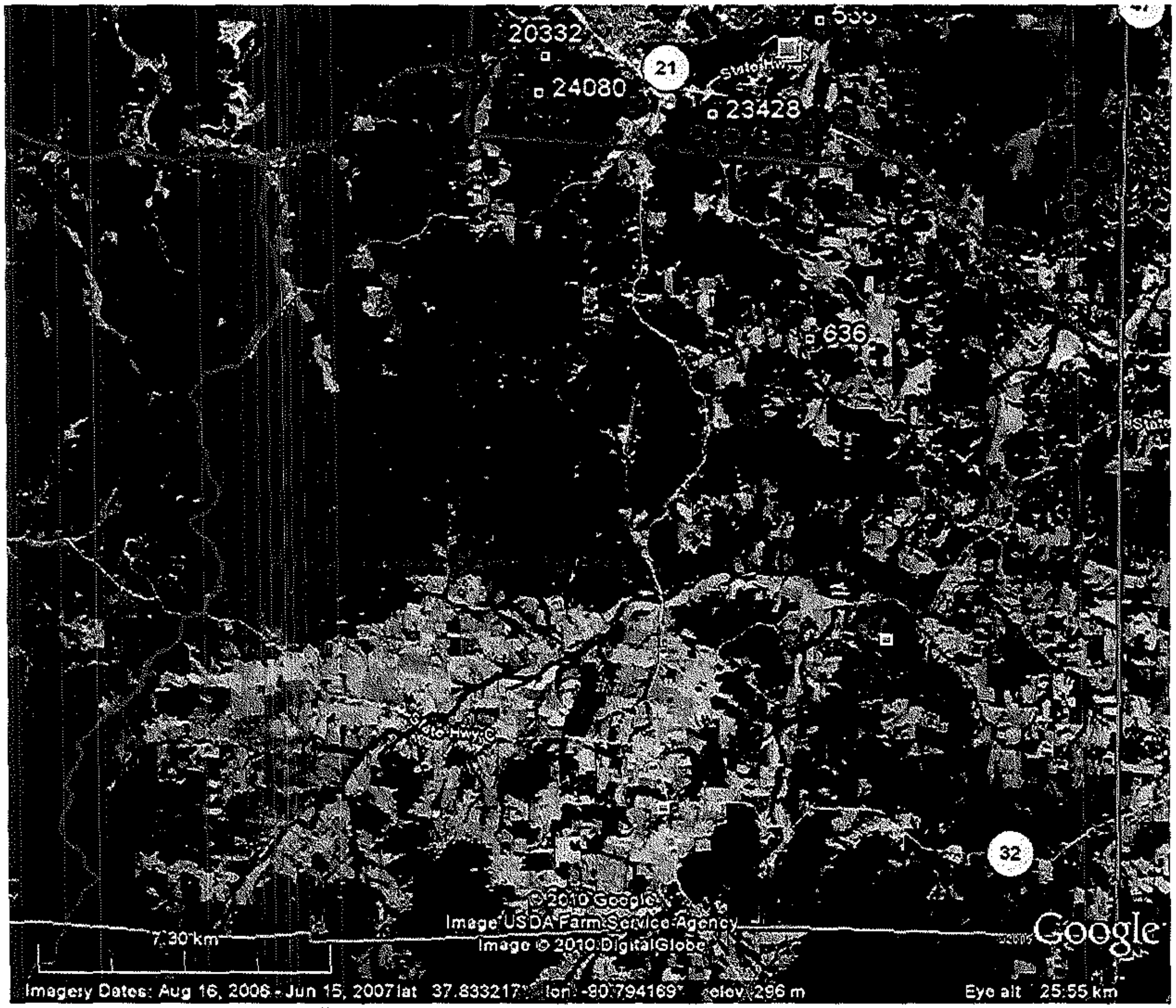
Shaw Environmental, Inc.

Figure 3-4d

Washington County Missouri
Wells with Lead Levels above the MCL
Potosi Sampling Area

GM-2
66/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/5/10	JS	JS	KB	KS	s-136277-2/10-w



N

Property sampled during Point of Use Study

Wells Above Lead MCL

Shaw Environmental, Inc.

Figure 3-4e

Washington County Missouri
Wells with Lead Levels above the MCL
Furnace Creek Sampling Area

GM-2
67/323

4.0 Selection of Point-of-Use Devices

This section summarizes the data from the sampling effort conducted during the pilot program and presents a selection of potential POU devices.

4.1 Summary of Contaminants Detected

Table 4.1 shows the compounds from the 27 sites that were detected at levels above their respective MCLs. This table also shows the associated number of sites that were above the MCLs for each of the compounds. Table 4.2 shows the analytical data for each property for each contaminant that exceeds the MCL.

The majority of the sites monitored under the pilot program require POU drinking water treatment systems for lead (19 of 27 sites). A small number of sites also require treatment for nitrate (2 sites), sulfate (1 site), E. coli (2 sites), barium (1 site), cadmium (1 site), antimony (2 sites) and TDS (3 sites) because of MCL exceedences.

For the majority of the sites, the only contaminant of concern is lead. Lead can be removed at the kitchen tap by using a variety of POU devices including adsorption filters and Reverse Osmosis (RO) systems. Both of these systems are typically mounted in the cabinet under the sink and treat only cold water that is used for drinking and cooking. In addition to lead, RO systems can also treat the other contaminants identified in this study at concentrations above their MCLs.

4.2 Selection of POU Devices

Black & Veatch Special Projects Corp. (BVSPC) prepared a memorandum titled *"Point of Use Technical Evaluation – Drinking Water Treatment Systems"* (EPA Contract No. EP-S7-05-06, EPA Task Order No. 0036, BVSPC Project 044763, April 13, 2010) that compared different POU treatment technologies and presented the cost for each system. Table 4.3 presents a summary of those technologies selected from this technical memorandum as the devices most suitable for the removal of lead and the few other contaminants detected during this pilot program. Table 4.4 provides capital and operating and maintenance (O&M) costs for the different POU systems. These costs were obtained principally from the BVSPC report and were supplemented with cost information obtained from other vendors for add-on system components (e.g., tanks, pumps) that are required for optimal operation of the selected POU devices. Table

4.5 presents capital, O&M, and lifetime costs of adsorption filter treatment systems, including additional system components.

In addition to the BVSPC report, Shaw also reviewed EPA reports from the EPA Environmental Technology Verification (ETV) Program. The POU systems recommended in this report have been certified by NSF International (NSF). Additional information was also obtained from knowledgeable contacts at vendors, installers, NSF, and EPA with experience in the installation and operation of POU systems.

4.3 Operational and Installation Considerations

To investigate operational and installation considerations, an adsorption system and an RO system was procured and installed in a typical under-the-sink cabinet at the T&E Facility. Figure 4-1 shows the installation of a Culligan Preferred 250 system along with a booster pump and an accumulator. Figure 4-2 shows the installation of a Watts WP-4V RO system in a test mode. This installation includes a booster pump, an accumulator, and a permeate pump. In addition to lessons learned from the operation of these two test systems, a number of installation and operational considerations were identified from discussions with vendors, review of available literature, and experience from other EPA-led field efforts. This section highlights some identified considerations that may influence the final selection of a suitable POU device.

4.3.1 Faucet Pressure

The majority of homes in this study area are fed from well pumps connected to an accumulator tank that is typically set to cycle between 20 pounds per square inch (psi) and 60 psi water pressure. This pressure setting can result in a low pressure in the home that is further exacerbated by the pressure drop across POU devices, intended to operate at the higher line pressure that is typical of homes supplied by municipal water systems. Thus, a concern that has been raised is the lack of water flow rate that is produced from the POU systems and the resulting additional time required to fill common household devices such as coffee pots. As can be seen in Table 4.3, adsorption filter systems can treat more water per day than the RO systems. However, additional equipment can be employed to improve the water flow rate through the faucet.

RO systems are typically rated to operate at 40 psi feed pressure. Depending on the equipment at the property (well depth, pump condition, etc.), the line pressure may not reach 40 psi. Since an RO system will not operate below 40 psi, the addition of a booster pump (such as an Aquatec

6800 with a transformer and pressure switch) will increase the line pressure above 40 psi and allow the RO system to operate as designed. Adsorption filter systems may not have the same pressure requirement of RO systems; however, installations with low line pressure can also benefit from the addition of a booster pump to increase the flow rate through the filter. A booster pump will require a 120 VAC outlet under the sink that must be installed if power is not already available at that location. The cost of this electrical supply is assumed to be included in the installation costs.

4.3.2 Permeate Pump

Although not necessary for the operation of the RO system, a permeate pump can improve the performance of the system. The Aquatec ERP 500 is powered by the hydraulic energy of the reject water lost to the drain (no electricity required). The permeate pump forces product into the storage tank, reducing membrane back pressure and maximizing the available feed pressure. The vendors indicate that these pumps can reduce the reject water from the RO system by up to 80 percent. Other benefits of permeate pumps include higher delivery pressure, faster water production, superior water quality, and extended filter/membrane life.

A permeate pump was installed and tested at the EPA's T&E Facility. The results of these tests are presented in Appendix D. On average, the presence of a permeate pump improved the permeate recovery (i.e., the ratio of permeate to feed water) by approximately 69% and reduced the time required to produce 1 gallon of treated water by 43% relative to a system without a permeate pump.

On some RO systems, the post-filter is located downstream of the accumulator tank to remove any possible taste and odor that may be imparted to the water from the bladder in the accumulator tank. For such systems, a permeate pump placed on the line leading to the accumulator tank would require that the post-filter be bypassed. An example of such an installation is the Watts Premier WP-4V unit that was installed and tested at the T&E Facility.

4.3.3 Accumulator Tanks

Because RO systems produce water at a much slower rate than adsorption systems, they include an accumulator tank that is located under-the-sink to store treated water. The accumulator tank stores water until it is needed and is pressurized to deliver water quickly. After the tank is emptied, it is slowly refilled by the RO system.

Including an accumulator tank under the sink with an adsorption system would improve the flow rate of treated water from such systems. As in an RO system, the water would flow through the adsorption filter at its normal treated flow rate of approximately 0.5 gallons per minute (gpm) and would be stored in the pressurized accumulator tank. When water is needed, the water flows out of the accumulator tank at a rate of 1 gpm. The accumulator tank would then be refilled as the water is treated by the adsorption filter. The filter media and manifolds control the flow rate of the water through the adsorption filters (rather than the faucets), so that the water will have the required residence time in the media before filling the accumulator tank. However, water quality may deteriorate in the accumulator tank with infrequent use.

4.3.4 Faucet Flow Rate

The U.S. Department of Energy recommends a flow rate of 1 gpm at a kitchen faucet for efficient use of water. Including a booster pump and a permeate pump should allow the POU device faucet to flow at this rate when the accumulator tank is full. As the accumulator tank empties, the flow rate is expected to drop until the flow reaches the maximum operating flow rate for an adsorption filter (approximately 0.5 gpm) or almost stops as in the case of an RO system.

Alternative system designs are also available to increase the flow rate through the POU systems. These systems are also shown in Table 4.3. As described above, an adsorption filter can be connected to an accumulator tank to increase the flow rate through the faucet. This will increase the flow through the faucet for approximately 5 minutes. After 5 minutes, the flow will decrease to approximately 0.5 gpm.

If two adsorption filters are mounted in parallel, the system will continuously generate water at twice the rated flow rate for a single filter. This increased flow rate could be used to replace the entire cold water supply to the kitchen sink, estimated at 10 gallons per day (gpd) based on the capacity of the units selected by BVSPC; however, this will increase the frequency with which the adsorption filter system cartridges will need to be replaced, as shown in Table 4.5. This will increase the cost of use for this setup.

There are also higher flow RO POU units, as shown in Table 4.3. Excel Water manufactures undersink RO systems that are rated for 50 gpd and 100 gpd. Both of these units include an accumulator tank that is located under the sink. A small whole-house RO system, rated for 250 gpd, includes a much larger accumulator tank. This system could be used to supply all of the cold water to the kitchen sink, but it is too large to be mounted under the sink. A new system, the "GE Merlin Tankless RO System", is small enough to be mounted under the sink, but it does not require an accumulator tank. In fact, a pressurized storage tank will create backpressure on the system that will reduce performance. This system is rated for a continuous flow of 0.5 gpm (720 gpd) of treated water.

4.3.5 *Water Hardness*

RO systems are designed for water hardness of 10 grains per gallon (171 mg/L $CaCO_3$). For this water quality, the RO membranes have an estimated life of 3 to 5 years. The average water hardness of the 27 properties monitored during the pilot program was approximately 350 mg/L $CaCO_3$. At this hardness level, vendors project the membrane life expectancy of RO systems to be shortened from 3 years to 1 year. Because the hardness level does not affect adsorption filters, the lifetime costs for the adsorption filter units is unaffected by hardness. Table 4.5 shows the capital cost, annual O&M cost, and lifetime costs for replacing the membranes every 3 years, every 2 years, and annually.

An alternative to replacing the membranes more frequently is to install a water softening system with the RO system. Several types of POU water softening filters (Everpure, Doulton USA, Applied Membrane Filters, Pentek) can be used to reduce the water hardness entering the RO system. A Pentek WS-10 water softening cartridge costs approximately $20 (waterfiltersonline.com). The capacity of this cartridge is 750 grains of hardness. The average hardness of the samples collected for the pilot program was approximately 20 grains per gallon. With an estimated annual water use per home of 480 gallons/year (BVSPC), approximately 13 water softening cartridges would be required annually. This would result in an annual cost of $260 for water softening cartridges, much higher than the cost of any of the RO membranes listed in Table 4.4. Also, it would be much more inconvenient than changing a membrane cartridge annually. This increased cost and maintenance make the option of installing a POU water softener impractical. However, if a location already has a whole-house water softener installed, the hardness of the water treated by the RO system would be reduced and the RO system would also reduce the sodium content of the softened water.

4.3.6 *End-of-Life Indicator Devices*

Each of the POU treatment devices evaluated in Table 4.3 has an end-of-life indicator, with the exception of the Culligan Preferred 250. The end-of-life indicator notifies the resident when maintenance is required to keep the unit operating properly. The majority of units include a timer and an indicator light to remind the user to change filters, cartridges, membranes, etc. When an adsorption filter is exhausted, the unit will still allow water to flow through without adequate treatment, thus resulting in MCL exceedences without any warning to the resident.

RO units also use lights to indicate that the prefilter should be changed. However, the water produced by an RO system continues to be adequately treated even if the filters are not changed. The flow rates from these units will typically decline as the membranes deteriorate or become fouled with scale (from hard water).

Three units -- two units from Adedge Technologies and one unit from Aqua Pure DWS1000 -- include a mechanical countdown shut-off device to stop the flow of water through the filter when maintenance is required (i.e., the cartridge needs to be replaced).

A third-party shutoff device based on the volume of water treated is available from Freshwatersystems.com. Termed the "Waterminder", the system is available to monitor a total flow-through capacity of either 1800 gallons or 3800 gallons. The system can be adjusted in 100-gallon increments and can be restarted as required.

Because the Culligan Preferred 250 does not have an end-of-life indicator, the adsorption filter must be changed at a predetermined time, or a flow totalizer (such as Grainger No. 3FKP1, $146) could be installed with the filter. This cost has been included in the capital and annual total costs in Tables 4.4 and 4.5. However, if the adsorption filter is changed on an established schedule (similar to units that have a time-based indicator, rather than a flow-based system), the cost of the flow meter could be eliminated.

4.4 Maintenance and Monitoring

After the POU treatment units have been installed, the units will require regular maintenance and sampling to ensure their effectiveness. The frequency of maintenance and monitoring will depend on the systems procured for installation.

4.4.1 Maintenance

The presence of a local vendor capable of providing installation support and any required maintenance support may reduce O&M costs and be a favorable consideration during the selection of appropriate POU systems for Washington County. The manufacturer's maintenance procedures and schedules should be followed to ensure the best performance from the systems. Some likely maintenance procedures include the following:

- POU systems are not to be installed on hot water lines. They are only meant to be installed on cold water supply lines.
- Water that has air bubbles and has a cloudy appearance is typical after installation; the bubbles and cloudiness should disappear after water runs through the system.
- Replace the filters/membranes according to the manufacturer recommendations (based on time or volume of water treated.
- When replacing the filters/membranes, close the water supply to the filters/membranes and open the faucet to relieve the pressure.
- A small amount of water may leak from the tubes, filters, membranes, etc. A towel can be used to clean up the water.
- Replace the battery in the faucet to remind about the filter replacement (if applicable).
- Reset the auto-shutoff device (if applicable).
- Record the water volume on the totalizer (if applicable).
- For RO systems, fill and flush the accumulator tank 3 times during the initial startup and after replacing the membrane.
- Sanitize RO systems annually.
- Check the air pressure in the accumulator tank when the tank is empty of water. Supplement air pressure if needed.
- If the RO system will not be used for more than 2 months, turn off the water supply to the system, drain the accumulator tank, and remove and store the membrane in the refrigerator.
- With new adsorption systems, open the filtered water faucet and allow fine carbon particles to purge from the cartridge. Close the faucet when "fines" (carbon particulates) are no longer visible in the filtered water, approximately 10 minutes.

4.4.2 Monitoring

Following installation of POU systems at various homes, a monitoring network to establish proper function of the system could be desirable after the first year of operation. Thereafter, based on the results of the monitoring program, a changeout schedule for various replacement components (such as filters or membrane) could be established, eliminating further monitoring efforts.

A representative of NSF stated that a problem occasionally arises with units being assembled improperly at the factory. Therefore, monitoring the unit soon after installation should ensure that the unit was assembled and installed properly. Thereafter, the sampling frequency could be reduced.

4.5 Comparison of Adsorption System and RO Systems

The following table provides pros and cons of adsorption filters and RO systems for treating the contaminants detected during this study:

Adsorption Filter	RO System
Less complicated.	More complicated (multiple cartridges).
Only treats water for lead.	Treats a wider variety of contaminants.
Less maintenance (only one or two cartridges).	More maintenance with multiple cartridges.
Not affected by hardness.	Hard water can reduce membrane life by up to 33%.
Less expensive to operate. Filter cartridges are cheaper.	More expensive to operate especially if hardness results in annual membrane changeout.
Higher flow rate (up to 1 gpm when installed in parallel).	Lower flow rate. Flow rate can be sporadic while accumulator tank fills.
System could experience contaminant breakthrough if the filter changeout schedule is not followed.	Less likely to have contaminant breakthrough even if scheduled maintenance is not performed.

A theoretical understanding of the treatment mechanism of adsorption filters and RO systems in provided in Appendix D. This information was extracted from http://www.explainthatstuff.com/howwaterfilterswork.html.

Table 4.1. Compounds Detected Above the Drinking Water Maximum Contaminant Level in the Pilot Program

Compound, units	Number of Sites over MCL	Maximum Detected Concentration	MCLs
Nitrate, mg/L	2	17.4	10 (P)
Sulfate, mg/L	1	523	250 (S)
E. coli, CFU per 100 mL	2	70	0 (P)
Barium, μg/L	1	2145	2000 (P)
Lead, μg/L	19	99	15 (TT)
Cadmium, μg/L	1	6	5 (P)
Antimony, μg/L	2	9	6(P)
TDS, mg/L	3	734.5	500 (S)

(P) Primary MCL
(S) Secondary MCL
(TT) Treatment Technique

Table 4.2
Pilot Program for Selection of POU Devices
POU Sample Results Greater than the MCL

Property ID	Property Location	Dissolved Metals (µg/L)								Total Metals (µg/L)								Anions (mg/L)		Total Dissolved Solids (mg/L)	E-Coli (e-coli per 100mL)	
		Faucet Purged				Faucet Unpurged				Faucet Purged				Faucet Unpurged								
		Lead	Barium	Cadmium	Antimony	Lead	Barium	Cadmium	Antimony	Lead	Barium	Cadmium	Antimony	Lead	Barium	Cadmium	Antimony	Nitrate	Sulfate		Sample	Duplicate
20158	Richwoods	37	999	<0.4	<2.1	40	996	<0.4	2	39	992	<0.4	1	36	994	<0.4	<2.1	1.006	4.209	284.343	0	0
40015	Richwoods	<0.2	59	<0.4	<2.1	<0.2	56	<0.4	<2.1	<0.2	59	<0.4	<2.1	<0.2	59	<0.4	<2.1	0.050	150.865	593.264	0	0
40034	Richwoods	8	463	<0.4	<2.1	9	466	<0.4	<2.1	7	463	<0.4	<2.1	12	444	<0.4	<2.1	5.510	12.658	175.532	0	0
40140	Richwoods	25	1748	<0.4	<2.1	22	1751	<0.4	<2.1	22	1745	<0.4	<2.1	23	1755	<0.4	<2.1	1.297	6.187	300.851	0	0
40140 [1]	Richwoods	23	1757	<0.4	<2.1	--		--	--	25	1723	<0.4	<2.1	--		--	--	1.299	6.180	296.444	0	0
40159	Richwoods	--	--	--	--	<0.2	<0.2	<0.4	<2.1	--	--	--	--	<0.2	<0.2	<0.4	1	--	--	--	--	--
40159 [2]	Richwoods	<0.2	<0.2	<0.4	<2.1	--	--	--	--	<0.2	<0.2	<0.4	<2.1	--	--	--	--	1.656	11.379	408.368	0	0
40159 [3]	Richwoods	<0.2	520	<0.4	<2.1	--	--	--	--	<0.2	520	<0.4	<2.1	--	--	--	--	2.257	11.853	303.279	0	0
40159 [4]	Richwoods	<0.2	445	<0.4	<2.1	--	--	--	--	<0.2	439	<0.4	<2.1	--	--	--	--	--	--	--	--	--
20199	Old Mines	14	2127	<0.4	<2.1	14	2145	<0.4	<2.1	15	2122	<0.4	<2.1	14	2140	<0.4	<2.1	4.985	5.650	335.366	0	0
30090	Old Mines	20	1087	<0.4	5	21	1154	<0.4	4	22	1092	<0.4	5	19	1109	<0.4	4	0.484	5.746	333.071	0	0
30312	Old Mines	35	406	<0.4	<2.1	32	409	<0.4	<2.1	35	415	<0.4	<2.1	33	412	<0.4	<2.1	6.491	10.692	349.796	0	0
30412	Old Mines	<0.2	1	<0.4	4	<0.2	1	<0.4	4	<0.2	1	<0.4	4	<0.2	2	<0.4	5	<0.038	84.565	626.459	0	0
30412 [5]	Old Mines	11	53	<0.4	6	--	--	--	--	17	53	<0.4	5	--	--	--	--	--	--	--	--	--
30513	Old Mines	25	234	<0.4	<2.1	28	242	<0.4	<2.1	26	231	<0.4	<2.1	28	247	<0.4	<2.1	13.939	31.283	431.500	0	0
30541	Old Mines	34	806	<0.4	<2.1	36	805	<0.4	<2.1	36	800	<0.4	<2.1	37	803	<0.4	<2.1	0.992	5.097	295.968	0	0
30924	Old Mines	3	1027	4	<2.1	3	961	3	<2.1	2	1032	4	<2.1	6	953	3	1	2.081	10.931	342.105	0	0
30924 [6]	Old Mines	7	1043	3	<2.1	--	--	--	--	2	1048	3	2	--	--	--	--	2.076	11.131	346.465	0	0
123	Potosi	27	391	<0.4	<2.1	29	450	<0.4	<2.1	32	394	<0.4	<2.1	43	455	1	<2.1	3.489	12.894	332.990	0	0
555	Potosi	80	1430	1	<2.1	86	1413	1	<2.1	91	1425	1	<2.1	87	1404	1	<2.1	0.963	10.916	262.500	0	0
20332	Potosi	21	395	1	<2.1	32	400	1	<2.1	28	392	1	<2.1	32	398	1	<2.1	0.920	6.765	435.060	0	0
20425	Potosi	14	181	1	<2.1	15	177	1	<2.1	16	183	1	<2.1	18	183	1	<2.1	6.978	10.197	405.534	70	20
20435	Potosi	27	131	6	<2.1	23	131	6	<2.1	35	133	6	<2.1	23	131	5	<2.1	0.055	22.078	334.940	0	0
20459	Potosi	10	11	2	<2.1	0.2	11	2	<2.1	5	10	2	<2.1	4	11	1	<2.1	0.498	522.706	734.500	0	0
20517	Potosi	34	208	<0.4	<2.1	34	203	<0.4	<2.1	37	207	<0.4	<2.1	40	206	<0.4	<2.1	3.331	24.931	489.110	5	0
20594	Potosi	77	233	1	<2.1	72	233	1	<2.1	76	229	1	<2.1	63	238	1	<2.1	0.555	7.370	351.172	0	0
20594 [1]	Potosi	59	232	<0.4	<2.1	53	241	3	4	55	229	1	<2.1	48	240	1	<2.1	0.498	7.222	345.276	0	0
20613	Potosi	7	463	<0.4	<2.1	13	488	<0.4	<2.1	10	467	<0.4	<2.1	11	489	<0.4	2	0.872	7.256	187.402	0	0
20868	Potosi	38	86	1	<2.1	54	92	1	<2.1	45	90	1	<2.1	29	92	2	<2.1	17.352	42.901	493.927	0	0
23428	Potosi	32	277	1	<2.1	41	273	1	<2.1	30	277	1	<2.1	36	272	1	<2.1	5.034	26.158	399.593	0	0
23428 [1]	Potosi	30	279	1	<2.1	--	--	--	--	31	276	1	<2.1	--	--	--	--	5.022	26.377	402.479	0	0
24019	Potosi	62	244	<0.4	<2.1	61	244	<0.4	<2.1	99	244	<0.4	<2.1	66	243	<0.4	<2.1	0.590	6.363	281.624	0	0
24055	Potosi	40	1185	<0.4	<2.1	45	1187	<0.4	<2.1	47	1181	<0.4	<2.1	41	1179	<0.4	<2.1	1.723	11.644	316.000	0	0
24055 [7]	Potosi	<0.2	4	1	<2.1	--	--	--	--	<0.2	4	1	<2.1	--	--	--	--	<0.038	0.289	0.000	0	0
24080	Potosi	25	1321	<0.4	5	29	1307	<0.4	9	29	1314	<0.4	4	29	1306	<0.4	<2.1	1.020	6.248	262.151	0	0
636	Furnace Creek	48	448	<0.4	<2.1	48	436	<0.4	<2.1	48	445	<0.4	<2.1	69	434	<0.4	<2.1	0.897	13.869	380.328	0	0
Count of Properties > MCL		21	1	1	1	19	1	1	1	24	1	1	0	20	1	1	0	2	1	3	2	1

National Drinking Water Regulations MCL for Lead (15), Barium (2000), Cadmium (5), Antimony (6), Nitrate (1), Sulfate (250), TDS (500), E-coli (0)
20: Sample exceeds the MCL
--: Sample Not Analyzed
<0.2: Non-Detect, Result less than the Reporting Limit
1: Field Duplicate
2: Unsoftened, unfiltered
3: Unsoftened
4: Softened
5: Samples taken from the outside faucet
6: Unfiltered sample
7: Field Blank

Table 4.3. Proposed POU Devices for Treatment of Nitrate, Sulfate, E. coli, Barium, Lead, Cadmium, and TDS

Treatment Options and Manufacturer's Listing	Contaminants							Process		Process: Filtration			Certified/ Recommended				Flow Rate (gpd)	Service Cycle (gal)
	Nitrate	Sulfate	E. coli	Ba	Pb	Cd	TDS	RO	IX	MF	SBAC	AA/IBS	NSF	WQA	Others	ETV		
Reverse Osmosis (RO)/Filter Devices*																		Membranes: 1-3 years
Watts WP-4V	x	x	x	x	x	x	x	x		o	o		x	x		x	9.1	Filters - annual
GE Profile PXRQ15F	x	x	x	x	x	x	x	x		o	o		x	x	x		11.2	Filters - annual
Whirlpool WHER25 (aka Sears Kenmore Ultrafilter 500)	x	x	x	x	x	x	x	x		o	o		x	x	x	x	14.5	Filters - annual
Pentek RO 3500	x	x	x	x	x	x	x	x		o	o		x				7.6	Filters - 6 mo.
Aqua Pure AP RO 5500	x	x	x	x	x	x	x	x		o	o		x				11	Filters - 6 mo.
High-Flow RO Devices																		
Excel Water 5-Stage RO System	x	x	x	x	x	x	x	x		x	x		x	x			50	Filters - annual
Excel Water High Capacity 5-Stage RO System	x	x	x	x	x	x	x	x		x	x		x				100	Filters - annual
Excel Water Compact Wall Mount 250 GPD	x	x	x	x	x	x	x	x									250	Filters - annual
GE Merlin Tankless RO System	x	x	x	x	x	x	x	x					x	x			720	Filters - 6 mo.
Adsorption/Filter Systems Under Counter Regular																		
Culligan US-EZ-4					x	?					x	x	x	x			720	500
Pentek 1500					?	?				x	x		x				720	1000
Aqua Pure DWS1000					x	?				x	x	x	x		x		864	625
Kenmore (2 Stage Dual) 38461					x	?				x	x	x	x		x		864	1000
Kenmore (2 Stage Elite) 38501					x	?				x	x	x	x				720	280
GE Smart Water GXSV65F					x	?					x	x	x				864	1200
Whirlpool (Dual Filter) WHED20					x	?					x	x	x				864	270
Culligan Preferred 250					x					x	x		x				720	1,000
Under Counter Specialty - Arsenic																		
Adedge (two Stage) EHC2S271001					x	?			x	x	x	x	x				720	1,000
Adedge (one Stage) Plus-AS-PB-PID					x	?				x	x	x	x				1,440	960

Notes and Abbreviations

Applicability
- x - applies to criteria listed
- ? - not NSF tested, but similar to lead

Contaminants
- Ba - barium
- Pb - lead
- Cd - cadmium
- TDS - total dissolved solids

Processes (x - primary, o - optional)
- RO - reverse osmosis
- IX - ion exchange (includes only cartridge-type filters)
- MF - mechanical filtration
- SBAC - solid block activated carbon
- AA - activated alumina
- IBS - iron-based sorption

Certifications
- NSF - National Sanitary Foundation, International
- WQA - Water Quality Association
- Others - Consumer Report
- ETV - Environmental Technology Verification Program

* RO Design Considerations (B&V Report)
- Hardness < 171 mg/l $CaCO_3$
- Fe < 100 ug/l
- Mn < 100 ug/l
- TDS < 2000 mg/l
- Inlet Pressure: 40 - 100 psi

Table 4.4. Capital and Operation and Maintenance Costs for Proposed POU Treatment Units

Treatment Options and Manufacturer's Listing	Capital Cost: Purchase Price[a]	Booster Pump[b]	Permeate Pump[c]	Pressure Tank[d]	Waterminder[e]	Installation[a]	O&M Costs: Filter Cost[a]	Membrane Cost[a]
Reverse Osmosis (RO)/Filter Devices								
Watts WP-4V	$270	$125	$60			$100	$50	$70
GE Profile PXRQ15F	$300	$125	$60			$100	$100	$90
Whirlpool WHER25 (aka Sears Kenmore Ultrafilter 500)	$210	$125	$60			$100	$80	$60
Pentek RO 3500	$270	$125	$60			$100	$54	$102
Aqua Pure AP RO 5500	$410	$125	$60			$100	$93	$139
High-Flow RO Devices								
Excel Water 5-Stage RO System	$307	$156				$100	$81	$87
Excel Water High Capacity 5-Stage RO System	$747	$156				$100	$171	$109
Excel Water Compact Wall Mount 250 GPD	$4,265					$100	$66	$248
GE Merlin Tankless RO System	$400	$250				$100	$92	$500
Adsorption/Filter Systems								
Under Counter Regular								
Culligan US-EZ-4	$119	$156		$50	$26	$50	$53	
Pentek 1500	$175	$156		$50	$26	$50	$37	
Aqua Pure DWS1000	$319	$156		$50		$50	$103	
Kenmore (2 Stage Dual) 38461	$106	$156		$50	$26	$50	$52	
Kenmore (2 Stage Elite) 38501	$150	$156		$50	$26	$50	$64	
GE Smart Water GXSV65F	$171	$156		$50	$26	$50	$43	
Whirlpool (Dual Filter) WHED20	$161	$156		$50	$26	$50	$57	
Culligan Preferred 250[f]	$125	$156		$50	$26	$50	$70	
Under Counter Specialty - Arsenic								
Adedge (two Stage) EHC2S271001	$377	$156		$50		$50	$92	
Adedge (one Stage) Plus-AS-PB-PID	$471	$156		$50		$50	$141	

[a] Unless otherwise stated, data from the April 15, 2010, Black & Veatch Report were used.

[b] Aquatec 6800 booster pump, transformer, and pressure switch from Freshwatersystems.com (<50 gpd)
Aquatec 8800 booster pump, transformer, and pressure switch from Freshwatersystems.com (>50 gpd)
Variable speed 3-4.0 gpm 65 psi 115 V UL pump from Freshwatersystems.com
NOTE: Booster pump is not required if the line pressure is greater than 40 psi.

[c] Aquatec ERP 500 permeate pump from Waterfiltersonline.com

[d] 4.4-gallon pressure tank (#RO-132) from Freshwatersystems.com

[e] Cost of Waterminder 1800 or 3800 from Freshwatersystems.com (same price)

[f] Cost of Culligan Preferred 250 from Waterfilters.net

Table 4.5. Capital Costs, Operation and Maintenance Costs, and Lifetime Costs of Adsorption Treatment Systems

Treatment Options and Manufacturer's Listing	Capital Cost					O&M Costs: Filters		Cost					
	Purchase Price[a]	Booster Pump[b]	Pressure Tank[c]	Waterminder[d]	Installation[a]	Cost[a]	Frequency (per year)[a]	Capital	O&M (annual)	1 yr (total)	3 yr (total)	5 yr (total)	10 yr (total)
Adsorption/Filter Systems - Low Flow Systems (one filter, rated at 0.5 - 0.6 gpm @ 60 psi)													
Under Counter Regular													
Culligan US-EZ-4	$119	$156	$50	$26	$50	$53	2	$401	$106	$507	$719	$931	$1,461
Pentek 1500	$175	$156	$50	$26	$50	$37	2	$457	$74	$531	$679	$827	$1,197
Aqua Pure DWS1000	$319	$156	$50		$50	$103	2	$575	$206	$781	$1,193	$1,605	$2,635
Kenmore (2 Stage Dual) 38461	$106	$156	$50	$26	$50	$52	2	$388	$104	$492	$700	$908	$1,428
Kenmore (2 Stage Elite) 38501	$150	$156	$50	$26	$50	$64	2	$432	$128	$560	$816	$1,072	$1,712
GE Smart Water GXSV65F	$171	$156	$50	$26	$50	$43	2	$453	$86	$539	$711	$883	$1,313
Whirlpool (Dual Filter) WHED20	$161	$156	$50	$26	$50	$57	2	$443	$114	$557	$785	$1,013	$1,583
Culligan Preferred 250[e]	$125	$156	$50	$26	$50	$70	1	$407	$70	$477	$617	$757	$1,107
Under Counter Specialty - Arsenic													
Adedge (two Stage) EHC2S271001	$377	$156	$50		$50	$92	1	$633	$106	$739	$951	$1,163	$1,693
Adedge (one Stage) Plus-AS-PB-PID	$471	$156	$50		$50	$141	1	$727	$106	$833	$1,045	$1,257	$1,787
Adsorption/Filter Systems - High Flow Systems (two filters, rated at 1.0 - 1.2 gpm @ 60 psi)													
Under Counter Regular													
Culligan US-EZ-4	$238	$156		$26	$100	$53	8	$520	$424	$944	$1,792	$2,640	$4,760
Pentek 1500	$350	$156		$26	$100	$37	4	$632	$148	$780	$1,076	$1,372	$2,112
Aqua Pure DWS1000	$638	$156			$100	$103	6	$894	$618	$1,512	$2,748	$3,984	$7,074
Kenmore (2 Stage Dual) 38461	$212	$156		$26	$100	$52	4	$494	$208	$702	$1,118	$1,534	$2,574
Kenmore (2 Stage Elite) 38501	$300	$156		$26	$100	$64	14	$582	$896	$1,478	$3,270	$5,062	$9,542
GE Smart Water GXSV65F	$342	$156		$26	$100	$43	4	$624	$172	$796	$1,140	$1,484	$2,344
Whirlpool (Dual Filter) WHED20	$322	$156		$26	$100	$57	14	$604	$798	$1,402	$2,998	$4,594	$8,584
Culligan Preferred 250[e]	$250	$156		$26	$100	$70	4	$532	$280	$812	$1,372	$1,932	$3,332
Under Counter Specialty - Arsenic													
Adedge (two Stage) EHC2S271001	$754	$156			$100	$92	4	$1,010	$106	$1,116	$1,328	$1,540	$2,070
Adedge (one Stage) Plus-AS-PB-PID	$942	$156			$100	$141	4	$1,198	$106	$1,304	$1,516	$1,728	$2,258

[a] Unless otherwise stated, data from the April 15, 2010, Black & Veatch Report were used.
[b] Aquatec 8800 booster pump, transformer, and pressure switch from Freshwatersystems.com (>50 gpd)
NOTE: Booster pump is not required if the line pressure is greater than 40 psi.
[c] 4.4-gallon pressure tank (#RO-132) from Freshwatersystems.com
[d] Cost of Waterminder 1800 or 3800 from Freshwatersystems.com
[e] Cost of Culligan Preferred 250 from Waterfilters.net

Table 4.6. Capital Costs, Operation and Maintenance Costs, and Lifetime Costs of RO Treatment Systems

Treatment Options and Manufacturer's Listing	Capital Cost	3 Yr Membrane Replacement				2 Yr Membrane Replacement				1 Yr Membrane Replacement			
		Annual O&M Cost	1 yr (total)	5 yr (total)	10 yr (total)	Annual O&M Cost	1 yr (total)	5 yr (total)	10 yr (total)	Annual O&M Cost	1 yr (total)	5 yr (total)	10 yr (total)
Reverse Osmosis (RO)/Filter Devices													
Watts WP-4V	$555	$73	$628	$920	$1,285	$85	$640	$980	$1,405	$120	$675	$1,155	$1,755
GE Profile PXRQ15F	$585	$130	$715	$1,235	$1,885	$145	$730	$1,310	$2,035	$190	$775	$1,535	$2,485
Whirlpool WHER25 (aka Sears Kenmore Ultrafilter 500)	$495	$100	$595	$995	$1,495	$110	$605	$1,045	$1,595	$140	$635	$1,195	$1,895
Pentek RO 3500	$555	$105	$660	$1,080	$1,605	$156	$711	$1,335	$2,115	$207	$762	$1,590	$2,625
Aqua Pure AP RO 5500	$695	$232	$927	$1,855	$3,015	$256	$951	$1,975	$3,255	$325	$1,020	$2,320	$3,945
High-Flow RO Devices													
Excel Water 5-Stage RO System	$563	$125	$688	$1,188	$1,813	$168	$731	$1,403	$2,243	$212	$775	$1,623	$2,683
Excel Water High Capacity 5-Stage RO System	$1,003	$226	$1,229	$2,133	$3,263	$280	$1,283	$2,403	$3,803	$335	$1,338	$2,678	$4,353
Excel Water Compact Wall Mount 250 GPD	$4,365	$149	$4,514	$5,110	$5,855	$190	$4,555	$5,315	$6,265	$314	$4,679	$5,935	$7,505
GE Merlin Tankless RO System	$750	$259	$1,009	$2,045	$3,340	$342	$1,092	$2,460	$4,170	$592	$1,342	$3,710	$6,670

Figure 4-1. Typical Adsorption POU Undersink Installation

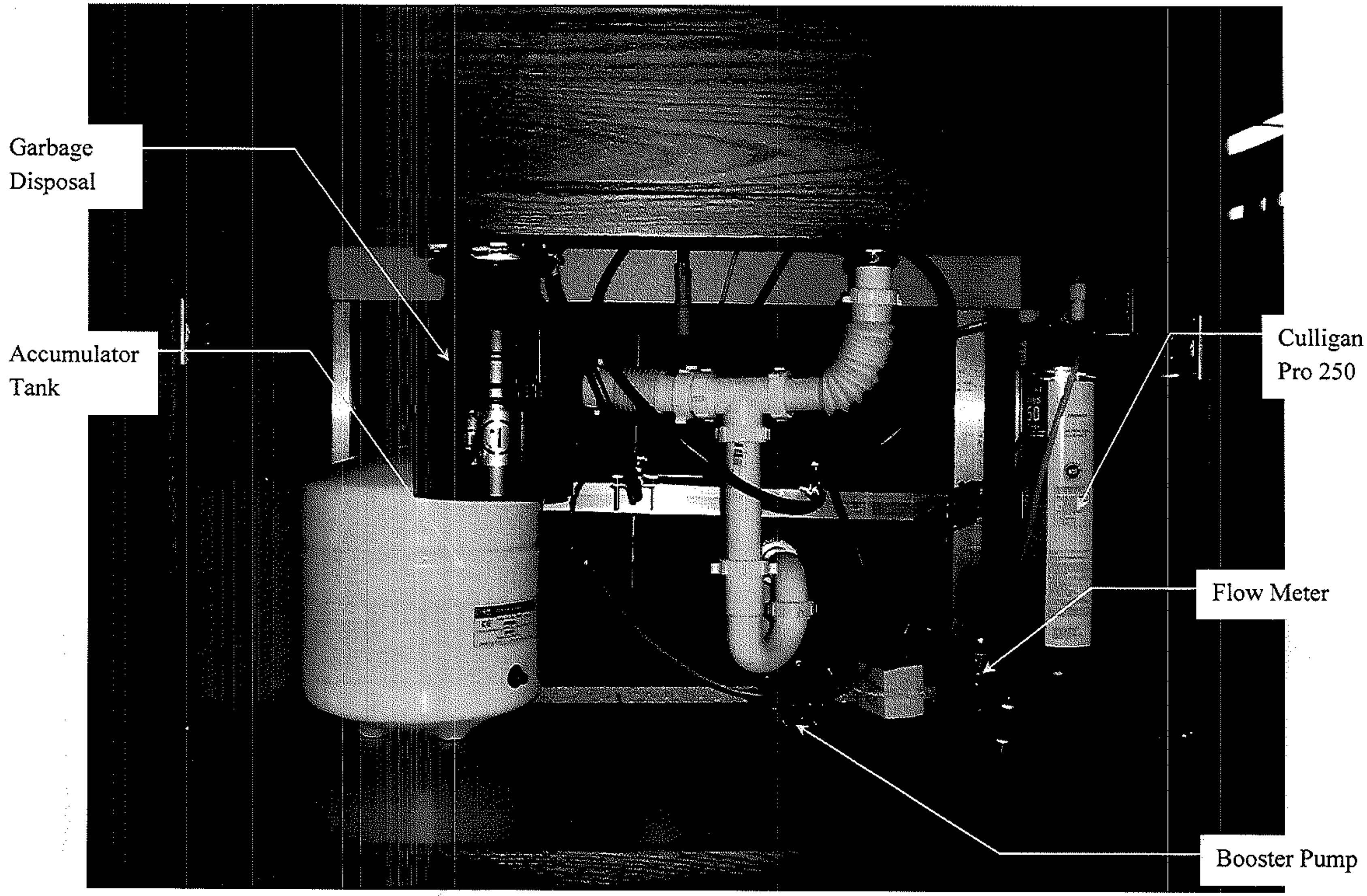
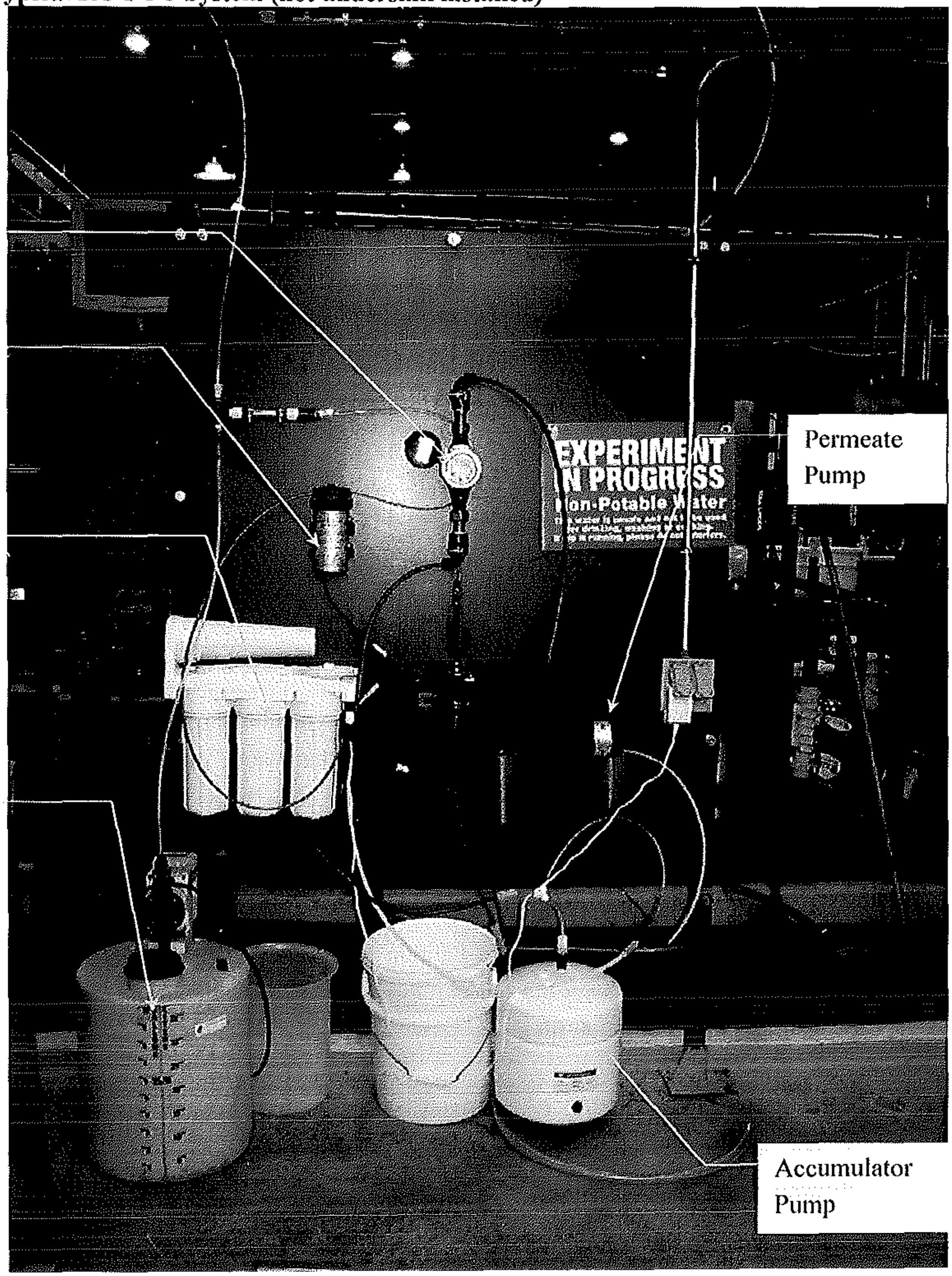


Figure 4-2. Typical RO POU System (not undersink installed)



5.0 Conclusions

The pilot program sampling effort conducted for this study encompassed 27 homes of the 348 homes with potentially contaminated wells in the four sampling areas of Washington County, MO. These four areas include Old Mines, Richwoods, Potosi, and Furnace Creek. The analytical data from water samples collected from these 27 homes are summarized in Table 5.1 which shows that 19 homes (70% of the 27 homes sampled) had lead concentrations above the MCL of 15 µg/L. Lead was found to be the predominant contaminant exceeding the MCL. However, up to 2 homes showed barium, cadmium, antimony, nitrate, and E. coli levels above their respective MCLs.

Table 5.1 presents a summary of historical data for the 348 homes located in this study area. The historical data show that about 90% of the 348 homes had a lead exceedence above the MCL. The historical analytical data for the 27 homes included in this study showed reasonable agreement with the data obtained from analysis at the T&E Facility. Thus, the analytical results of the pilot study may be reasonably extended to the larger study area.

Figure 5-1 presents a flow chart showing a decision methodology for selecting POU devices and add-on accessories based on the anticipated contaminants, expected water quality, and line pressure. Table 5.2 identifies the sites in the four study areas that are potential candidates for specific POU devices based on the decision criteria presented in Figure 5-1. Details of the contamination concentration leading to the POU selection are presented in Appendix A. For properties with only lead, an under-the-counter adsorption filter (such as the Culligan Preferred 250) is recommended. However, the addition of an accumulator tank under the sink can improve the water flow rate through the faucet. Figure 5-2 shows a conceptual diagram for a typical installation of an adsorption filter.

For properties with multiple contaminants above the MCL, an RO system (such as the Watts WP-4V or GE Merlin) is recommended. Depending on the line pressure, a booster pump and a permeate pump would also be recommended. Figure 5-3 shows a conceptual diagram for a typical installation of an RO unit. Figure 5-4 shows a conceptual diagram for a typical installation of a high-flow RO unit (GE Merlin).

Several installation and O&M considerations were also identified through this study. Principally, adsorption systems were preferred where lead was the contaminant of concern because of the higher flow rates associated with these systems along with the low cost of operation (filter changes). RO systems were identified as a necessary treatment device in homes that showed the presence of other contaminants in addition to lead. However, RO systems typically produced lower water flows and the membranes were prone to lower operational life in the presence of the hard water typical of this region leading to higher operating costs.

This study also examined end-of-life indicator devices for the POU systems. Two types of devices were potentially identified – a time-based indicator life and a flow-based resettable, water shutoff device. A flow meter may also be used in conjunction with these devices to track water usage and to schedule the manufacturers recommended maintenance procedures (including replacement of various consumable elements).

Table 5-3 summarizes the performance specifications for typical Under-the-Sink POU devices based on adsorption filters and RO Systems. This table provides a guideline for the selection of a POU device based on site-specific preferences for flow rate and available line pressure. The table also specifies recommended accessories based on site-specific conditions.

Table 5.1
Pilot Program for Selection of POU Devices
Analytical Results Summary for the Households Targeted for POU Devices

Study Area	# of Properties in POU Study	# of Properties Exceeding the MCL			
		Lead	Barium	Cadmium	Arsenic
Richwoods	5	2	0	0	0
Old Mines	7	4	1	0	0
Potosi	14	12	0	1	0
Furnace Creek	1	1	0	0	0
Totals:	27	19	1	1	0

Study Area	% of POU Study Area	% of Properties Exceeding the MCL			
		Lead	Barium	Cadmium	Arsenic
Richwoods	18.52%	40.00%	0.00%	0.00%	0.00%
Old Mines	25.93%	57.14%	14.29%	0.00%	0.00%
Potosi	51.85%	85.71%	0.00%	7.14%	0.00%
Furnace Creek	3.70%	100.00%	0.00%	0.00%	0.00%
Totals:	100.00%	70.37%	3.70%	3.70%	0.00%

Study Area	# of Properties Targeted for POU Devices	# of Properties Exceeding the MCL			
		Lead	Barium	Cadmium	Arsenic
Richwoods	53	53	0	0	0
Old Mines	142	121	13	9	0
Potosi	152	140	4	3	0
Furnace Creek	1	1	0	0	0
Totals:	348	315	17	12	0

Study Area	% of Study Area	% of Properties Exceeding the MCL			
		Lead	Barium	Cadmium	Arsenic
Richwoods	15.23%	100.00%	0.00%	0.00%	0.00%
Old Mines	40.80%	85.21%	9.15%	6.34%	0.00%
Potosi	43.68%	92.11%	2.63%	1.97%	0.00%
Furnace Creek	0.29%	100.00%	0.00%	0.00%	0.00%
Totals:	100.00%	90.52%	4.89%	3.45%	0.00%

Table 5.2
Pilot Program for Selection of POU Devices
POU Selection Summary

Study Area	# of Properties Targeted for POU Devices	Filter Selection (# of Properties)		
		No Filter	Adsorption Filter	RO
Richwoods	53	0	53	0
Old Mines	142	1	119	22
Potosi	152	7	138	7
Furnace Creek	1	0	1	0
Totals:	348	8	311	29

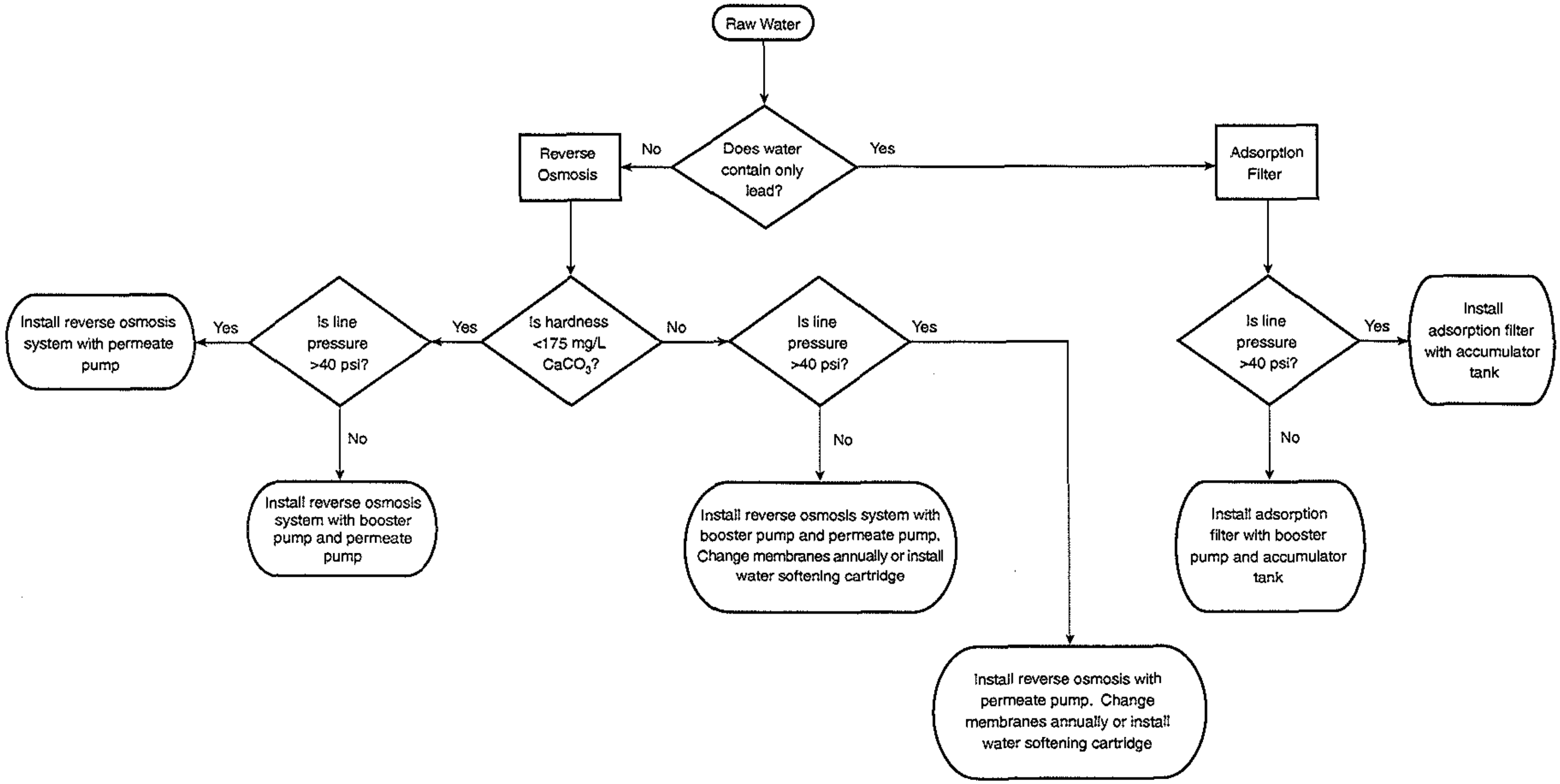
Study Area	% of Study Area	Filter Selection (% of Properties)		
		No Filter	Adsorption Filter	RO
Richwoods	15.23%	0.00%	100.00%	0.00%
Old Mines	40.80%	0.70%	83.80%	15.49%
Potosi	43.68%	4.61%	90.79%	4.61%
Furnace Creek	0.29%	0.00%	100.00%	0.00%
Totals:	100.00%	2.30%	89.37%	8.33%

Table 5.3. Typical Performance Specifications for Under-the-Sink POU Devices

POU Device Type	Typical Installation	Flow Rate (gpm)	Recommended Line Pressure	Recommended Accessories	Capacity	Recommended Maintenance
Adsorption Filter – Low flow option	Single Unit Under-the-Sink	0.5 gpm	10 psi to 40 psi. Install booster pump if rated flow rate is not achieved.	Waterminder shutoff device or other end-of-life indicator	500 to 1000 gallons	Filter changeout at capacity
Adsorption Filter – High flow option	Dual Unit Under-the-Sink	1 gpm	10 psi to 40 psi. Install booster pump if rated flow rate is not achieved.	Waterminder shutoff device or other end-of-life indicator	1000 to 2000 gallons	Filter changeout at capacity
Adsorption Filter – Instantaneous High flow	Single Unit Under-the-Sink	1 gpm instantaneous, 0.5 gpm steady-state	10 psi to 40 psi. Install booster pump if rated flow rate is not achieved.	- Accumulator tank (4 gallon) - Waterminder shutoff device or other end-of-life indicator	500 to 1000 gallons	Filter changeout at capacity

POU Device Type	Typical Installation	Flow Rate (gpm)	Recommended Line Pressure	Recommended Accessories	Capacity	Recommended Maintenance
Reverse Osmosis – Low Flow	Under-the-Sink Installation	1 gpm instantaneous, tailing off to 0 gpm when accumulator tank is empty. Approximately 10 gallons per day total flow.	40 psi minimum. Install booster pump if this pressure is not available.	- Accumulator tank (4 gallon) standard with RO system. - Filter maintenance indicator standard with RO systems - Permeate pump optional to reduce reject water volumes and cycle times	No exhaustion capacity.	Sediment and carbon filters integral to RO unit typically replaced at 6 month intervals. RO membranes replaced at one to three year intervals depending on hardness.
Reverse Osmosis – High Flow	Under-the-Sink Installation	Ranges from 0.5 gpm to 1 gpm continuous flow depending on water quality and time in service.	40 psi minimum. Install booster pump if this pressure is not available.	- No accumulator recommended for this system. - Filter maintenance indicator standard with RO systems.	No exhaustion capacity.	Sediment and carbon filters integral to RO unit typically replaced at 6 month intervals. RO membranes replaced at one to three year intervals depending on hardness.

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/16/10	JIS	JIS	KB	RS	s-136277-2/10-w



Shaw Environmental, Inc.

Figure 5-1.

Flow Chart of POU Device Selection

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/16/10	JIS	JIS	KB	RS	s-136277-2/10-w

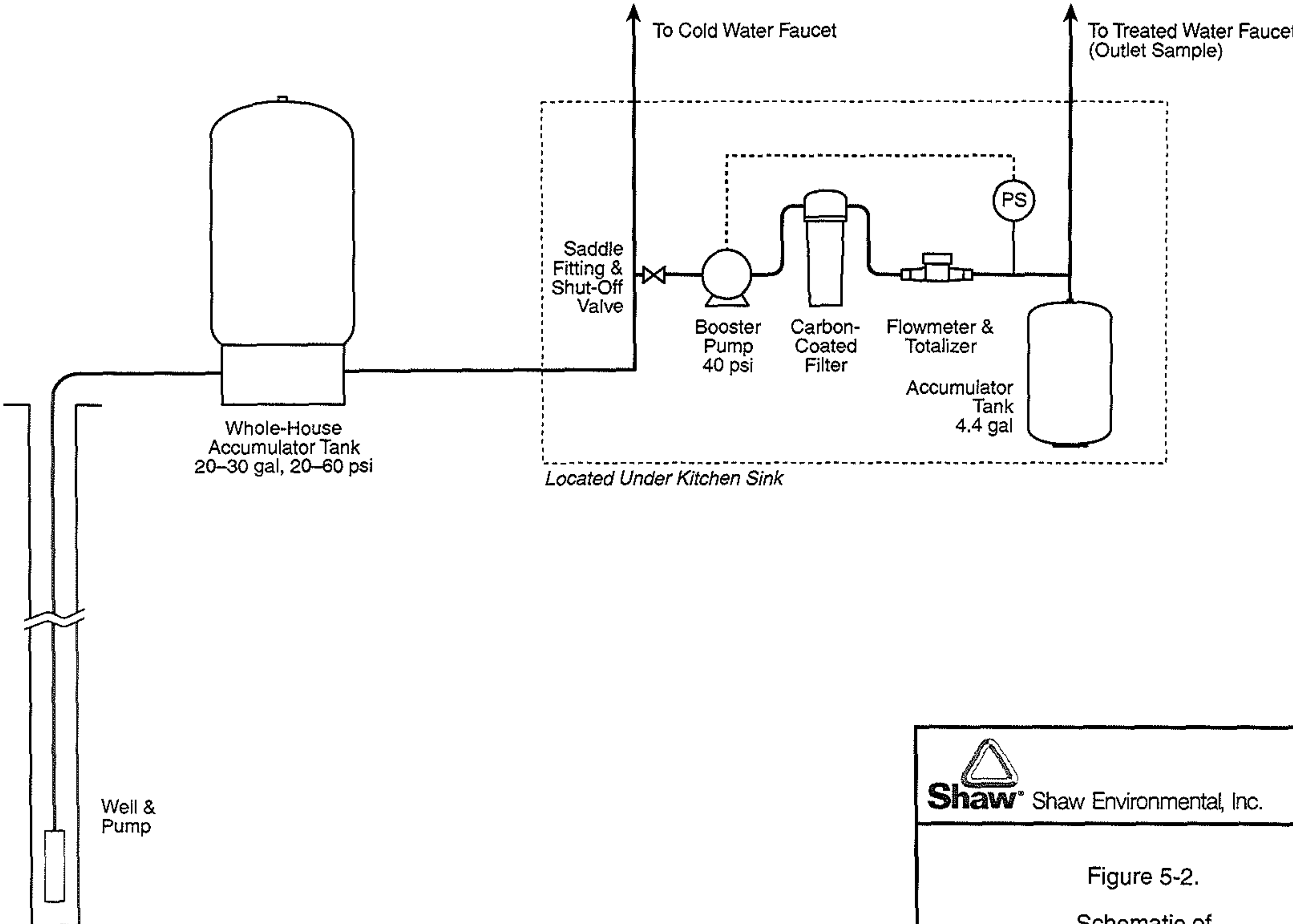


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Figure 5-2.

Schematic of
Typical Adsorption Filter POU System
To Remove Lead From Drinking Water

GM-2
91/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/16/10	JIS	JIS	KB	RS	s-136277-2/10-w

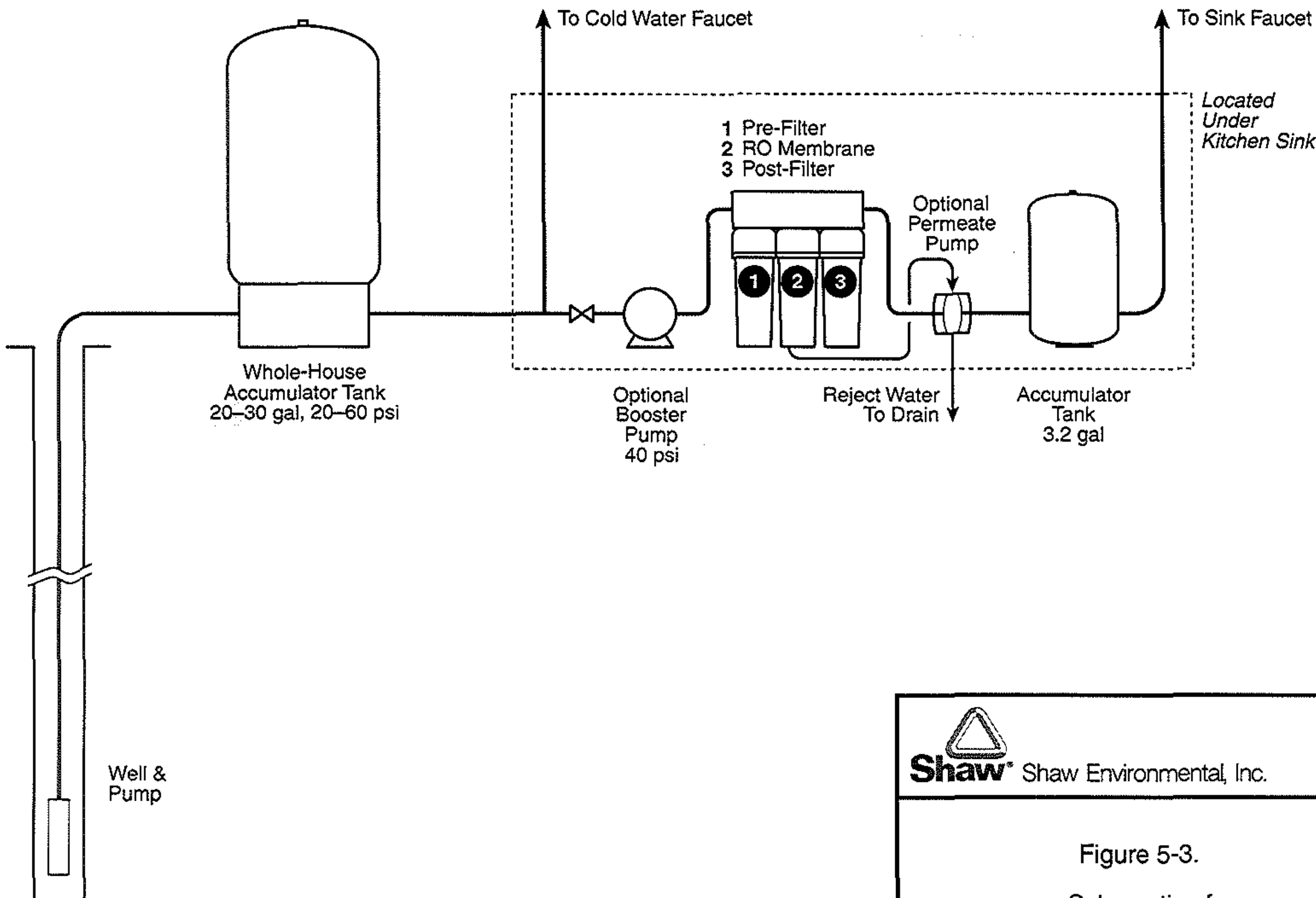

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Figure 5-3.

Schematic of Typical Reverse Osmosis POU System To Remove Contaminants From Drinking Water

GM-2

92/323

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Cincinnati, OH	2/16/10	JIS	JIS	KB	RS	s-136277-2/10-w

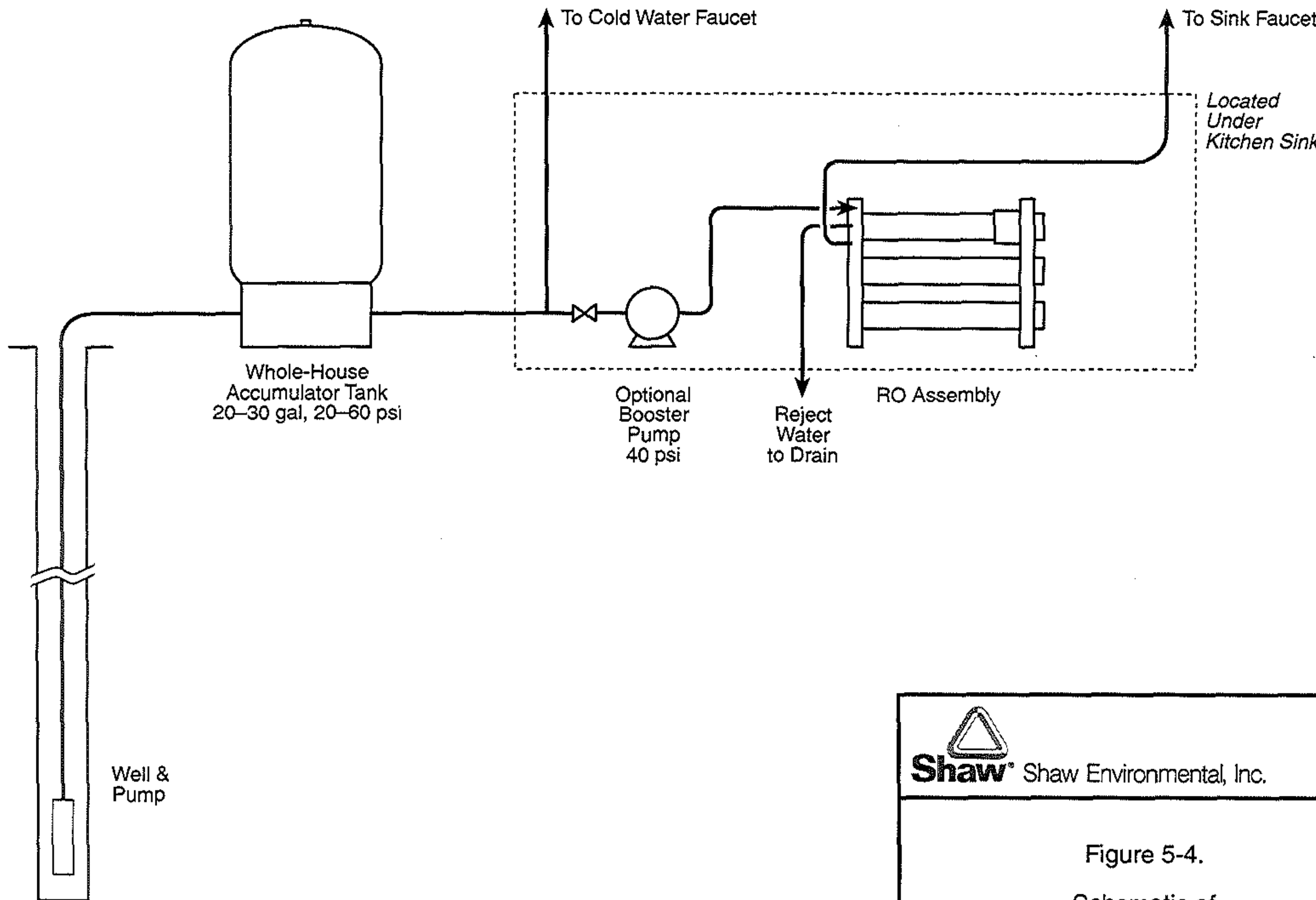

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Figure 5-4.

Schematic of High Flow Reverse Osmosis POU System To Remove Contaminants From Drinking Water

GM-2

93/323

Appendix A

POU Recommendations Based on Historical Monitoring

Appendix A
Pilot Program for Selection of POU Devices
POU Selection by Individual Property ID

Property ID	Location	# of Samples Exceeding the Action Level				POU	Multiple Units?	Comments
		Lead	Barium	Cadmium	Arsenic			
20002	Richwoods	1	0	0	0	Adsorption Filter	--	
20004	Richwoods	1	0	0	0	Adsorption Filter	2	
20005	Richwoods	2	0	0	0	Adsorption Filter	--	
20006	Richwoods	2	0	0	0	Adsorption Filter	--	
20007	Richwoods	2	0	0	0	Adsorption Filter	--	
20009	Richwoods	1	0	0	0	Adsorption Filter	2	
20012	Richwoods	2	0	0	0	Adsorption Filter	3	
20014	Richwoods	2	0	0	0	Adsorption Filter	2	
20016	Richwoods	1	0	0	0	Adsorption Filter	--	
20018	Richwoods	1	0	0	0	Adsorption Filter	--	
20024	Richwoods	1	0	0	0	Adsorption Filter	--	
20028	Richwoods	1	0	0	0	Adsorption Filter	--	
20031	Richwoods	2	0	0	0	Adsorption Filter	--	
20032	Richwoods	2	0	0	0	Adsorption Filter	--	
20051	Richwoods	1	0	0	0	Adsorption Filter	--	
20052	Richwoods	1	0	0	0	Adsorption Filter	--	
20092	Richwoods	2	0	0	0	Adsorption Filter	--	
20125	Richwoods	2	0	0	0	Adsorption Filter	4	
20125	Richwoods	1	0	0	0	Adsorption Filter	--	
20127	Richwoods	1	0	0	0	Adsorption Filter	--	
20158	Richwoods	3	0	0	0	Adsorption Filter	--	
40008	Richwoods	1	0	0	0	Adsorption Filter	--	
40009	Richwoods	1	0	0	0	Adsorption Filter	2	
40011	Richwoods	1	0	0	0	Adsorption Filter	--	
40012	Richwoods	1	0	0	0	Adsorption Filter	--	
40015	Richwoods	1	0	0	0	Adsorption Filter	--	
40034	Richwoods	1	0	0	0	Adsorption Filter	--	
40040	Richwoods	1	0	0	0	Adsorption Filter	--	
40070	Richwoods	1	0	0	0	Adsorption Filter	--	
40084	Richwoods	1	0	0	0	Adsorption Filter	--	
40085	Richwoods	1	0	0	0	Adsorption Filter	--	
40087	Richwoods	1	0	0	0	Adsorption Filter	--	
40088	Richwoods	1	0	0	0	Adsorption Filter	--	
40089	Richwoods	1	0	0	0	Adsorption Filter	--	
40115	Richwoods	1	0	0	0	Adsorption Filter	--	
40120	Richwoods	1	0	0	0	Adsorption Filter	--	
40126	Richwoods	1	0	0	0	Adsorption Filter	--	
40128	Richwoods	2	0	0	0	Adsorption Filter	2	
40129	Richwoods	1	0	0	0	Adsorption Filter	--	
40131	Richwoods	1	0	0	0	Adsorption Filter	--	
40139	Richwoods	1	0	0	0	Adsorption Filter	2	
40140	Richwoods	2	0	0	0	Adsorption Filter	--	
40154	Richwoods	1	0	0	0	Adsorption Filter	--	
40159	Richwoods	1	0	0	0	Adsorption Filter	--	
40161	Richwoods	1	0	0	0	Adsorption Filter	--	
40164	Richwoods	1	0	0	0	Adsorption Filter	--	
40184	Richwoods	1	0	0	0	Adsorption Filter	--	Shares well with 40161
40186	Richwoods	1	0	0	0	Adsorption Filter	--	
40203	Richwoods	1	0	0	0	Adsorption Filter	--	
40207	Richwoods	1	0	0	0	Adsorption Filter	--	
40215	Richwoods	1	0	0	0	Adsorption Filter	--	
40223	Richwoods	1	0	0	0	Adsorption Filter	--	
40228	Richwoods	1	0	0	0	Adsorption Filter	--	
72	Old Mines	0	1	0	0	RO [1]	--	
20145	Old Mines	0	1	0	0	RO [1]	--	
20171	Old Mines	2	0	0	0	Adsorption Filter	--	
20173	Old Mines	1	0	0	0	Adsorption Filter	--	
20186	Old Mines	2	0	0	0	Adsorption Filter	--	
20199	Old Mines	1	1	0	0	RO	--	
20203	Old Mines	1	0	0	0	Adsorption Filter	2	
20204	Old Mines	1	0	0	0	Adsorption Filter	--	
20206	Old Mines	1	0	0	0	Adsorption Filter	--	
20208	Old Mines	1	0	0	0	Adsorption Filter	--	

Property ID	Location	# of Samples Exceeding the Action Level				POU	Multiple Units?	Comments
		Lead	Barium	Cadmium	Arsenic			
20252	Old Mines	1	0	0	0	Adsorption Filter	--	
20334	Old Mines	2	0	0	0	Adsorption Filter	--	
30006	Old Mines	1	0	0	0	Adsorption Filter	--	
30008	Old Mines	1	0	0	0	Adsorption Filter	--	
30017	Old Mines	1	0	0	0	Adsorption Filter	--	
30025	Old Mines	1	0	0	0	Adsorption Filter	--	
30026	Old Mines	1	0	0	0	Adsorption Filter	2	
30040	Old Mines	1	0	0	0	Adsorption Filter	--	
30048	Old Mines	0	1	0	0	RO [1]	--	
30055	Old Mines	1	0	0	0	Adsorption Filter	2	
30069	Old Mines	1	0	0	0	Adsorption Filter	--	
30070	Old Mines	1	0	0	0	Adsorption Filter	--	
30071	Old Mines	1	0	0	0	Adsorption Filter	--	
30075	Old Mines	0	1	0	0	RO [1]	--	
30088	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30090	Old Mines	2	0	0	0	Adsoprtion Filter	--	
30091	Old Mines	1	0	0	0	Adsoprtion Filter	2	
30096	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30105	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30106	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30107	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30108	Old Mines	1	0	0	0	Adsoprtion Filter	--	Shares well with 30107
30112	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30127	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30139	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30142	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30146	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30148	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30155	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30156	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30165	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30173	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30177	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30180	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30181	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30185	Old Mines	1	0	0	0	Adsoprtion Filter	2	
30214	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30223	Old Mines	1	0	0	0	Adsoprtion Filter	2	
30245	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30247	Old Mines	1	0	0	0	Adsoprtion Filter	--	
30299	Old Mines	0	1	0	0	RO [1]	--	
30300	Old Mines	1	0	0	0	Adsorption Filter	--	
30306	Old Mines	1	0	0	0	Adsorption Filter	--	
30308	Old Mines	1	0	0	0	Adsorption Filter	2	
30310	Old Mines	0	0	1	0	RO [1]	--	
30312	Old Mines	2	0	0	0	Adsorption Filter	--	
30316	Old Mines	1	0	0	0	Adsorption Filter	--	
30317	Old Mines	1	0	0	0	Adsorption Filter	--	Shares well with 30316
30319	Old Mines	1	0	0	0	Adsorption Filter	--	
30322	Old Mines	0	1	0	0	RO [1]	--	
30324	Old Mines	1	0	0	0	Adsorption Filter	--	
30325	Old Mines	0	0	0	0	No Filter	--	Shares well with 30326
30343	Old Mines	1	0	0	0	Adsorption Filter	--	
30356	Old Mines	0	1	0	0	RO [1]	--	
30358	Old Mines	1	0	0	0	Adsorption Filter	--	
30369	Old Mines	1	0	0	0	Adsorption Filter	--	
30372	Old Mines	1	0	0	0	Adsorption Filter	--	
30373	Old Mines	1	0	0	0	Adsorption Filter	--	
30374	Old Mines	1	0	0	0	Adsorption Filter	2	
30377	Old Mines	1	0	0	0	Adsorption Filter	--	
30379	Old Mines	1	0	0	0	Adsorption Filter	--	
30395	Old Mines	1	0	0	0	Adsorption Filter	--	

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Appendix A
Pilot Program for Selection of POU Devices
POU Selection by Individual Property ID

Property ID	Location	# of Samples Exceeding the Action Level				POU	Multiple Units?	Comments
		Lead	Barium	Cadmium	Arsenic			
30405	Old Mines	1	0	0	0	Adsorption Filter	--	
30412	Old Mines	1	0	0	0	Adsorption Filter	--	
30427	Old Mines	1	0	0	0	Adsorption Filter	--	
30438	Old Mines	1	0	1	0	RO	--	
30446	Old Mines	1	0	0	0	Adsorption Filter	--	
30448	Old Mines	2	0	0	0	Adsorption Filter	--	
30449	Old Mines	1	0	0	0	Adsorption Filter	--	
30457	Old Mines	1	0	0	0	Adsorption Filter	--	
30459	Old Mines	1	0	0	0	Adsorption Filter	--	
30502	Old Mines	1	0	0	0	Adsorption Filter	--	
30513	Old Mines	2	0	0	0	Adsorption Filter	--	
30529	Old Mines	1	0	0	0	Adsorption Filter	--	
30531	Old Mines	1	0	0	0	Adsorption Filter	--	
30532	Old Mines	1	0	0	0	Adsorption Filter	2	
30534	Old Mines	1	0	0	0	Adsorption Filter	--	
30538	Old Mines	2	0	0	0	Adsorption Filter	--	Shares well with 30541
30539	Old Mines	2	0	0	0	Adsorption Filter	--	Shares well with 30541
30540	Old Mines	1	0	0	0	Adsorption Filter	--	
30541	Old Mines	2	0	0	0	Adsorption Filter	--	
30551	Old Mines	1	0	0	0	Adsorption Filter	--	
30552	Old Mines	1	0	0	0	Adsorption Filter	--	
30561	Old Mines	1	0	0	0	Adsorption Filter	--	
30576	Old Mines	1	0	0	0	Adsorption Filter	--	
30585	Old Mines	1	0	0	0	Adsorption Filter	--	
30586	Old Mines	0	1	0	0	RO [1]	--	
30602	Old Mines	1	0	0	0	Adsorption Filter	2	
30604	Old Mines	2	0	0	0	Adsorption Filter	--	
30606	Old Mines	1	0	0	0	Adsorption Filter	--	
30607	Old Mines	1	0	0	0	Adsorption Filter	--	
30609	Old Mines	1	0	0	0	Adsorption Filter	--	
30617	Old Mines	1	0	0	0	Adsorption Filter	--	
30630	Old Mines	1	0	0	0	Adsorption Filter	--	
30654	Old Mines	1	0	0	0	Adsorption Filter	--	
30657	Old Mines	1	0	0	0	Adsorption Filter	--	
30659	Old Mines	1	0	0	0	Adsorption Filter	--	
30664	Old Mines	1	0	0	0	Adsorption Filter	--	
30673	Old Mines	1	0	0	0	Adsorption Filter	--	
30675	Old Mines	1	0	0	0	Adsorption Filter	--	
30693	Old Mines	1	0	0	0	Adsorption Filter	--	
30697	Old Mines	1	0	0	0	Adsorption Filter	--	
30704	Old Mines	1	0	0	0	Adsorption Filter	--	
30706	Old Mines	0	0	1	0	RO [1]	--	
30712	Old Mines	1	0	0	0	Adsorption Filter	--	
30715	Old Mines	1	0	0	0	Adsorption Filter	--	
30716	Old Mines	0	1	0	0	RO [1]	--	
30718	Old Mines	1	0	0	0	Adsorption Filter	--	
30727	Old Mines	0	0	1	0	RO [1]	--	
30729	Old Mines	0	1	0	0	RO [1]	--	
30738	Old Mines	1	0	0	0	Adsorption Filter	--	
30741	Old Mines	1	0	0	0	Adsorption Filter	--	
30820	Old Mines	0	1	0	0	RO [1]	--	
30821	Old Mines	0	0	1	0	RO [1]	--	
30844	Old Mines	1	0	0	0	Adsorption Filter	--	
30861	Old Mines	1	0	0	0	Adsorption Filter	--	
30897	Old Mines	1	0	0	0	Adsorption Filter	--	
30902	Old Mines	1	0	0	0	Adsorption Filter	--	
30904	Old Mines	1	0	0	0	Adsorption Filter	--	
30920	Old Mines	0	0	1	0	RO [1]	--	Shares well with 30821
30924	Old Mines	0	0	1	0	RO [1]	--	
30928	Old Mines	0	0	1	0	RO [1]	--	Shares well with 30947
30931	Old Mines	1	0	0	0	Adsorption Filter	--	
30934	Old Mines	1	0	0	0	Adsorption Filter	--	Shares well with 30931

Appendix A
Pilot Program for Selection of POU Devices
POU Selection by Individual Property ID

Property ID	Location	# of Samples Exceeding the Action Level				POU	Multiple Units?	Comments
		Lead	Barium	Cadmium	Arsenic			
30944	Old Mines	1	0	0	0	Adsorption Filter	--	
30947	Old Mines	0	0	1	0	RO [1]	--	
30952	Old Mines	1	0	0	0	Adsorption Filter	--	
30953	Old Mines	1	0	0	0	Adsorption Filter	--	
30959	Old Mines	1	0	0	0	Adsorption Filter	--	
30983	Old Mines	1	0	0	0	Adsorption Filter	--	
31047	Old Mines	1	0	0	0	Adsorption Filter	--	
40005	Old Mines	0	1	0	0	RO [1]	--	
1	Potosi	1	0	0	0	Adsorption Filter	--	
5	Potosi	1	0	0	0	Adsorption Filter	--	
13	Potosi	1	0	0	0	Adsorption Filter	--	
14	Potosi	1	0	0	0	Adsorption Filter	--	
41	Potosi	1	0	0	0	Adsorption Filter	--	
42	Potosi	1	0	0	0	Adsorption Filter	--	
47	Potosi	0	1	0	0	RO [1]	--	
64	Potosi	1	0	0	0	Adsorption Filter	--	
69	Potosi	0	0	0	0	No Filter	--	
75	Potosi	1	0	0	0	Adsorption Filter	--	
86	Potosi	1	0	0	0	Adsorption Filter	--	
87	Potosi	1	0	0	0	Adsorption Filter	--	
112	Potosi	0	0	1	0	RO [1]	--	
115	Potosi	1	0	0	0	Adsorption Filter	--	
116	Potosi	1	0	0	0	Adsorption Filter	--	
119	Potosi	1	0	0	0	Adsorption Filter	--	
120	Potosi	0	0	0	0	No Filter	--	
121	Potosi	0	0	0	0	No Filter	--	
123	Potosi	2	0	0	0	Adsorption Filter	--	
128	Potosi	1	0	0	0	Adsorption Filter	--	
423	Potosi	1	0	0	0	Adsorption Filter	--	
428	Potosi	0	0	0	0	No Filter	--	
432	Potosi	1	0	0	0	Adsorption Filter	--	
439	Potosi	1	0	0	0	Adsorption Filter	--	
441	Potosi	1	0	0	0	Adsorption Filter	2	
443	Potosi	1	0	0	0	Adsorption Filter	--	
449	Potosi	1	0	0	0	Adsorption Filter	2	
461	Potosi	1	0	0	0	Adsorption Filter	--	
470	Potosi	1	0	0	0	Adsorption Filter	--	
471	Potosi	1	0	0	0	Adsorption Filter	--	
473	Potosi	1	0	0	0	Adsorption Filter	--	
491	Potosi	1	0	0	0	Adsorption Filter	--	
523	Potosi	1	0	0	0	Adsorption Filter	8+	
524	Potosi	1	0	0	0	Adsorption Filter	3	
528	Potosi	1	0	0	0	Adsorption Filter	--	
529	Potosi	1	0	0	0	Adsorption Filter	--	
548	Potosi	0	1	0	0	RO [1]	--	
555	Potosi	2	0	0	0	Adsorption Filter	2	
1634	Potosi	1	0	0	0	Adsorption Filter	--	
1646	Potosi	1	0	0	0	Adsorption Filter	--	
1653	Potosi	2	0	0	0	Adsorption Filter	--	
1661	Potosi	2	0	0	0	Adsorption Filter	2	
1662	Potosi	2	0	0	0	Adsorption Filter	--	Shares well with 1661
1663	Potosi	2	0	0	0	Adsorption Filter	--	Shares well with 1661
1667	Potosi	1	0	0	0	Adsorption Filter	--	
20270	Potosi	2	0	0	0	Adsorption Filter	--	
20300	Potosi	1	0	0	0	Adsorption Filter	--	
20305	Potosi	1	0	0	0	Adsorption Filter	--	
20321	Potosi	1	0	0	0	Adsorption Filter	--	
20325	Potosi	1	0	0	0	Adsorption Filter	--	
20326	Potosi	1	0	0	0	Adsorption Filter	--	
20327	Potosi	1	0	0	0	Adsorption Filter	--	
20328	Potosi	1	0	0	0	Adsorption Filter	--	
20329	Potosi	1	0	0	0	Adsorption Filter	--	
20330	Potosi	1	0	0	0	Adsorption Filter	--	

Appendix A
Pilot Program for Selection of POU Devices
POU Selection by Individual Property ID

Property ID	Location	# of Samples Exceeding the Action Level				POU	Multiple Units?	Comments
		Lead	Barium	Cadmium	Arsenic			
20331	Potosi	1	0	0	0	Adsorption Filter	--	
20332	Potosi	2	0	0	0	Adsorption Filter	--	
20335	Potosi	1	0	0	0	Adsorption Filter	--	
20337	Potosi	1	0	0	0	Adsorption Filter	--	
20338	Potosi	1	0	0	0	Adsorption Filter	--	
20339	Potosi	2	0	0	0	Adsorption Filter	--	
20340	Potosi	0	0	0	0	No Filter	--	Shares well with Unknown Property ID[2]
20343	Potosi	2	0	0	0	Adsorption Filter	--	
20344	Potosi	1	0	0	0	Adsorption Filter	--	
20353	Potosi	1	0	0	0	Adsorption Filter	--	
20362	Potosi	1	0	0	0	Adsorption Filter	2	Shares well with 20495
20373	Potosi	1	0	0	0	Adsorption Filter	--	
20379	Potosi	1	0	0	0	Adsorption Filter	--	Shares well with 20496
20380	Potosi	1	0	0	0	Adsorption Filter	--	
20390	Potosi	1	0	0	0	Adsorption Filter	--	
20393	Potosi	1	0	0	0	Adsorption Filter	--	
20396	Potosi	1	0	0	0	Adsorption Filter	--	
20397	Potosi	1	0	0	0	Adsorption Filter	--	
20410	Potosi	1	0	0	0	Adsorption Filter	--	
20412	Potosi	0	2	0	0	RO[1]	--	
20414	Potosi	1	0	0	0	Adsorption Filter	--	
20424	Potosi	1	0	0	0	Adsorption Filter	--	
20425	Potosi	2	0	0	0	Adsorption Filter	--	
20427	Potosi	1	0	0	0	Adsorption Filter	--	
20432	Potosi	1	0	0	0	Adsorption Filter	--	
20435	Potosi	2	0	2	0	RO	--	
20455	Potosi	1	0	0	0	Adsorption Filter	--	
20459	Potosi	1	0	0	0	Adsorption Filter	--	
20464	Potosi	1	0	1	0	RO	--	
20465	Potosi	1	0	0	0	Adsorption Filter	--	
20467	Potosi	1	0	0	0	Adsorption Filter	--	
20471	Potosi	1	0	0	0	Adsorption Filter	--	
20481	Potosi	1	0	0	0	Adsorption Filter	--	
20486	Potosi	1	0	0	0	Adsorption Filter	--	
20494	Potosi	1	0	0	0	Adsorption Filter	--	
20495	Potosi	1	0	0	0	Adsorption Filter	2	
20496	Potosi	1	0	0	0	Adsorption Filter	--	
20497	Potosi	1	0	0	0	Adsorption Filter	--	Shares well with 20496
20503	Potosi	1	0	0	0	Adsorption Filter	--	
20508	Potosi	1	0	0	0	Adsorption Filter	--	
20517	Potosi	2	0	0	0	Adsorption Filter	--	
20519	Potosi	1	0	0	0	Adsorption Filter	--	
20571	Potosi	1	0	0	0	Adsorption Filter	--	
20576	Potosi	1	0	0	0	Adsorption Filter	3	
20591	Potosi	1	0	0	0	Adsorption Filter	--	Shares well with 20592
20592	Potosi	1	0	0	0	Adsorption Filter	--	
20594	Potosi	2	0	0	0	Adsorption Filter	--	
20600	Potosi	1	0	0	0	Adsorption Filter	--	
20603	Potosi	1	0	0	0	Adsorption Filter	--	
20604	Potosi	1	0	0	0	Adsorption Filter	--	
20607	Potosi	2	0	0	0	Adsorption Filter	--	
20613	Potosi	1	0	0	0	Adsorption Filter	--	
20618	Potosi	1	0	0	0	Adsorption Filter	--	
20625	Potosi	1	0	0	0	Adsorption Filter	--	
20637	Potosi	1	0	0	0	Adsorption Filter	--	
20638	Potosi	1	0	0	0	Adsorption Filter	--	
20669	Potosi	1	0	0	0	Adsorption Filter	--	
20701	Potosi	1	0	0	0	Adsorption Filter	--	
20731	Potosi	2	0	0	0	Adsorption Filter	--	
20767	Potosi	1	0	0	0	Adsorption Filter	2	
20775	Potosi	1	0	0	0	Adsorption Filter	--	
20832	Potosi	1	0	0	0	Adsorption Filter	--	
20833	Potosi	1	0	0	0	Adsorption Filter	2	

Appendix A
Pilot Program for Selection of POU Devices
POU Selection by Individual Property ID

Property ID	Location	# of Samples Exceeding the Action Level				POU	Multiple Units?	Comments
		Lead	Barium	Cadmium	Arsenic			
20837	Potosi	1	0	0	0	Adsorption Filter	--	
20838	Potosi	1	0	0	0	Adsorption Filter	--	Shares well with 20837
20868	Potosi	2	0	0	0	Adsorption Filter	--	
20882	Potosi	1	0	0	0	Adsorption Filter	--	
20916	Potosi	1	0	0	0	Adsorption Filter	--	Shares well with 20917
20917	Potosi	1	0	0	0	Adsorption Filter	--	
20941	Potosi	1	0	0	0	Adsorption Filter	--	Shares well with 20837
21034	Potosi	1	0	0	0	Adsorption Filter	--	
23064	Potosi	1	0	0	0	Adsorption Filter	--	
23269	Potosi	2	0	0	0	Adsorption Filter	--	
23426	Potosi	1	0	0	0	Adsorption Filter	--	Shares well with 23427
23427	Potosi	1	0	0	0	Adsorption Filter	--	
23428	Potosi	2	0	0	0	Adsorption Filter	--	
23429	Potosi	1	0	0	0	Adsorption Filter	--	
23438	Potosi	1	0	0	0	Adsorption Filter	--	
23442	Potosi	1	0	0	0	Adsorption Filter	--	
23474	Potosi	1	0	0	0	Adsorption Filter	--	Shares well with 20604
23482	Potosi	1	0	0	0	Adsorption Filter	--	
23564	Potosi	1	0	0	0	Adsorption Filter	--	
23566	Potosi	0	0	0	0	No Filter	--	
23569	Potosi	2	0	0	0	Adsorption Filter	--	
23594	Potosi	1	0	0	0	Adsorption Filter	--	
23611	Potosi	2	0	0	0	Adsorption Filter	--	
23612	Potosi	0	0	0	0	No Filter	--	
23658	Potosi	1	0	0	0	Adsorption Filter	--	
23672	Potosi	0	1	0	0	RO [1]	--	
23712	Potosi	1	0	0	0	Adsorption Filter	--	
24019	Potosi	2	0	0	0	Adsorption Filter	--	
24055	Potosi	2	0	0	0	Adsorption Filter	--	
24059	Potosi	1	0	0	0	Adsorption Filter	--	
24080	Potosi	2	0	0	0	Adsorption Filter	--	
24082	Potosi	1	0	0	0	Adsorption Filter	--	
24124	Potosi	1	0	0	0	Adsorption Filter	--	
24125	Potosi	1	0	0	0	Adsorption Filter	--	
636	Furnace Creek	1	0	0	0	Adsorption Filter	--	

1: Lead Sample does not exceed 15 µg/L, but either Barium, Cadmium, or Arsenic exceeds the MCL
2: Shares well with unknown Property ID, Adsorption Filter assigned based on results
20125: 2 Wells on the Property
POU Device Selection: If the Lead result exceeded the action level of 15 µg/L and any additional analytes exceeded their MCL, then a RO Unit was selected. If Lead was the only analyte to exceed the action level, then an Adsorption Filter was seleted. If Lead did not exceed the action level, but other analytes exceeded their MCL, then a RO was selected. If no samples exceeded an action level, then No Filter was selected

Appendix B

Trip Report and Data Summary
Tetra Tech

TETRA TECH

January 25, 2010

Mr. Roy Crossland
START Project Officer
U.S. Environmental Protection Agency, Region 7
901 North 5th Street
Kansas City, Kansas 66101

Subject: **Trip Report and Data Summary**
Washington County Point-of-Use Study, Washington County, Missouri
CERCLIS ID Nos. MON000705027 (Old Mines)
MON000705023 (Potosi)
MON000705032 (Richwoods)
MON000705842 (Furnace Creek)
U.S. EPA Region 7 START 3, Contract No. EP-S7-06-01
Task Order Nos. 0144 through 0147
Task Monitor: Craig Smith, EPA Region 7 Work Assignment Manager

Dear Mr. Crossland:

Tetra Tech EM Inc. is submitting the enclosed Trip Report and Data Summary for household well water sampling for the Washington County Point of Use (POU) Study in Washington County, Missouri. If you have any questions or comments regarding this submittal, please contact the project manager at (816) 412-1785.

Sincerely,

Colin Willits
START Project Manager

for Ted Faile, PG, CHMM
START Program Manager

Enclosures

Tetra Tech EM Inc.
415 Oak Street, Kansas City, MO 64106
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X9004.09.0144, 0145, 0146, and 0147

TRIP REPORT AND DATA SUMMARY
WASHINGTON COUNTY POINT OF USE STUDY – WASHINGTON COUNTY, MISSOURI
CERCLIS ID NOS. MON000705027 (OLD MINES)
MON000705023 (POTOSI)
MON000705032 (RICHWOODS)
MON000705842 (FURNACE CREEK)

Superfund Technical Assessment and Response Team (START) 3
Contract No. EP-S7-06-01, Task Orders 0144 through 0147

Prepared For:

U.S. Environmental Protection Agency
Region 7
901 North 5th Street
Kansas City, Kansas 66101

January 25, 2010

Prepared By:

Tetra Tech EM Inc.
415 Oak St.
Kansas City, Missouri 64106
(816) 412-1741

CONTENTS

APPENDICES

TABLES

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) Region 7 Superfund Division tasked Tetra Tech EM Inc., (Tetra Tech), under Superfund Technical Assessment and Response Team (START) 3 Contract No. EP-S7-06-01, Task Order Nos. 0144 through 0147, to provide sampling support for a large-scale pilot study in Washington County, Missouri, to evaluate lead in residential drinking water and alternative water systems to the point of use (POU) carbon filtration systems currently installed at residences near lead mine sites throughout the county. This study was conducted by EPA Region 7 in conjunction with EPA's Office of Research and Development (ORD) National Risk Management Research Laboratory (NRMRL). Analyses were performed at EPA's Test & Evaluation (T&E) facility in Cincinnati, Ohio, operated by Shaw Environmental and Infrastructure, Inc. (Shaw). Split samples were also collected for comparison analysis by the EPA Region 7 laboratory in Kansas City, Kansas.

Four Superfund mine waste sites are located in Washington County. In 2008, three of the sites (Old Mines, Potosi, and Richwoods) were placed on the National Priorities List (NPL) due to lead contamination in groundwater. Investigation at the fourth site (Furnace Creek) is in progress. At the time of this pilot study, approximately 270 residences at these sites were receiving bottled water supplied by EPA or had previously allowed EPA to install Culligan carbon filtration POU filters in their kitchen sinks. The POU study was designed to provide water quality data to assist EPA in deciding whether POU filter systems should be installed at residences currently receiving bottled water, or whether other technologies might be more effective.

EPA elected to collect water well samples at 27 of the 270 residences in order to obtain data from 10 percent of the locations in the study area. START was tasked to assist in selection of sampling locations, obtain access from property owners, and collect the water samples. Among the 27 residences to be sampled were eight where POU units had been installed. Only one residence in the Furnace Creek area (EPA Property Identification Number FRCK-636) was receiving bottled water, and thus it was selected. The remaining 18 locations were selected proportional to the number of residences receiving bottled water in each of the three remaining areas. That is, about 16 percent (4) were selected from the Richwoods area, 38 percent (7) were selected from the Old Mines area, and 43 percent (7) were selected from the Potosi area.

The geology and well depths included in the Hazard Ranking System (HRS) scoring packages for the three NPL sites were reviewed to ensure that samples from different sections of the aquifer (different bedrock units) were collected, if possible. In addition, the sampling data for locations receiving bottled water were reviewed to determine what metals concentrations exceeded maximum contaminant levels (MCL). It was determined that all locations receiving bottled water had lead concentrations in groundwater above the action level of 15 micrograms per liter (μg/L) or cadmium concentrations above the 5 μg/L MCL. Consideration was also given to selecting some sampling locations where other metals had been identified at concentrations above their respective MCLs. Two locations were selected where cadmium had been detected over its 5 μg/L MCL; however, only one of these could be sampled (Location 20435). Access could not be arranged to sample the second selected location. One location was selected where the barium concentration exceeded the 2,000 μg/L MCL; however, access could not be obtained for this location. The highest previous barium concentrations detected at the sampled locations were 1,790 μg/L at Location 40140 and 1,770 μg/L at Location 20199. Remaining sample locations were then selected based on geographic distribution within the study area. Typically, several wells were present in any area, and locations were selected randomly from within the local geographic area, with preference given to locations near main highways. One nearby alternate location was selected for each of the 18 locations in the event that interior access could not be obtained. START was able to sample 10 of the 18 pre-selected locations (including FRCK-636) and four of the designated alternate locations. Five additional alternate locations were substituted in the field for locations where access could not be obtained at either the pre-selected primary or alternate locations. A second location (30924) where cadmium had been detected at a concentration above the MCL was also selected. It replaced a lead-contaminated sample location about 3 miles to the north. The other alternate locations were typically within about 0.5 mile of the originally selected location.

2.0 SITE BACKGROUND INFORMATION

The POU study area encompassed approximately 384 square miles in Washington County, Missouri (see Figure 1, Appendix A). This area is the sum of the study areas previously identified by EPA as the Richwoods, Old Mines, Potosi, and Furnace Creek sites. The study areas are locations of historical, large-scale mining operations. These areas are primarily rural, with scattered residences and a few commercial businesses generally located along highways. Lead, zinc, iron ore, silver, and barite have been mined in these areas.

Washington County is in southeastern Missouri, on the northwest side of the St. Francois Mountains, which form the core of the Ozark Uplift. Precambrian-aged rocks (particularly granites and volcanic rocks) are exposed in the St. Francois Mountains, with some of these rocks extending into southeastern Washington County. Cambrian or Ordovician-aged dolomites with lesser amounts of shales, limestones, and sandstones are typically the uppermost bedrock in Washington County. In the study areas, bedrock units generally range in age from the Ordovician-aged Roubidoux Formation to the Cambrian Potosi

Dolomite; however, older units may be exposed in stream valleys. Several major structural trends and fault systems are present in the county, and blocks of bedrock have been moved up or down relative to each other. Mine shafts, as well as solution weathering and fractures have created channels and conduits for groundwater movement within the aquifer (U.S. Department of Agriculture [USDA] 2003).

The Ordovician-aged Roubidoux Formation and Gasconade Dolomite, along with the underlying Cambrian-aged Eminence and Potosi Dolomites, form the lower part of the Ozark Aquifer. The Ozark Aquifer is the source of most domestic water wells in the area. The underlying Elvins Group (Derby-Doerun Dolomite and Davis Formation) form the base of the Ozark Aquifer and confining unit for the St. Francois Aquifer. The St. Francois Aquifer is typically not used as a water source in areas where the prolific Ozark Aquifer is present. In Washington County, wells are typically completed as open holes in bedrock; consequently, wells could produce from both the Ozark Aquifer and the St. Francois Aquifer. Currently, 80 feet of surface casing is typically installed in wells; however, older wells may have less casing (Miller and Vandike 1997).

Washington County is characterized by rugged terrain. An elevation difference of over 1,000 feet occurs across the county; however, elevations locally may vary by about 200 feet (USDA 2003). The climate in Washington County, Missouri, is characterized by cool winters and hot summers. The average daily maximum temperature is 88 degrees Fahrenheit (°F) in the summer and 31°F during the winter. Total annual precipitation is about 39.33 inches, with 47 percent (18.7 inches) falling between April and September (USDA 2003).

3.0 SITE ACTIVITIES

Residential well sampling activities were conducted in October 2009 by START team members (STM) Greg Blattner and Jason Heflin. Samples from the 27 locations were sent to EPA's T&E facility in Cincinnati, Ohio, for all analyses. Split samples for metals analysis were collected at four locations under Analytical Services Request (ASR) number 4693 and sent to the EPA Region 7 laboratory in Kansas City, Kansas. Table 1 summarizes the residential well addresses, EPA property identification numbers, dates sampled, and the sample locations and corresponding sample numbers. Figure 2 in Appendix A shows the locations of the sampled residences, which of these locations had Culligan POU filters installed, and where split samples were collected. A copy of START's logbook is provided in Appendix B.

TABLE 1

RESIDENTIAL WELL SAMPLE SUMMARY
WASHINGTON COUNTY POINT OF USE STUDY – WASHINGTON COUNTY, MISSOURI

EPA Property Identification	Mine Waste Area	Sampled Address	Latitude (Degrees North)	Longitude (Degrees West)	Sample Date	Location Sampled and Corresponding Sample Number				
						Unpurged Culligan Tap	Purged Culligan Tap	Unpurged Sink Faucet	Purged Sink Faucet	Additional Samples Collected
Samples Collected at Residences Having Culligan Point-of-Use Filtration Systems										
123	Potosi	11652 E. State Hwy E.	37.95754	90.74033	10/26/2009	ORD-13	ORD-14	ORD-132	ORD-133	
555	Potosi	10092 Warden Lake Dr.	37.94.81	90.72861	10/19/2009	ORD-1	ORD-2	ORD-102	ORD-103,	
20594	Potosi	10149 Laramarque Dr.	37.99488	90.7392117	10/20/2009	ORD-7/7FD	ORD-8/8FD	ORD-108/108FD	ORD-109/109FD	
20613*	Potosi	10488 Shepard Rd.	37.9841667	90.7604583	10/23/2009	ORD-9	ORD-10	ORD-124 4693-4	ORD-125 4693-5	
20868	Old Mines	10614 N. Dogpatch Rd.	38.1956	90.71677	10/19/2009	ORD-3	ORD-4	ORD-104	ORD-105	
24019	Potosi	10797 Laramarque Dr.	37.98997	90.74809	10/20/2009	ORD-5	ORD-6	ORD-106	ORD-107	
24055*	Potosi	12222 Gun Club Rd.	37.96299	90.81494	10/23/2009	ORD-11	ORD-12	ORD-128 4693-8	ORD-129 4693-9	
40015	Richwoods	14377 W. State Hwy 47	38.12320	90.77866	10/28/2009	ORD-15	ORD-16	ORD-146	ORD-147	
Samples Collected at Residences Receiving Bottled Water										
20332	Potosi	10090 Shore Dr.	37.93527	90.806685	10/21/2009	NA	NA	ORD-112	ORD-113	
20425	Potosi	10513 Millor Rd.	37.96746	90.77184	10/21/2009	NA	NA	ORD-114	ORD-115	
20435	Potosi	10248 Keyes Branch Rd.	37.95713	90.75861	10/19/2009	NA	NA	ORD-100	ORD-100	
20459	Potosi	14243 E. State Hwy E	37.98760	90.72091	10/21/2009	NA	NA	ORD-116	ORD-117	
20517	Potosi	10994 E. State Hwy E	37.95254	90.75086	10/29/2009	NA	NA	ORD-152	ORD-153	
23428	Potosi	10066 Nugget Rd.	37.92219	90.75924	10/27/2009	NA	NA	ORD-136	ORD-137/137FD	
24080	Potosi	12019 Sunwood Rd.	37.92693	90.80856	10/21/2009	NA	NA	ORD-118	ORD-119	
20199	Old Mines	10752 Mystic Rd.	38.01986	90.74503	10/29/2009	NA	NA	ORD-150	ORD-151	
30090	Old Mines	17614 State Hwy F	38.02624	90.83862	10/22/2009	NA	NA	ORD-120	ORD-121	
30312	Old Mines	10148 Autumn Rd.	38.06864	90.73505	10/20/2009	NA	NA	ORD-110	ORD-111	
30412*	Old Mines	10502 Peppersville Rd.	38.06873	90.71959	10/22/2009	NA	NA	ORD-122 4693-1	ORD-123 (Inside) 4693-2	ORD-123 (Outside) 4693-3
30541	Old Mines	15568 State Hwy F	38.003	90.82249	10/27/2009	NA	NA	ORD-140	ORD-141	
30924	Old Mines	19385 N. State Hwy 21	38.05744	90.76101	10/26/2009	NA	NA	ORD-130	ORD-131 (Unfiltered)	ORD-131 (Filtered)
30513	Old Mines	11695 Lakeshore Dr.	38.04562	90.66862	10/28/2009	NA	NA	ORD-144	ORD-145	
20158	Richwoods	10952 Click Rd.	38.18205	90.841365	10/26/2009	NA	NA	ORD-134	ORD-135	
40034	Richwoods	10880 Providence Rd.	38.19728	90.81641	10/28/2009	NA	NA	ORD-148	ORD-149	
40140	Richwoods	10172 Turtle Rd.	38.16844	90.81769	10/27/2009	NA	NA	ORD-138	ORD-139/139FD	
40159	Richwoods	10192 Calico Rd.	38.12638	90.77485	10/27/2009	NA	NA	ORD-142	ORD-143-S (Filtered)	ORD-143-US (Filtered) ORD-143-USUF
FRCK-636*	Furnace Creek	13340 John Smith Rd.	37.87123	90.73136	10/23/2009	NA	NA	ORD-126 4693-6	ORD-127 4693-7	

Notes:

Sample numbers labeled with the prefix ORD- were sent to EPA's Test and Evaluation facility for analysis; those labeled with the prefix 4693- were split samples sent to EPA's Region 7 Laboratory.

* Locations where split samples were collected for analysis by EPA Region 7 laboratory

EPA U.S. Environmental Protection Agency
FD Field duplicate
NA Not applicable (no Culligan unit)
ORD Office of Research and Development
FRCK Furnace Creek

During residential well sampling from October 19 through 29, 2009, STMs Blattner and Heflin collected 80 groundwater samples from 27 residential domestic wells. Where POU systems had been installed, START collected samples from the Culligan POU tap before purging standing water from the unit (unpurged). A second sample was collected after purging the POU unit. At each residence, samples were also collected from the kitchen sink faucet before and after purging. Residents had been asked not to use the POU tap for at least 4 hours prior to sampling that day; however, these durations of non use varied per location. The time the unit had been unused, as well as the purge times at each sampling location, were recorded on field sheets for all locations. These field sheets are included in Appendix C. Homeowner questionnaires, which included information regarding the household water systems, are also included with the field sheets in Appendix C.

At several locations, residents had installed water softeners or filters; consequently, additional samples were collected at those properties so that EPA could evaluate the effects of those systems. At Location 30924, a non-Culligan filtered water sample (ORD-131 Filtered) was collected. Also, samples were collected of softened and filtered water (ORD-143-S Filtered), the unsoftened but filtered water (ORD-143-US Filtered), and unsoftened and unfiltered water (ORD-143-USUF) at Location 40159. At Location 30412, a split sample (4693-3) was collected of purged, unsoftened water at an outside spigot (ORD-123 Outside).

The following is an outline of the routine sampling procedures followed by START:

Unpurged Culligan POU Treatment Samples

1. Completed property identification information on field sheet and homeowner questionnaire. Determined the approximate time elapsed since the POU carbon filtration unit last had been used (4 or more hours, if possible). Recorded this information on the field sheet, along with the approximate date that the filter last had been replaced.

2. Turned on filtered water and immediately filled one 150-milliliter (mL) high-density polyethylene (HDP) container pre-preserved with nitric acid (HNO_3) for analysis for total metals.

3. Filled a 0.45-micron Nalgene filter container with unpurged water from POU filtration unit. Drew unfiltered water from the Nalgene container using a new syringe. Attached a solid-phase micro-extraction (SPME) cartridge to the syringe and pushed water through the SPME cartridge using a low-volume peristaltic pump, collecting the sample in a 150-mL HDP container pre-preserved with HNO_3 for total arsenic III/V analysis.

4. Filtered the remaining water through the Nalgene filter using a hand pump. Drew a sample of the filtered water into a new syringe. Attached a SPME cartridge to the syringe and pushed water through the SPME cartridge using a low-volume peristaltic pump, collecting the sample in a 150-mL HDP container pre-preserved with HNO_3 for dissolved arsenic III/V analysis.

5. Transferred the remaining filtered water to one 150-mL HDP container pre-preserved with HNO_3 for analysis for dissolved metals.

Purged Culligan POU Treatment Samples

Before the appropriate sample containers were filled with purged water, water was allowed to run through the POU filtration unit for at least 5 minutes to ensure that the filtration unit and any water lines or holding tanks had been purged, and the well was drawing water from the aquifer.

1. Repeated the procedure for collection of the unpurged metals samples. Collected one 150-mL HDP container pre-preserved with HNO_3 for total metals analysis.

2. Filled a new 0.45-micron Nalgene filter container with purged water from filtration unit. Drew unfiltered water from the Nalgene container into a new syringe. Attached a SPME cartridge to the syringe and pushed water through the SPME cartridge, collecting the sample in a 150-mL HDP container pre-preserved with HNO_3 for total arsenic III/V analysis.

3. Filtered remaining water through the Nalgene filter using a hand pump. Drew a sample of the filtered water into a new syringe. Attached a SPME cartridge to the syringe and pushed water through the SPME cartridge, collecting the sample in a 150-mL HDP container pre-preserved with HNO_3 for dissolved arsenic III/V analysis.

4. Transferred the remaining filtered water to one 150-mL HDP container pre-preserved with HNO_3 for analysis for dissolved metals.

Unpurged, Untreated Well Water Samples

1. Completed property identification information on field sheet and homeowner questionnaire. Indicated whether well was in use or approximately how long since well last had been used.

2. Turned on water and immediately filled one 150-mL HDP container pre-preserved with HNO_3 for analysis for total metals.

3. Filled a new 0.45-micron Nalgene filter container with unpurged water from kitchen faucet. Drew unfiltered water from the Nalgene container using a new syringe. Attached a SPME cartridge to the syringe and pushed water through the SPME cartridge, collecting the sample in a 150-mL HDP container pre-preserved with HNO_3 for total arsenic III/V analysis.

4. Filtered the remaining water through the Nalgene filter using a hand pump. Drew a sample of the filtered water into a syringe. Attached a SPME cartridge to the syringe and pushed water through the SPME cartridge, collecting the sample in a 150-mL HDP container pre-preserved with HNO_3 for dissolved arsenic III/V analysis.

5. Transferred the remaining filtered water to one150-mL polypropylene container pre-preserved with HNO_3 for analysis for dissolved metals.

Purged, Untreated Well Water Samples

Before the appropriate sample containers were filled with purged water, water was allowed to run for at least 5 minutes to ensure that any water lines or holding tanks had been purged, and the well was drawing water from the aquifer.

1. Repeated the procedure for collection of the unpurged metals samples. Collected one 150-mL HDP container pre-preserved with HNO_3 for total metals analysis.

2. Filled a new 0.45-micron Nalgene filter container with purged water from filtration unit. Drew unfiltered water from the Nalgene container into a new syringe. Attached a SPME cartridge to the syringe and pushed water through the SPME cartridge, collecting the sample in a 150-mL HDP container pre-preserved with HNO_3 for total arsenic III/V analysis.

3. Filtered remaining water through the Nalgene filter using a hand pump. Drew a sample of the filtered water into a new syringe. Attached a SPME cartridge to the syringe and pushed water through the SPME cartridge, collecting the sample in a 150-mL HDP container pre-preserved with HNO_3 for dissolved arsenic III/V analysis.

4. Transferred the remaining filtered water to one 150-mL HDP container pre-preserved with HNO_3 for analysis for dissolved metals.

5. Collected two unpreserved 40-mL amber vials for anions analysis.

6. Filled test kit containers for field analyses of hardness and chlorine; performed these analyses, and recorded the results on the field sheet.

7. Collected three 40-mL amber vials pre-preserved with hydrochloric acid (HCl) for volatile organic compound (VOC) analysis.

8. Collected two unpreserved 250-mL HDP containers for analysis for inorganic parameters (alkalinity, turbidity, total suspended solids, total dissolved solids).

9. Collected one unpreserved 1-liter (L) amber container for analysis for semivolatile organic compounds (SVOC).

10. Collected one 250-mL HDP container pre-preserved with sulfuric acid (H_2SO_4) for analysis for total organic carbon and nitrate/nitrite.

11. Collected two unpreserved, 100-mL fecal coliform containers for E. Coli analysis.

12. Collected sample in YSI water quality meter and allowed field parameters (temperature, pH, and conductivity) to stabilize.

13. Recorded field parameters for temperature (degrees Celsius [°C]), pH, and conductivity (microsiemens per centimeter [μS/cm]) on the field sheet.

Quality Assurance/ Quality Control (QA/QC) samples consisted of a field blank and field duplicate samples sent to the T&E facility, and split samples sent to the Region 7 EPA laboratory. The field blank, field duplicates, and split samples were collected to measure sampling and analytical precision. All QA/QC samples were collected, preserved, and analyzed in the same manner as the samples discussed in Section 3.0.

START shipped samples the evening of every day on which sampling had been conducted, due to short holding times for E. Coli analysis. Split samples 4693-1 through -9 were shipped to the EPA Region 7 laboratory on October 26, 2009. The split samples were analyzed for total and dissolved metals only.

4.0 SPLIT SAMPLE ANALYTICAL DATA SUMMARY

The samples submitted to the EPA Region 7 laboratory were analyzed for more metals than were the samples submitted to the T&E facility. Total and dissolved cobalt, copper, nickel, and zinc were reported in the EPA split samples, while antimony, barium, cadmium, lead, and manganese were reported for samples submitted to both laboratories. The T&E Facility was to submit the results of its analyses to EPA in a separate report.

Table 2 compares the metals results reported by both the T&E facility and EPA Region 7 laboratory for unpurged residential well samples. Table 3 compares the metals results from both laboratories for the purged residential well samples. Two of the contaminants of interest for this study, arsenic and cadmium, were not detected in any of the split samples. Antimony was not detected by the EPA Region 7 laboratory above a detection limit of 2 µg/L, but it was reported by the T&E facility at up to 6 µg/L. Analytical results are compared to established benchmarks in the Superfund Chemical Data Matrix (SCDM) and to EPA's Regional Screening Concentrations for tap water (EPA 2004, 2009).

Precision, a measure of the variability of a measurement system, is typically estimated by means of duplicate and replicate measurements, and is expressed in terms of relative percent difference (RPD). Precision of the analytical results is evaluated by calculating the RPD between results for split samples (EPA 2007). The RPD is calculated as follows:

$$RPD = \left[\frac{2|X_1 - X_2|}{|X_1 + X_2|} \right] x100$$

where:

X_1 and X_2 equal the concentrations reported for the duplicate pair.

Table 4 shows RPD calculations for barium and lead in split samples.

TABLE 2

ANALYTICAL DATA SUMMARY FOR UNPURGED RESIDENTIAL WELL SAMPLES
WASHINGTON COUNTY POINT OF USE STUDY – WASHINGTION COUNTY, MISSOURI

Analyte	Benchmark Values (µg/L)				EPA Property Identification, Sample Number, and Results (µg/L)							
					30412		20613		FRCK-636		24055	
	SCDM MCL	SCDM RfD	SCDM CR	RSL (tap water)	T&E	EPA	T&E	EPA	T&E	EPA	T&E	EPA
					ORD-122	4693-1	ORD-124	4693-4	ORD-126	4693-6	ORD-128	4693-8
Metals – Dissolved												
Antimony	6	15	NE	15	4	2 U	ND	2 U	ND	2 U	ND	2 U
Barium	2,000	2,600	NE	7,300	1	10 U	488	504	436	453	1,187	1,240
Cadmium	5	18	NE	18	ND	1 U	ND	1 U	ND	1 U	ND	1.11
Lead	15	NE	NE	NE	ND	1.11 U	13	10.6	**48**	**49.2**	**45**	**46.1**
Manganese	NE	5,100	NE	880	ND	1 U	1	1 U	ND	1 U	1	1 U
Metals – Total												
Antimony	6	15	NE	15	5	2 U	2	2 U	ND	2 U	ND	2 U
Barium	2,000	2,600	NE	7,300	2	10 U	489	510	434	473	1,179	1,260
Cadmium	5	18	NE	18	ND	1 U	ND	1 U	ND	1 U	ND	1.18
Lead	15	NE	NE	NE	ND	1 UJ	11	11.3 J	**69**	**52.6 J**	**41**	**46.0 J**
Manganese	NE	5,100	NE	880	ND	1 U	1	1 U	ND	1 U	1	1 U

Notes:

Bold value indicates a concentration that exceeds a benchmark value.

CR	Cancer Risk Screening Concentration (from SCDM)
EPA	U.S. Environmental Protection Agency Region 7 laboratory
FRCK	Furnace Creek
J	The identification of the analyte is acceptable; the reported value is an estimate
MCL	Maximum contaminant level
µg/L	Micrograms per liter
ND	Not detected; reporting limits not provided by T&E facility
NE	Not established
ORD	Office of Research and Development
RfD	Reference Dose Screening Concentration (from SCDM)
RSL	Regional Screening Level (EPA 2009)
SCDM	Superfund Chemical Data Matrix (EPA 2004)
T&E	Test and Evaluation facility
U	The analyte was not detected at or above the reporting limit.
UJ	The analyte was not detected at or above the reporting limit. The reporting limit is an estimate.

TABLE 3

ANALYTICAL DATA SUMMARY FOR PURGED RESIDENTIAL WELL SAMPLES
WASHINGTON COUNTY POINT OF USE STUDY – WASHINGTION COUNTY, MISSOURI

Analyte	Benchmark Values (µg/L)				EPA ID and Results (µg/L)											
					30412				20613		FRCK-636		24055	
	SCDM MCL	SCDM RfD	SCDM CR	RSL (tap water)	T&E	EPA	T&E	EPA	T&E	EPA	T&E	EPA	T&E	EPA
					ORD-123 (Inside)	4693-2	ORD-123 (Outside)	4693-3	ORD-125	4693-5	ORD-127	4693-7	ORD-129	4693-9
Metals – Dissolved														
Antimony	6	15	NE	15	4	2 U	6	2 U	ND	2 U	ND	2 U	ND	2 U
Barium	2,000	2,600	NE	7,300	1	10 U	53	53	463	477	448	459	1,185	1,230
Cadmium	5	18	NE	18	ND	1 U	ND	1 U	ND	1 U	ND	1 U	ND	1.08
Lead	15	NE	NE	NE	ND	1 U	11	17.4	7	8.73	**48**	**51.7**	**40**	**44.2**
Manganese	NE	5,100	NE	880	ND	1 U	9	8.97	1	1 U	1	1 U	1	ND
Metals – Total														
Antimony	6	15	NE	15	4	2 U	5	2 U	ND	2 U	ND	2 U	ND	2 U
Barium	2,000	2,600	NE	7,300	1	10 U	53	54.1	467	504	445	479	1,181	1,220
Cadmium	5	18	NE	18	ND	1 U	ND	1 U	ND	1 U	ND	1 U	ND	1.07
Lead	15	NE	NE	NE	ND	1 UJ	17	19.4 J	10	9.46 J	**48**	**54.2 J**	**47**	**44.3 J**
Manganese	NE	5,100	NE	880	ND	1 U	8	8.77	1	1 U	1	1 U	1	1 U

Notes:

Bold value indicates a concentration that exceeds a benchmark value.

CR	Cancer Risk Screening Concentration (from SCDM)
EPA	U.S. Environmental Protection Agency Region 7 laboratory
FRCK	Furnace Creek
J	The identification of the analyte is acceptable; the reported value is an estimate
MCL	Maximum contaminant level
µg/L	Micrograms per liter
ND	Not detected; reporting limits not provided by T&E facility
NE	Not established
ORD	Office of Research and Development
RfD	Reference Dose Screening Concentration (from SCDM)
RSL	Regional Screening Level (EPA 2009)
SCDM	Superfund Chemical Data Matrix (EPA 2004)
T&E	Test and Evaluation facility
U	The analyte was not detected at or above the reporting limit.
UJ	The analyte was not detected at or above the reporting limit. The reporting limit is an estimate.

TABLE 4

RELATIVE PERCENT DIFFERENCE CALCULATIONS FOR BARIUM AND LEAD WASHINGTON COUNTY POINT OF USE STUDY – WASHINGTION COUNTY, MISSOURI

Location	Parameter/Sample	EPA T&E Facility Result (µg/L)	EPA Region 7 Laboratory Result (µg/L)	RPD
30412 (Outside)	D/Barium – Purged	53	53	0
	T/Barium – Purged	53	54.1	2.05
	D/Lead – Purged	11	17.4	**45.07**
	T/Lead – Purged	17	19.4	13.19
20613	D/Barium – Unpurged	488	504	3.23
	T/Barium –Unpurged	489	510	4.20
	D/Barium – Purged	463	477	2.98
	T/Barium – Purged	467	504	7.62
	D/Lead – Unpurged	13	10.6	20.34
	T/Lead –Unpurged	11	11.3 J	2.69
	D/Lead – Purged	7	8.73	22
	T/Lead – Purged	10	9.46 J	5.55
FRCK-636	D/Barium – Unpurged	436	453	3.82
	T/Barium –Unpurged	434	473	8.6
	D/Barium – Purged	448	459	2.43
	T/Barium – Purged	445	479	7.36
	D/Lead – Unpurged	48	49.2	2.47
	T/Lead –Unpurged	69	52.6 J	**26.97**
	D/Lead – Purged	48	51.7	7.42
	T/Lead – Purged	48	54.2 J	12.13
24055	D/Barium – Unpurged	1,187	1,240	4.37
	T/Barium –Unpurged	1,179	1,260	6.62
	D/Barium – Purged	1,185	1,230	3.73
	T/Barium – Purged	1,181	1,220	3.25
	D/Lead – Unpurged	45	46.1	2.41
	T/Lead –Unpurged	41	46 J	11.49
	D/Lead – Purged	40	44.2	9.98
	T/Lead – Purged	47	44.3 J	5.91

Notes:

Bold value indicates calculation exceeds the acceptable RPD goal of 25 percent.

D	Dissolved
EPA	U.S. Environmental Protection Agency
J	The identification of the analyte is acceptable; the reported value is an estimate.
µg/L	Micrograms per liter
RPD	Relative percent difference
T	Total
T&E	Test and Evaluation

A maximum RPD of 25% is required for the data to be considered acceptably precise. RPDs shown on Table 4 were calculated for lead and barium concentrations at Locations 20613, FRCK-636, and 24055. No RPDs were calculated for the inside samples from Location 30412 because of the low concentrations of metals detected. The RPD was calculated for the purged sample collected from the untreated well water at an exterior spigot (samples ORD-123 [Outside] and 4693-3). The RPD for the dissolved lead from the purged sample exceeds the RPD goal; however, this is related to the low concentrations detected in the samples. The T&E facility determined a dissolved lead concentration of 11 µg/L in this sample, compared to the estimated 17.4 µg/L determined by the EPA Region 7 laboratory.

The RPD calculated for the unpurged, total lead sample collected from the kitchen sink at Location FRCK-636 in the Furnace Creek study area slightly exceeded the RPD goal of 25 percent. The T&E facility determined a total lead concentration of 69 µg/L in this sample, compared to the estimated 52.6 µg/L determined by the EPA Region 7 laboratory. However, based on the RPDs calculated for the 28 sample pairs overall, the data appears to meet the precision criteria.

5.0 REFERENCES

Miller and Vandike. 1997. Groundwater Resources of Missouri.

U.S. Department of Agriculture (USDA). 2003. Soil Survey of Washington County, Missouri. Version 1.0. November 10.

U.S. Environmental Protection Agency (EPA). 2004. Superfund Chemical Data Matrix (SCDM) Table. Washington, D.C. January.

EPA. 2007. Generic Quality Assurance Project Plan for Region 7's Superfund Lead-Contaminated Sites. June.

EPA. 2009. Regional Screening Levels. On-line address: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm. December 10.

APPENDIX A

FIGURES

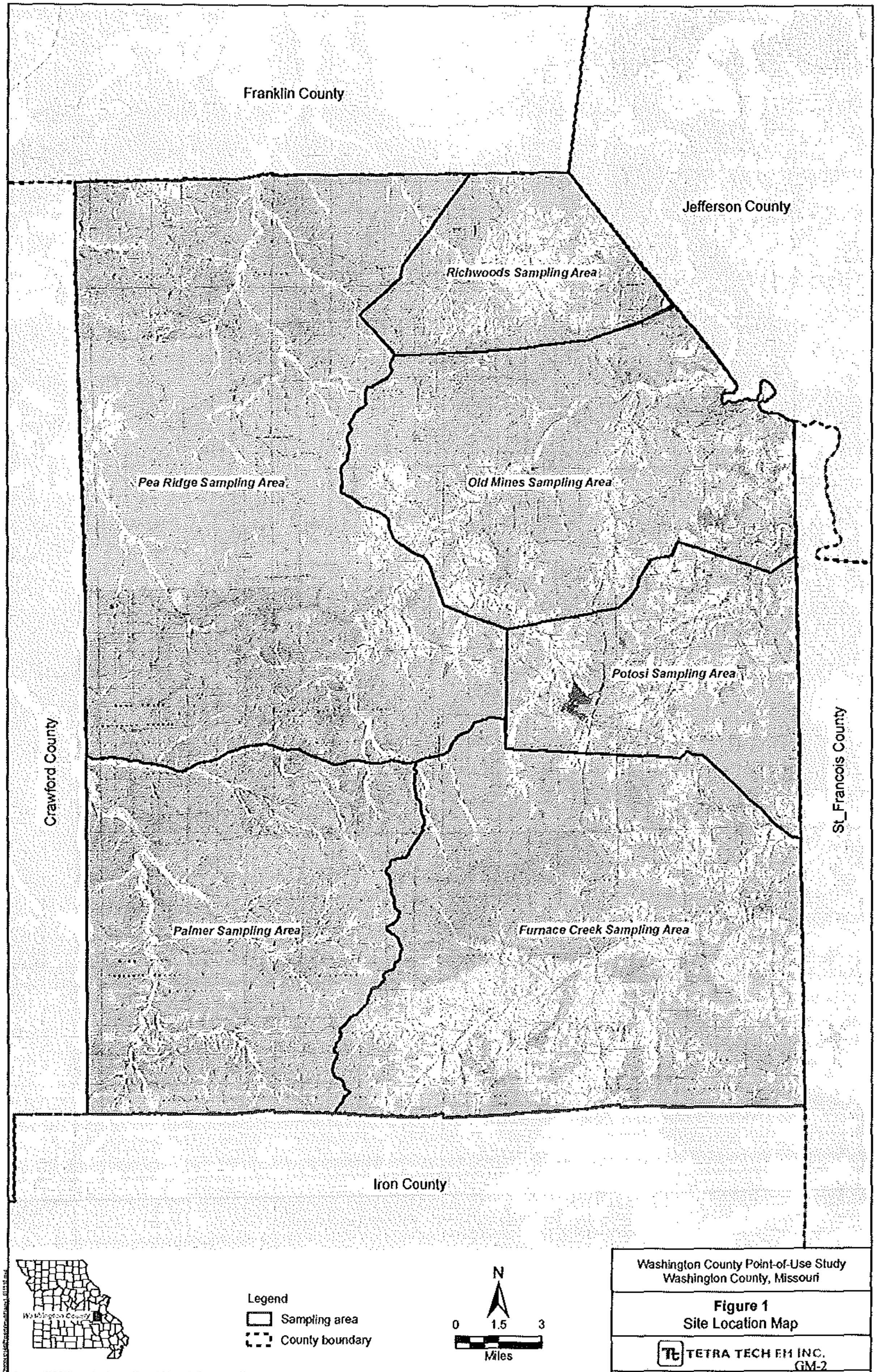
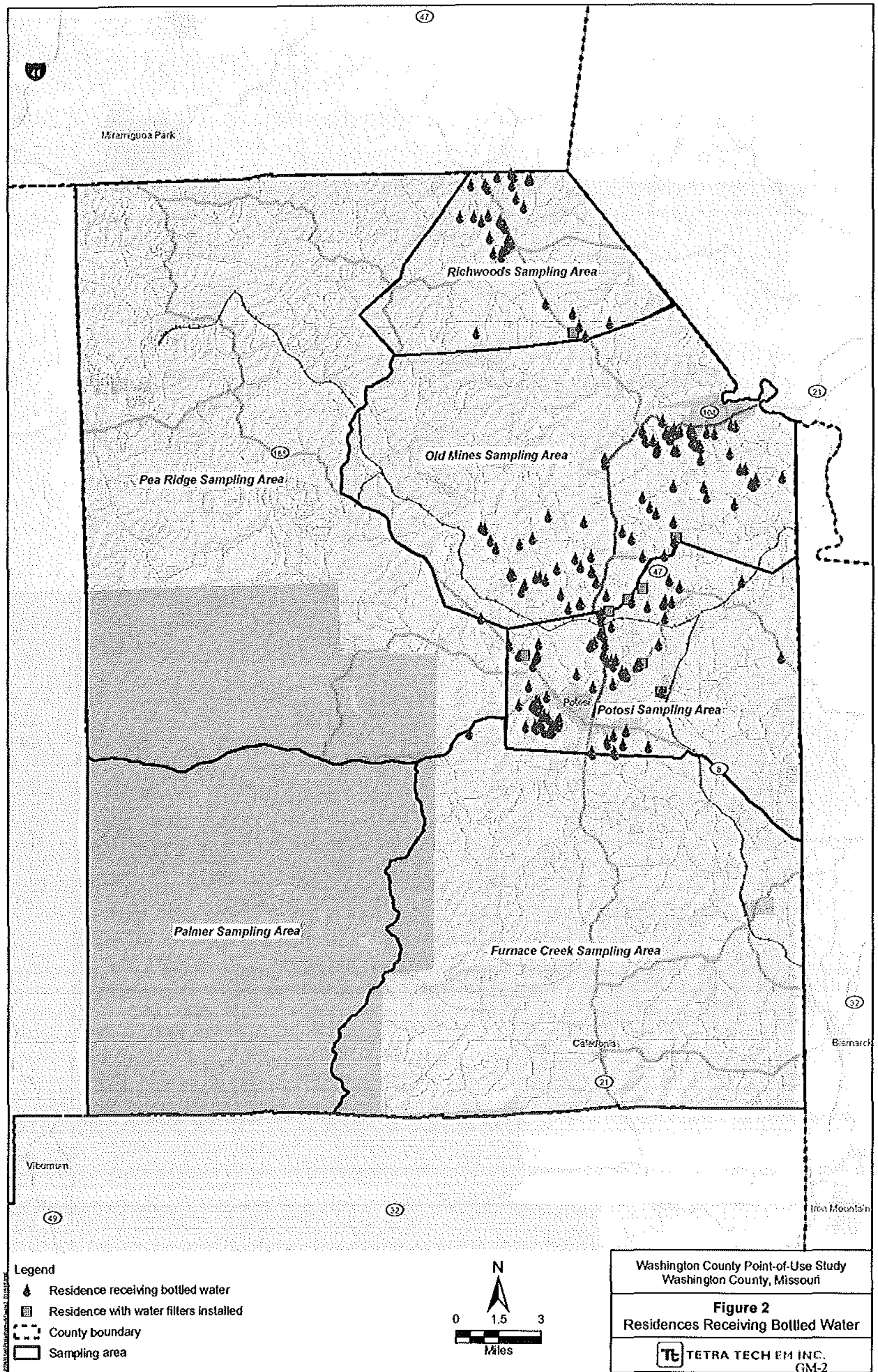


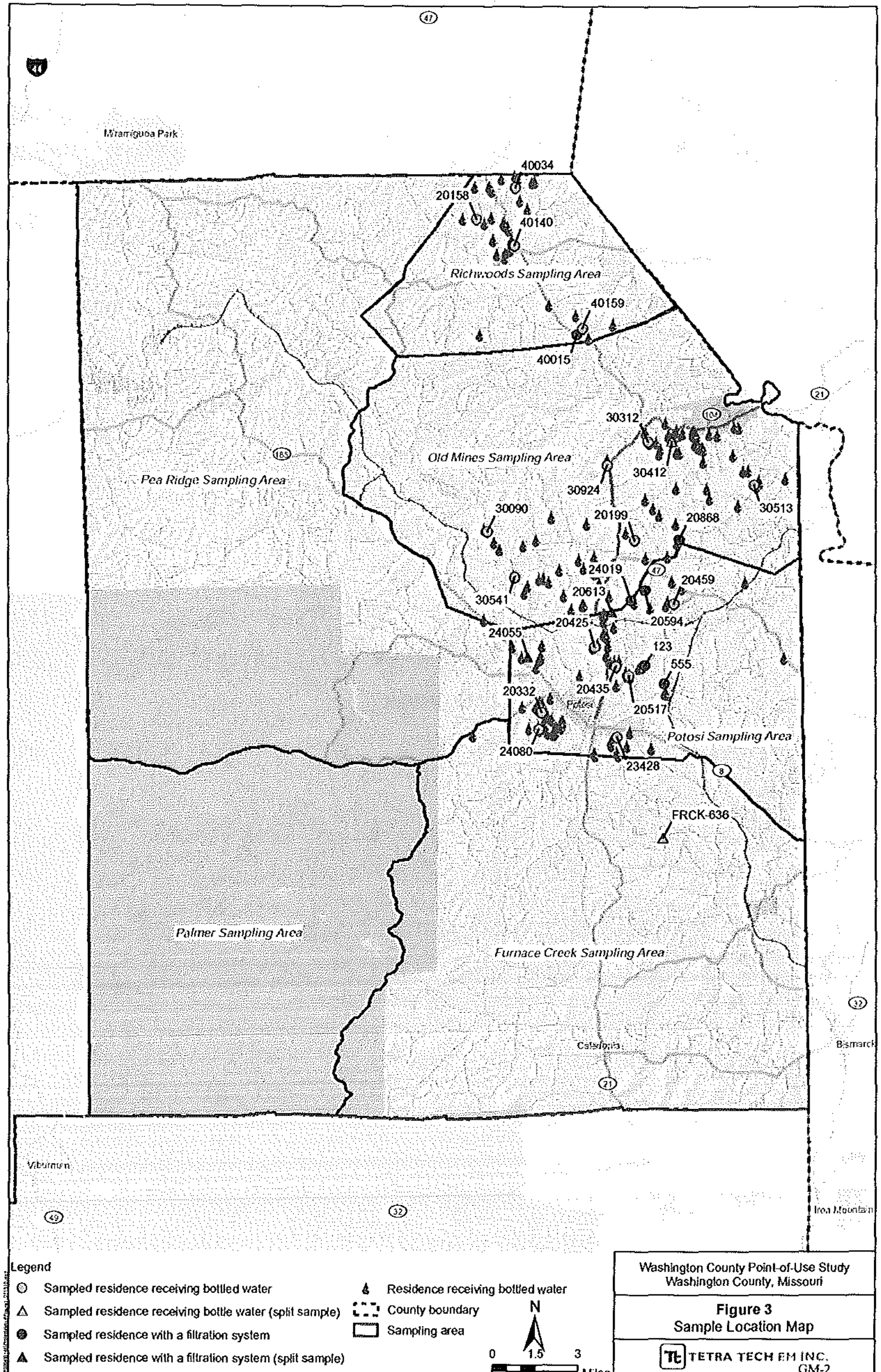
Figure 1
Site Location Map



Washington County Point-of-Use Study
Washington County, Missouri

Figure 2
Residences Receiving Bottled Water

TETRA TECH EM INC.



Washington County Point-of-Use Study
Washington County, Missouri

Figure 3
Sample Location Map

TETRA TECH EM INC.

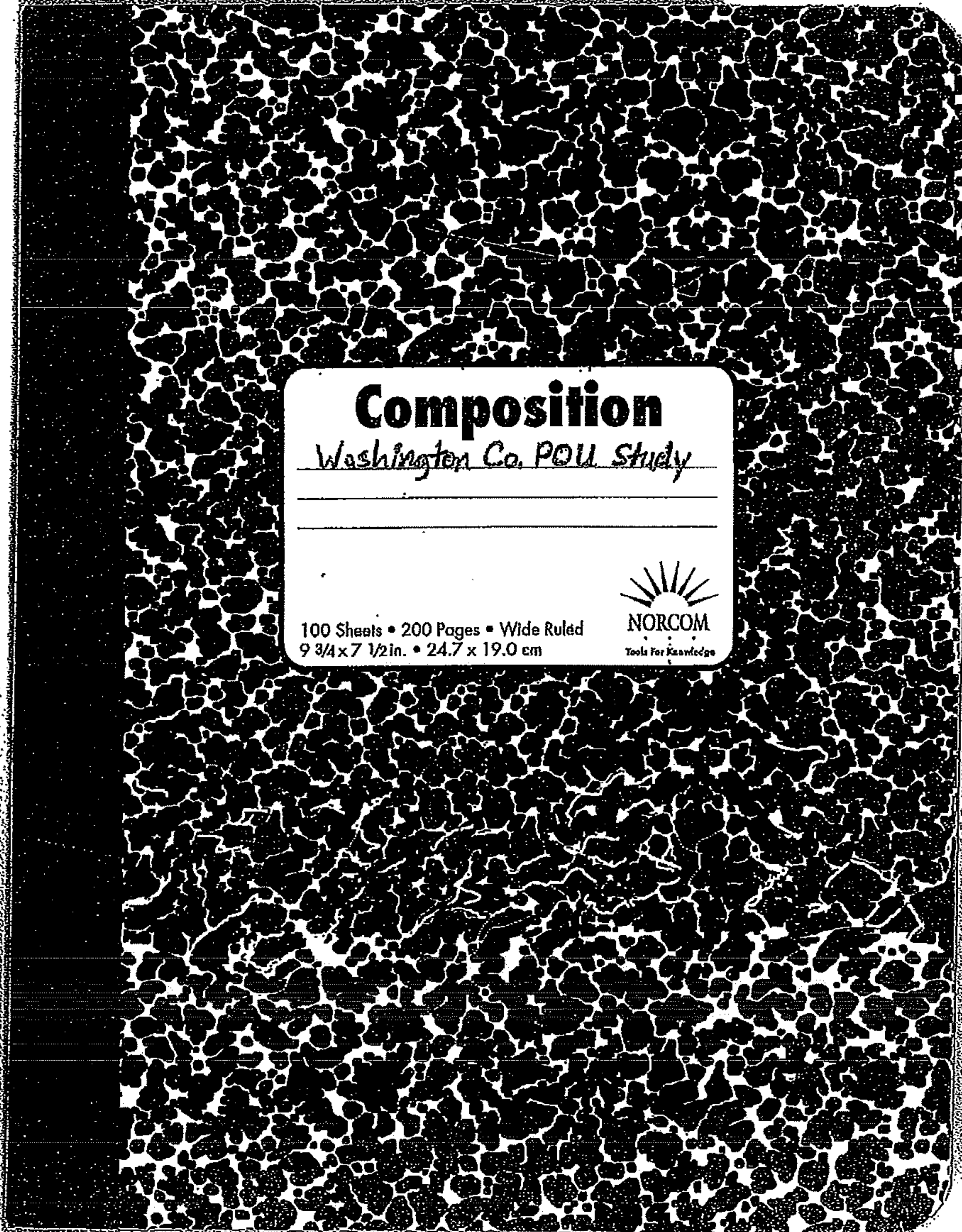
GM-2
121/323

APPENDIX B

LOGBOOK

APPENDIX B

LOGBOOK


Composition
Washington Co. POU Study
100 Sheets • 200 Pages • Wide Ruled
9 3/4 x 7 1/2 in. • 24.7 x 19.0 cm
NORCOM
Tools For Knowledge

10-18-09 POU Study

1200 STM Heflin leaves Kansas City for Caledonia, Mo

1530 STM Blattner leaves St. Louis

1650 Arrive at EPA office, Caledonia

Prep for POU sampling.

2100 Hotel – End Day

10-18-09

CB

10-19-09 POU sampling

0700 STM Blattner + Heflin meet in lobby, Blattner calibrates YSI, Heflin buys ice + distilled water

- 0800 Arrive at EPA 20435, [redacted]
- 1100 Arrive at EPA 555, [redacted]

1310 Lunch

- 1420 EPA 20868, [redacted]

1620 Leave for Gas Station to get Ice + pack.

1630 Arrive at Gas Station, pack samples, COC - discuss strategies for sampling rest of week.

1800 Leave for St. Louis. STM Heflin back to office - schedule appointments

1920 Arrive at Fedex - Ship packages/samples.

~~1945~~ End Day
2045

10-19-09
CB

10-20-09 PoU Study

0630 STM Blatter leaves Fenton.
0710 STM Heflin picks up ICE for sampling.
0745 Meet at Hotel, leave for sampling
-0800 Arrive at EPA 24019, [redacted]
-1025 Arrive at EPA 20594, [redacted]
1315 Phone property owners to schedule appointments
1345 Lunch
-1500 Arrive at EPA 30312, [redacted]
1700 Arrive at gas station - ice down samples, pack, COC QC, fuel.
1800 STM Blatter leaves for St. Louis. STM Heflin leaves for Caledonia EPA office to restock supplies.
1900 STM Blatter arrives at Fedex in St Louis
1930 Phone property owners to schedule sampling
2100 End Day

10-20-09
CB

Poll Study 10-21-09

0635 STM Blattner leaves Fenton
0715 STM Heflin picks up ice
0750 Meet at Hotel
- 0800 Arrive at EPA 20332, [redacted]
- 1030 Arrive at EPA 20425, [redacted]
1210 Lunch
- 1255 Arrive at EPA 20459, [redacted]
- 1500 Arrive at EPA 24080, [redacted]
1640 Arrive at gas station, Ice + pack samples, QC, COC
1710 STM Blattner Leave for St. Louis, STM Hefner leaves for EPA office to re-supply.
1830 Arrive at Fedex to ship samples.
- Phone property owners to schedule appointments.
20:15 Leave for Tetratech to get canopy tent.
20:30 End Day

10-21-09
CB

POU Study 10-22-09

0700 STM Blattner leaves Fenton
0715 STM Heflin leaves Hotel to buy Ice.
0810 Meet at EPA 30090, [redacted]
0945 Discuss split samples w/ Craig Smith + Nicole Roblez.
1020 Hotel, pick up Fedex (YSI + DI water) email
1100 Arrive at EPA 23428, [redacted]
Owner not home.
1145 Lunch
- Speak w/ property owner [redacted] about sampling at his property. He would like to speak w/ EPA about his filter system. Gave his info to Craig Smith. Scheduled appointment for 1230.
1230 STM Heflin involved in auto accident.
1245 Drove STM Heflin to Hotel, he phones Work Care, Enterprise, etc.
STM Blattner phones property owners, arranges replacement help.
1500 STM Blattner + O'Connor arrive at EPA 30412, [redacted]
1820 STM Blattner leaves for St. Louis, STM O'Connor to Potosi
1950 STM Blattner ships samples at Fedex.
- Phone property owners to schedule appointments
2045 End Day
10-22-09
AB

GM-2
129/323

ROU Study 10-23-09

0700 STM Blattner leaves Fenton
0715 STM Heflin leaves hotel to buy ice.
-0800 Arrive at EPA 20613, [redacted]
-1035 Arrive at EPA ~~24055~~ FRCK1636, [redacted]
(STM Heflin to EPA office to get supplies.)
1140 STM Heflin arrives w/ supplies.
1300 Lunch
-1345 Arrive at EPA 24055, [redacted]
Blank samples taken
1620 Arrive at gas station - pack samples
1710 STM Blattner leaves for St. Louis
1830 Ship samples at Fedex
1900 End Day

10-23-09
CB

POU Study 10-26-09

0700 STM Blattner leaves St. Louis Tetra Tech office.
0715 STM Heflin leaves Hotel to get ice.
0800 Arrive at EPA 30924, [redacted]
Property has whole home filtration system
-sampled all purged samples before and after it.
-pH probe problems - will get new probe tomorrow.
1130 Arrive at EPA 123, [redacted]
1400 Lunch.
1455 Arrive at EPA 20158, [redacted]
1710 Pack samples on ice at gas station, QC, coc's
1800 STM Blattner leaves for St Louis, STM Heflin to Caledonia office for supplies.
1930 Drop off samples at Fedex.
-call property owners to schedule/confirm.
2100 Arrive at Tetratech office to pick up Nalgene filters + custody seals, Emails.
2200 End Day.

10-26-09
CB

10-27-09 POM Study

0645 STM Blattner leaves Fenton
0800 Arrive at EPA ~~23420~~ CB 23420, [redacted]
Meet STM Hefflin - sample + duplicate.
1010 Arrive at EPA 40140, [redacted]
Sample + duplicate.
1250 Lunch.
1350 Arrive at EPA 30541, [redacted]
1525 Arrive at EPA 40159, [redacted]
1730 Arrive at gas station to pack coolers, COC, QC.
1815 Leave for St. Louis (STM Blattner), STM Hefflin leaves to pick up supplies.
1930 Arrive at Fedex to drop of coolers.
- phone property owners to confirm/schedule appts.
2030 End Day

10-27-09
CB

10-28-09 POU Study

0700 STM Blythe leaves Fenton
0800 Arrive at EPA 30513, [redacted]
1000 Arrive at EPA 40015, [redacted]
1220 lunch
1300 STM Heflin to get supplies - Blythe to hotel
to pick up Fedex'ed YSI, emails
1430 Arrive at EPA 402234, [redacted]
1630 Gas Station to pack Samples, QC, COC,
1800 Fedex Samples End Day

10-28-09

GM-2
133/323

10-29-09 POU Study

0710 STM Blattner leaves Easton
0810 Arrive at EPA 20199, [redacted]
1000 Arrive at EPA 20517, [redacted]
1200 Lunch
1300 Caledonia office, unload, clean up supplies, office, etc.
QC, COC. Email sampling report & filter pictures.
- STM Jason Hefflin leaves for Kansas City.
1630 STM Blattner leaves for St. Louis.
1800 Drop of samples at Fedex
1830 Drop of van at Tetra Tech - End Day

10-29-09
CB

GM
134

APPENDIX C

FIELD SHEETS

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 37.94381
Longitude: -90.72861

Sample Number: ORD-1
Sample Date: 10-19-09
Sample Time: 1120

Property Identification Number: 555 Study Area: 5

[redacted] Owners Phone Number: [redacted]

[redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: ~~Y~~ 6 Well shared with other residence(s): Yes [redacted]

Number of Occupants or persons supplied by well: 8 Children under 6 yrs: 2

Well Depth: ~75' Pump Depth: Well Age: over 35 yrs

Flow Rate at House: Flow Rate at PoU: 0.9L/min (Tap)

Holding Tank Make/Volume: 25-30 gal

Treatment System(s): Culligan Filter

Sample Collection Description:

Purge Time or Volume: Unpurged 12 hours+ (Tap), ~~purged 15 minutes~~ OB

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number:
Sampler's Initials: OB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: **ORD-2**
Sample Date: 10-19-09
Sample Time: 1137

Property Identification Number: ____________ Study Area: ____________

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: ____________

Tenant's Name: ____________ Tenant's Phone Number: ____________

Property Address: ____________

SEE ORD-1

Residence owner occupied: ________ Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: ________ Children under 6 yrs: ________

Well Depth: ____________ Pump Depth: ____________ Well Age: ________

Flow Rate at House: ____________ Flow Rate at PoU: ____________

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: purged 15 minutes

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Purged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
[redacted]	[redacted]	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ____________
Sampler's Initials: LB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study | **Sample Number: ORD-102**
Latitude: ____________ | **Sample Date:** 10-19-09
Longitude: ____________ | **Sample Time:** 1120

Property Identification Number: ____________ Study Area: ____________

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: ____________

Tenant's Name: SEEORD-1 Tenant's Phone Number: ____________

Property Address: ____________

Residence owner occupied: ________ Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: ________ Children under 6 yrs: ________

Well Depth: ____________ Pump Depth: ____________ Well Age: ________

Flow Rate at House: ____________ Flow Rate at PoU: 4.8 L/min (faucet)

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: unpurged 3 1/2 hours (faucet), ~~purged 15 min.~~ CB

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, ~~Unpurged~~	~~A[illegible]~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ____________
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-103
Sample Date: 10-9-09
Sample Time: 1137

Property Identification Number: ____________ **Study Area:** ____________
Owners Name: ____________ **Owners Phone Number:** ____________
Mailing Address: ____________
Tenant's Name: ____________ **Tenant's Phone Number:** ____________
Property Address: ____________

SEE ORD-1

Residence owner occupied: ______ **Well shared with other residence(s):** ____________
Number of Occupants or persons supplied by well: ______ **Children under 6 yrs:** ______

Well Depth: ______ **Pump Depth:** ______ **Well Age:** ______
Flow Rate at House: ______ **Flow Rate at POU:** 4.8L/min (faucet)

Holding Tank Make/Volume: ____________
Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: ~~unpurged 3 1/2 hours (faucet)~~, purged 15 minutes

Field Parameters:

Temperature (°C):	18.41°	ORP (mV):	243.6
Conductivity (µS/cm):	462	Test Kit Results:	
pH: (-27.6mV)	~~[illegible]~~ 6.70	Hardness:	307.8 mg/L
TDS (mg/L):	~~GB~~	Free Chlorine (mg/L):	Not present
DO (mg/L):	999.99 (999.9%)	Total Chlorine (mg/L):	Not present

Remarks: DO not calibrated correctly.

Photo Number: ______
Sampler's Initials: GB

EPA 555 scheduled: 10-19-09, 1100 am

Sink 3½ hours
Culligan 13 hours +

[redacted]

[Cut and paste from the Shaw fieldsheets. Forms 3-5 and 4-5: extract the field analytical data elements and combine into one datasheet, as page 2 below. This page 1 listing replaces entirely: Forms 1-5, 2-5, 3-5 and the balance of Forms 3-5 and 4-5. Put into similar tabular format].

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS

Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7

Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

2. Well information (describe: location, depth, construction? details, driller?, ~~date~~, pump hp ~1/2 and gpm, maintenance done, ~~etc.)~~ new pumps, waterlines over 35 yrs old ~~[illegible]~~
located at [redacted] about 200 ft from house, ~75 ft deep.

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)
in house: 25-30 gal, 55 psi/off at well: 25-30 gal, ~60 psi

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)
8 yrs, PVC

5. Water softener (describe: connections/faucets, maintenance done, etc.)
None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, ~~maintenance done~~ and cost, homeowner satisfaction, etc.)
Better than the 5 gal bottles

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.) Too slow for homeowner

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.) – Property has run a hose from Culligan filter to refrigerator for ice machine.
icemake, use a lot, maybe 1 gal per day.

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)
Front of house, concrete, drainfield-sock, 8 yrs old.

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)
would like better flow rate

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 37.95113
Longitude: -90.75864

Sample Number: ORD-100
Sample Date: 10-19-09
Sample Time: 08:20

Property Identification Number: 20435 Study Area: ____

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: —

Residence owner occupied: Yes Well shared with other residence(s): ____

Number of Occupants or persons supplied by well: 3 Children under 6 yrs: 0

Well Depth: ? Pump Depth: ? Well Age: ?

Flow Rate at House: ____ Flow Rate at PoU: ~~8gpm~~ 8L/min GB

Holding Tank Make/Volume: ?

Treatment System(s): None

Sample Collection Description: ____

Purge Time or Volume: ~~8 m~~ GB UNPURGED for 10+ hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, Unpurged	~~[illegible]~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ____
Sampler's Initials: GB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 37.95713
Longitude: -90.75861

Sample Number: ORD-101
Sample Date: 10-19-09
Sample Time: 0825

SEE ORD-100

Property Identification Number: ______ Study Area: ______
Owners Name: ______ Owners Phone Number: ______
Mailing Address: ______
Tenant's Name: ______ Tenant's Phone Number: ______
Property Address: ______
Residence owner occupied: ______ Well shared with other residence(s): ______
Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______
Flow Rate at House: ______ Flow Rate at POU: ______

Holding Tank Make/Volume: ______
Treatment System(s): ______

Sample Collection Description: ______

Purge Time or Volume: 8 minutes

Field Parameters:

Temperature (°C):	14.55	ORP (mV):	168.8
Conductivity (µS/cm):	529	Test Kit Results:	
pH:	6.71	Hardness:	461.7 mg/L
TDS (mg/L):		Free Chlorine (mg/L):	Not Present
DO (mg/L):	999.9% 174.2	Total Chlorine (mg/L):	Not Present

Remarks:

Photo Number: ______
Sampler's Initials: CB

10-19-09, 8:00 ✓ confirmed 10-18-09 @ 1700

Dave's Cell: 573 210-8227

[Cut and paste from the Shaw fieldsheets. Forms 3-5 and 4-5: extract the field analytical data elements and combine into one datasheet, as page 2 below. This page 1 listing replaces entirely: Forms 1-5, 2-5, 3-5 and the balance of Forms 3-5 and 4-5. Put into similar tabular format].

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

EPAID 20435, 1. Home (describe: name, address, phone number, ID number, mine area, etc.)

[redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

location: N/W corner of house, 7-8 ft. Bladder was repaired in August '09

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

Unknown, buried underground near well head

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

5 yrs old,

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

None

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

8L/min

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

Trays – 2-3 trays/week

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

Front yard 30 ft from house, Concrete w/ drainfield

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

Likes the bottled water

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 38.1966
Longitude: -90.71677

Sample Number: ORD-3
Sample Date: 10-19-09
Sample Time: 1440

Property Identification Number: 20868 Study Area: 8
Owners Name: [redacted] Owners Phone Number: [redacted]
Mailing Address: [redacted]
Tenant's Name: ______ Tenant's Phone Number: ______
Property Address: Same as above
Residence owner occupied: yes Well shared with other residence(s): ______
Number of Occupants or persons supplied by well: 2 Children under 6 yrs: –

Well Depth: 220 Pump Depth: 200 Well Age: 30
Flow Rate at House: ______ Flow Rate at PoU: 0.6 L/min

Holding Tank Make/Volume: 30 gal
Treatment System(s): Culligan filter

Sample Collection Description: ______

Purge Time or Volume: unpurged for 6 hrs.

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ______
Sampler's Initials: GB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-4
Sample Date: 10/7/09
Sample Time: 1500

Property Identification Number: ____________ Study Area: ____________

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: ____________

Tenant's Name: SEE ORD-4 3 ~~/~~ SRM 1-10-10 Tenant's Phone Number: ____________

Property Address: ____________

Residence owner occupied: ________ Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: ________ Children under 6 yrs: ________

Well Depth: ____________ Pump Depth: ____________ Well Age: ________

Flow Rate at House: ____________ Flow Rate at PoU: 0.6 L/min

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: 20 min

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Purged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Tap, Purged	~~Arsenic HVG~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ____________
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-104
Sample Date: 10-19-09
Sample Time: 1440

Property Identification Number: ____________ Study Area: ____________

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: ____________ SEE ORD-103 JTM 1-13-10

Tenant's Name: ____________ Tenant's Phone Number: ____________

Property Address: ____________

Residence owner occupied: ____________ Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: ____________ Children under 6 yrs: ____________

Well Depth: ____________ Pump Depth: ____________ Well Age: ____________

Flow Rate at House: ____________ Flow Rate at PoU: 5.1 L/min

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: Unpurged for 6 hrs

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, Unpurged	~~Arsenic III/V~~	1	~~Unfiltered, SPME~~	~~HNO~~$_3$ to pH <2	125 ml HDPE
		1	~~Filtered, SPME~~	~~HNO~~$_3$ to pH <2	125 ml HDPE

Remarks:

Photo Number: ____________
Sampler's Initials: CS

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study

Latitude: ______

Longitude: ______

Sample Number: ORD-105

Sample Date: 10-19-09

Sample Time: 1500

Property Identification Number: ______ Study Area: ______

Owners Name: ______ Owners Phone Number: ______

Mailing Address: SEE ORD-43 (JMH 1-13-10)

Tenant's Name: ______ Tenant's Phone Number: ______

Property Address: ______

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at POU: 5.1 L/min

Holding Tank Make/Volume: ______

Treatment System(s): ______

Sample Collection Description: ______

Purge Time or Volume: 20 min

Field Parameters:

Temperature (°C):	15.01	ORP (mV): /	190.6
Conductivity (µS/cm):	766	**Test Kit Results:**	
pH: -25.9 mv	6.67	Hardness:	495.9 mg/L CaCO3
TDS (mg/L):	—	Free Chlorine (mg/L):	Not Present
DO (mg/L):	48.31 (484.04)	Total Chlorine (mg/L):	Not Present

(recalibrated DO)

Remarks:

Photo Number: ______

Sampler's Initials: CB

Scheduled: 10-19-09, 1500

[Cut and paste from the Shaw fieldsheets. Forms 3-5 and 4-5: extract the field analytical data elements and combine into one datasheet, as page 2 below. This page 1 listing replaces entirely: Forms 1-5, 2-5, 3-5 and the balance of Forms 3-5 and 4-5. Put into similar tabular format].

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS

Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7

Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

20868 [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

2 ft of west side of trailer, 220 ft, pump at 200 ft, 30 yrs old
no maintenance - pressure tank replaced 15-20 years ago

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

30 gal, ~~30 psi on, 0 off~~ 60 on/40 off

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

~~30~~ 35 yrs, copper, new hot water tank - 1 yr ago

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

Likes culligan filter

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.) little to slow

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

Trays - 1-2 per day

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

35 ft of East side of home, metal tank w/ leach field

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

satisfied

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 37.98997
Longitude: -90.74009

Sample Number: ORD-5
Sample Date: 10-20-09
Sample Time: 0820

Property Identification Number: 24019 Study Area: 8

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: 5 Well shared with other residence(s): NO

Number of Occupants or persons supplied by well: 5 Children under 6 yrs: 0

Well Depth: 240' Pump Depth: ____ Well Age: 4yrs

Flow Rate at House: ____ Flow Rate at PoU: 1.5L/min (Tap)

Holding Tank Make/Volume: 30gal

Treatment System(s): Culligan Filter

Sample Collection Description: ____

Purge Time or Volume: 55 min

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ____
Sampler's Initials: GS

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-6
Sample Date: 10-20-09
Sample Time: 0820

Property Identification Number: ____________ Study Area: ____________

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: ____________

Tenant's Name: SEE ORD-5 Tenant's Phone Number: ____________

Property Address: ____________

Residence owner occupied: ______ Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ____________ Pump Depth: ____________ Well Age: ____________

Flow Rate at House: ____________ Flow Rate at PoU: ~~4.7~~ CB 1.5L/min

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: 55 min

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Purged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Tap, Purged	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ______
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______________
Longitude: ______________

Sample Number: ORD-106
Sample Date: 10-20-09
Sample Time: 0915

Property Identification Number: ______________ Study Area: ______________

Owners Name: ______________ Owners Phone Number: ______________

Mailing Address: SEE ORD5 ______________

Tenant's Name: ______________ Tenant's Phone Number: ______________

Property Address: ______________

Residence owner occupied: ________ Well shared with other residence(s): ______________

Number of Occupants or persons supplied by well: ________ Children under 6 yrs: ________

Well Depth: ______________ Pump Depth: ______________ Well Age: ______________

Flow Rate at House: ______________ Flow Rate at PoU: 4.2 L/min (faucet)

Holding Tank Make/Volume: ______________

Treatment System(s): ______________

Sample Collection Description: ______________

Purge Time or Volume: ______________

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, Unpurged	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ______________
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-107
Sample Date: 10-20-09
Sample Time: 0915

Property Identification Number: ____________ Study Area: ____________
Owners Name: ____________ Owners Phone Number: ____________
Mailing Address: SEE ORD-5
Tenant's Name: ____________ Tenant's Phone Number: ____________
Property Address: ____________
Residence owner occupied: ____________ Well shared with other residence(s): ____________
Number of Occupants or persons supplied by well: ____________ Children under 6 yrs: ____________

Well Depth: ____________ Pump Depth: ____________ Well Age: ____________
Flow Rate at House: ____________ Flow Rate at POU: ____________

Holding Tank Make/Volume: ____________
Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: ____________

Field Parameters:

Temperature (°C):	14.21	ORP (mV):	270.2
Conductivity (µS/cm):	452	Test Kit Results:	
pH:	6.79	Hardness:	329.9 mg/L
TDS (mg/L):	—	Free Chlorine (mg/L):	Not present
DO (mg/L):	999.99	Total Chlorine (mg/L):	Not present

Remarks:

Photo Number: ____________
Sampler's Initials: GB

Sheduled: 10-20-09, 8:00 Call back after 5pm for questionnaire

[Cut and paste from the Shaw fieldsheets. Forms 3-5 and 4-5: extract the field analytical data elements and combine into one datasheet, as page 2 below. This page 1 listing replaces entirely: Forms 1-5, 2-5, 3-5 and the balance of Forms 3-5 and 4-5. Put into similar tabular format].

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

EPAID: 24019 1. Home (describe: name, address, phone number, ID number, mine area, etc.)

[redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

pump 180' 240', Marshall Bye Drilling, drilled in 2005, 10 gpm, 3/4 hp

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

Unknown 45 psi off / 60 on 30 gal

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

House built in 2005

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify; type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

Kitchen Sink

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

4.2 L/min @ faucet, 1.5 L/min @ tap.

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

Ice trays, 1-2 per day

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

Good condition, behind the house

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

Kids like it

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 37.99488
Longitude: -90.7392117

Sample Number: ORD-7 /ORD-7 FD Dup
Sample Date: 10-20-09
Sample Time: 1048

Property Identification Number: 20594 Study Area: B

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: Y Well shared with other residence(s): —

Number of Occupants or persons supplied by well: 4 Children under 6 yrs: 0

Well Depth: 240' Pump Depth: 200' Well Age: 5 yrs

Flow Rate at House: Flow Rate at PoU: 1.46 L/min

Holding Tank Make/Volume: 30 gal, Challenger

Treatment System(s): Culligan filter

Sample Collection Description:

Purge Time or Volume: Unpurged for 12+ hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Unpurged	Total Metals	~~1~~ 2	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		~~1~~ 2	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number:
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______________
Longitude: ______________

Sample Number: ORD-8 /ORD-8 FD Dup
Sample Date: 10-20-07
Sample Time: 1107

Property Identification Number: ______________ Study Area: ______________

Owners Name: ______________ Owners Phone Number: ______________

Mailing Address: ______________

Tenant's Name: See ORD-7 Tenant's Phone Number: ______________

Property Address: ______________

Residence owner occupied: ______ Well shared with other residence(s): ______________

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______________ Pump Depth: ______________ Well Age: ______________

Flow Rate at House: ______________ Flow Rate at PoU: ______________

Holding Tank Make/Volume: ______________

Treatment System(s): ______________

Sample Collection Description: ______________

Purge Time or Volume: 14 minutes

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Purged	Total Metals	x2	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		x2	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Purged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	125 ml HDPE

Remarks:

Photo Number: ______________
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-108 /ORD-108FD Dup
Sample Date: 10-20-09
Sample Time: 1048

Property Identification Number: ____________ Study Area: ____________

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: ____________

Tenant's Name: ____________ Tenant's Phone Number: ____________

Property Address: SEE ORD-7

Residence owner occupied: ____________ Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: ____________ Children under 6 yrs: ____________

Well Depth: ____________ Pump Depth: ____________ Well Age: ____________

Flow Rate at House: ____________ Flow Rate at PoU: 2.84 L/min

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: Unpurged for 12 + hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	~~1~~ 2	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		~~1~~ 2	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, Unpurged	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ____________
Sampler's Initials: CaB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ~~ORD-109~~ /ORD-109FD
Sample Date: 10-20-09
Sample Time: 1107

Property Identification Number: ____________ Study Area: ____________
Owners Name: ____________ Owners Phone Number: ____________
Mailing Address: ____________
Tenant's Name: SEE ORD-7 Tenant's Phone Number: ____________
Property Address: ____________
Residence owner occupied: ______ Well shared with other residence(s): ______
Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______
Flow Rate at House: ______ Flow Rate at POU: ______

Holding Tank Make/Volume: ____________
Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: 19 minutes

Field Parameters:

Temperature (°C):	~~14.24~~ 14.11	ORP (mV):	132.3
Conductivity (µS/cm):	CB ~~400~~ 438	**Test Kit Results:**	
pH:	~~7.02~~ 6.82	Hardness:	
TDS (mg/L):	—	Free Chlorine (mg/L):	
DO (mg/L):	999.99	Total Chlorine (mg/L):	

Remarks:

Photo Number: ______
Sampler's Initials: CB

Sheduled: 10-20-09, 10:00-10:30 [redacted]

[Cut and paste from the Shaw fieldsheets. Forms 3-5 and 4-5: extract the field analytical data elements and combine into one datasheet, as page 2 below. This page 1 listing replaces entirely: Forms 1-5, 2-5, 3-5 and the balance of Forms 3-5 and 4-5. Put into similar tabular format].

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

EPA 20594 1. Home (describe: name, address, phone number, ID number, mine area, etc.) [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.) ? 5yrs ago

location: 30 ft East of house (5yrs old) 240', pump at ~~80~~ 200', water at 80' pump = 10gpm
US casing to 80'

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

30 gal Challenger brand 35 psi off

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

4 1/2 yrs old, PVC, no repairs

5. Water softener (describe: connections/faucets, maintenance done, etc.)

no softener

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.) Filter in refrigerator; whirlpool

OK - but slow flow rate

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

1.6L/min @ Culligan Tap, 2.84L/min @ faucet

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

4 Ice trays per day

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

back yard-west concrete w/ drain field, no maintenance.

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 38.068164
Longitude: -90.73505

Sample Number: ORD-110
Sample Date: 10-20-09
Sample Time: 1525

Property Identification Number: 30312 Study Area: 12

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: S Well shared with other residence(s): NO

Number of Occupants or persons supplied by well: 5 Children under 6 yrs: 0

Well Depth: ? Pump Depth: ? Well Age: 6yrs

Flow Rate at House: ? Flow Rate at PoU: 2.6L/min

Holding Tank Make/Volume: 30 gal / champion brand

Treatment System(s): none

Sample Collection Description:

Purge Time or Volume: unpurged for 12+ hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic HFV~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number:
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study

Sample Number: ORD-111

Latitude: ____________

Sample Date: 10-20-08

Longitude: ____________

Sample Time: 1545

Property Identification Number: ____________ Study Area: ____________

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: SEE-110

Tenant's Name: ____________ Tenant's Phone Number: ____________

Property Address: ____________

Residence owner occupied: ________ Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: ________ Children under 6 yrs: ________

Well Depth: ________ Pump Depth: ________ Well Age: ________

Flow Rate at House: ________ Flow Rate at POU: ________

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: 20 min

Field Parameters:

Temperature (°C):	17.11	ORP (mV):	160.2
Conductivity (µS/cm):	599	**Test Kit Results:**	
pH:	6.90	Hardness:	~~377~~ 376.2
TDS (mg/L):		Free Chlorine (mg/L):	Not Present
DO (mg/L):	999.99	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ________

Sampler's Initials: CB

10-20-09, 1530

[Cut and paste from the Shaw fieldsheets. Forms 3-5 and 4-5: extract the field analytical data elements and combine into one datasheet, as page 2 below. This page 1 listing replaces entirely: Forms 1-5, 2-5, 3-5 and the balance of Forms 3-5 and 4-5. Put into similar tabular format].

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

EPA 30312 [redacted]

1. Home (describe: name, address, phone number, ID number, mine area, etc.)
[redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)
Front yard ~50 ft from house, in 2003, no maintenance
driller is Patterson pump 2 hp

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)
Champion 30 gal, 50 psi off / 100 psi on

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)
2003, pvc

5. Water softener (describe: connections/faucets, maintenance done, etc.)
None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)
filter on refrigerator, "Pure Source 2 icewater filtration system"

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)
2,6 L/min

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)
Icemaker, 1 tray/day

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)
1500 gallon back yard, ~100 ft from house, regular emptying

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)
no problems, mom + kids drinks bottled water
Dad does not

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______
Longitude: ______

Sample Number: ORD-112
Sample Date: 10-21-09
Sample Time: 0813

Property Identification Number: 20332 Study Area: ______

Owners Name: ______ Owners Phone Number: ______

Mailing Address: SEE ORD-113

Tenant's Name: ______ Tenant's Phone Number: ______

Property Address: ______

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at PoU: 10 L/min

Holding Tank Make/Volume: ______

Treatment System(s): ______

Sample Collection Description: ______

Purge Time or Volume: Unpurged 10+ hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, Unpurged	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ______
Sampler's Initials: CB

Ba: 887.5 ug/L
Cd: 1U ug/L (10/25/05)
Pb: 17.25 ug/L
As: 1U ug/L

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-113
Sample Date: 10-21-09
Sample Time: 0850

Property Identification Number: 20332 Study Area: ~~20332~~ 2

Owners Name: [redacted] Owners Phone Number: ____________

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: ____________ Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: ____________ Children under 6 yrs: ____________

Well Depth: 500' Pump Depth: 256' Well Age: ?

Flow Rate at House: ____________ Flow Rate at POU: 10L/min

Holding Tank Make/Volume: could not locate

Treatment System(s): none

Sample Collection Description: ____________

Purge Time or Volume: 37 min

Field Parameters:

Temperature (°C):	14.23	ORP (mV):	192.1
Conductivity (µS/cm):	690	**Test Kit Results:**	
pH:	6.81	Hardness:	427.5
TDS (mg/L):	—	Free Chlorine (mg/L):	Not present
DO (mg/L):	—	Total Chlorine (mg/L):	"

Remarks:

Photo Number: ____________

Sampler's Initials: GB

10-21-09 @ 8:00

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS

Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: SA7 EPA # 20332

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

Located in front of trailer, ≈ 500' BGS. Built by Eye drilling

Pump is ≈ 250' BGS

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

Could not locate

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

Bottled water

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

Ba: 486 mg
Cd: 1U
Pb: 16.9 (10/25/05)
As: 1U

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 37.96746
Longitude: -90.77184

Sample Number: ORD-114
Sample Date: 10-21-09
Sample Time: 1048

Property Identification Number: 20425 Study Area: 3
Owners Name: [redacted] Owners Phone Number: [redacted]
Mailing Address: [redacted]
Tenant's Name: — Tenant's Phone Number: —
Property Address: Same
Residence owner occupied: 2 Well shared with other residence(s): no
Number of Occupants or persons supplied by well: 2 Children under 6 yrs: —

Well Depth: 270 Pump Depth: 270 Well Age: ~40 yrs
Flow Rate at House: ? Flow Rate at PoU: 5.3 L/min

Holding Tank Make/Volume: Well-Trol / 30 gal
Treatment System(s): No

Sample Collection Description:

Purge Time or Volume: Unpurged 12+ hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet ~~Tap,~~ Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet ~~Tap, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE
~~Tap, Purged~~	~~Total Metals~~	~~1~~	~~Unfiltered~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
		~~1~~	~~Filtered~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
~~Tap, Purged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
		~~1~~	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	125 ml HDPE

Remarks:

Photo Number:
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study

Latitude: ____________

Longitude: ____________

Sample Number: ORD-115__

Sample Date: 10-21-09

Sample Time: 1110

Property Identification Number: 20425 Study Area: ____________

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: ____________

Tenant's Name: ____________ Tenant's Phone Number: ____________

Property Address: ____________

SEE ORD-114

Residence owner occupied: ______ Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at POU: ______

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: 22 min

Field Parameters:

Temperature (°C):	14.05	ORP (mV):	174.0
Conductivity (µS/cm):	645	Test Kit Results:	
pH:	6.80	Hardness:	444.6
TDS (mg/L):	—	Free Chlorine (mg/L):	Not Present
DO (mg/L):	—	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ______

Sampler's Initials: GR

10-21-09 @ 1030

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: SA 3, 20425

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.) Well: Pump: Driller:

Frontyard about 6' from house, 270' ~~[illegible]~~ 270', Marshall Eye

Date: ~40 years ago, hp/gpm: ?, new pump 2 yrs ago.

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

30 gal, Wel-Trol press ?/?

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

18yrs old, PVC

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

None

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______
Longitude: ______

Sample Number: ORD-116
Sample Date: 10-21-09
Sample Time: 1315

Property Identification Number: 20459 Study Area: ______

Owners Name: ______ Owners Phone Number: ______

Mailing Address: ______

Tenant's Name: SEE ORD-117 Tenant's Phone Number: ______

Property Address: ______

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at PoU: ______

Holding Tank Make/Volume: ______

Treatment System(s): ______

Sample Collection Description: ______

Purge Time or Volume: Unpurged 12 hours +

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ______
Sampler's Initials: JB

Cd: 1U µg/L
Ba: 30
As: 1U
Pb: 23.7 (12/19/05)

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 37.98766
Longitude: -90.72091

Sample Number: ORD-117
Sample Date: 10-21-09
Sample Time: 1340

Property Identification Number: 20459 Study Area: 8
Owners Name: [redacted] Owners Phone Number: [redacted]
Mailing Address: [redacted]
Tenant's Name: — Tenant's Phone Number: —
Property Address: Same
Residence owner occupied: 2 Well shared with other residence(s): No
Number of Occupants or persons supplied by well: 2 Children under 6 yrs: 0

Well Depth: ~130' Pump Depth: ~80' Well Age: ?
Flow Rate at House: Flow Rate at POU: 4.66 L/min

Holding Tank Make/Volume: 30 gal
Treatment System(s): None

Sample Collection Description:

Purge Time or Volume: 25 min

Field Parameters:

Temperature (°C):	14.31	ORP (mV):	72.2
Conductivity (µS/cm):	914	**Test Kit Results:**	
pH:	6.72	Hardness:	666.9
TDS (mg/L):	—	Free Chlorine (mg/L):	Not present
DO (mg/L):	—	Total Chlorine (mg/L):	↓

Remarks:

Photo Number:
Sampler's Initials: LB

10-21-09, 1300 (call husband in evening for questionnaire)

[Cut and paste from the Shaw fieldsheets. Forms 3-5 and 4-5: extract the field analytical data elements and combine into one datasheet, as page 2 below. This page 1 listing replaces entirely: Forms 1-5, 2-5, 3-5 and the balance of Forms 3-5 and 4-5. Put into similar tabular format].

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS

Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

EPAID 20459 [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp ≈ 2 hp and gpm, maintenance done, etc.) maintenance done 5 yrs ago (bladder replaced)
Front yard ~10 ft from house, ~130 ft, 60 ft water table, pump ~80 ft

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)
30 gal 40 psi off / 60 psi on

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)
PVC, 23 yrs old

5. Water softener (describe: connections/faucets, maintenance done, etc.)
none

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)
none

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)
4.6 L/min

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)
buy ice, 1/2 10 lb bag per day.

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)
Front yard, ~100 ft from house, concrete tank w/ drainfield.

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

Like bottled water, would prefer bottled water to filter

Ba: 1210 µg/L
Cd: 2.98 µg/L (3/8/07)
Pb: 37.9 µg/L

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 37.92693
Longitude: -90.80856

Sample Number: ORD-118
Sample Date: 10-21-09
Sample Time: 1507

Property Identification Number: ~~24088~~ 24080 (CB) Study Area: 2

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: – Tenant's Phone Number: –

Property Address: Same

Residence owner occupied: y Well shared with other residence(s): no

Number of Occupants or persons supplied by well: 2 Children under 6 yrs: –

Well Depth: 200' Pump Depth: ? Well Age: 18

Flow Rate at House: ? Flow Rate at PoU: 4.7 L/min

Holding Tank Make/Volume: Buried / 30 gal

Treatment System(s): None

Sample Collection Description:

Purge Time or Volume: Unpurged 8 hrs

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, Unpurged	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number:
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study

Sample Number: ORD-119

Latitude: ______

Sample Date: 10-21-09

Longitude: ______

Sample Time: 1537

Property Identification Number: 24080 Study Area: ______

Owners Name: ______ Owners Phone Number: ______

Mailing Address: See

Tenant's Name: ORD-119 Tenant's Phone Number: ______

Property Address: ______

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at POU: ______

Holding Tank Make/Volume: ______

Treatment System(s): ______

Sample Collection Description: ______

Purge Time or Volume: 26 min

Field Parameters:

Temperature (°C):	15.25	ORP (mV):	149.8
Conductivity (µS/cm):	434	Test Kit Results:	
pH:	7.14	Hardness:	307.8
TDS (mg/L):	–	Free Chlorine (mg/L):	Not Present
DO (mg/L):	–	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ______

Sampler's Initials: CB

10-22-09 @ 1300 Wife home all day (flexible schedule)

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

37.72693, -90.86856

1. Home (describe: name, address, phone number, ID number/mine area, etc.)

Mine Area and ID Number: SA 2 EPA 24080

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

200', Back yard ~15' from house, Magical Eye Jr.-driller approx 18 yrs old, 3/4 hp pump

no maintenance

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

30, Buried

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

18 yrs old, copper, no repairs

5. Water softener (describe: connections/faucets, maintenance done, etc.)

No: Softener

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

None

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

Pb: 23.4 ug/L
Cd: 159 (3/10/06, Dissolved)
Ba: 1070
As: 1u

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 38.02624
Longitude: -90.83862

Sample Number: **ORD-120**
Sample Date: 10-22-09
Sample Time: 0835

Property Identification Number: 30090 Study Area: 18

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: 2 Well shared with other residence(s): No

Number of Occupants or persons supplied by well: 2 Children under 6 yrs: —

Well Depth: ? Pump Depth: ? Well Age: ?

Flow Rate at House: ? Flow Rate at PoU: 4.6 L/min

Holding Tank Make/Volume: 30 gal

Treatment System(s): softener Not in use, filter not in use - owner thinks it is bypassed

Sample Collection Description:

Purge Time or Volume: Unpurged for 10+ hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, ~~Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number:
Sampler's Initials: GB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______________
Longitude: ______________

Sample Number: ORD-121__
Sample Date: ______________
Sample Time: 0900

Property Identification Number: 30090 Study Area: 18
Owners Name: ______________ Owners Phone Number: ______________
Mailing Address: ______________
Tenant's Name: See ORD 120 Tenant's Phone Number: ______________
Property Address: ______________
Residence owner occupied: ______ Well shared with other residence(s): ______________
Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______
Flow Rate at House: ______ Flow Rate at POU: ______

Holding Tank Make/Volume: ______________
Treatment System(s): ______________

Sample Collection Description: ______________

Purge Time or Volume: 25 min

Field Parameters:

Temperature (°C):	14.22	ORP (mV):	245.3
Conductivity (µS/cm):	574	**Test Kit Results:**	
pH:	6.85	Hardness:	393.3
TDS (mg/L):	—	Free Chlorine (mg/L):	Not Present
DO (mg/L):	—	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ______
Sampler's Initials: CB

10-22-09, 8:00

(left message 10-21 @ 1840)

[Cut and paste from the Shaw fieldsheets. Forms 3-5 and 4-5: extract the field analytical data elements and combine into one datasheet, as page 2 below. This page 1 listing replaces entirely: Forms 1-5, 2-5, 3-5 and the balance of Forms 3-5 and 4-5. Put into similar tabular format].

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

EPAID 30090 1. Home (describe: name, address, phone number, ID number, mine area, etc.)

[redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

Front yard, repaired water line in July '09

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

30 gal, ~~50psi off/~~ 50psi off / 46 on ?

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

1976, copper, no repairs

5. Water softener (describe: connections/faucets, maintenance done, etc.)

not in use

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

~~none~~ old filter, never

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

4.6L/min

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

icemaker, 1 tray/day

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

~200 ft away, back yard, lagoon

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

everything ok. would prefer filter

As: 2.15 mg/L
Ba: 9.35
Cd: 1U
Pb: 23.55

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 38.06873
Longitude: -90.71959

Sample Number: ORD-122
Sample Date: 10/22/09
Sample Time: 1545

Property Identification Number: 30412 Study Area: 13

Owners Name: [redacted] Owners Phone Number: ______

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: y Well shared with other residence(s): NO

Number of Occupants or persons supplied by well: 6 Children under 6 yrs: 0

Well Depth: ? Pump Depth: ? Well Age: ?

Flow Rate at House: ? Flow Rate at PoU: 8.6 L/min

Holding Tank Make/Volume: Champion / 30 gal

Treatment System(s): (Softener)

Sample Collection Description: ______

Purge Time or Volume: Unpurged for 10+ hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Inside Faucet ~~Tap~~, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Unpurged~~	~~Arsenic III/V~~	1	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
		1	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	125 ml HDPE
~~Tap, Purged~~	~~Total Metals~~	1	~~Unfiltered~~	~~HNO_3 to pH <2~~	125 ml HDPE
		1	~~Filtered~~	~~HNO_3 to pH <2~~	125 ml HDPE
~~Tap, Purged~~	~~Arsenic III/V~~	1	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	125 ml HDPE
		1	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	125 ml HDPE

Remarks:

Photo Number: ______
Sampler's Initials: GB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-123 (inside)
Sample Date: 10-22-09
Sample Time: 1600

Property Identification Number: 30412 Study Area: ____________

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: SE ORD-122

Tenant's Name: ____________ Tenant's Phone Number: ____________

Property Address: ____________

Residence owner occupied: ____________ Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: ____________ Children under 6 yrs: ____________

Well Depth: ____________ Pump Depth: ____________ Well Age: ____________

Flow Rate at House: ____________ Flow Rate at POU: ____________

Holding Tank Make/Volume: ____________

Treatment System(s): (Softened)

Sample Collection Description: ____________

Purge Time or Volume: purged for 15 min

Field Parameters:

Temperature (°C):	14.10	ORP (mV):	90.4
Conductivity (µS/cm):	971	**Test Kit Results:**	
pH:	6.66	Hardness:	0
TDS (mg/L):	—	Free Chlorine (mg/L):	Not Present
DO (mg/L):	—	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ____________

Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-~~101~~ 123 (outside)
Sample Date: 10-22-09
Sample Time: 1040

Property Identification Number: 30412 Study Area: ____________

Owner's Name: [redacted] Owner's Phone Number: [redacted]

Mailing Address: SEE OKV [redacted]

Tenant's Name: [redacted] Tenant's Phone Number: [redacted]

Property Address: ____________

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at POU: ______

Holding Tank Make/Volume: ______

Treatment System(s): no / Unsoftened

Sample Collection Description: ____________

Purge Time or Volume: purged for 15 min

Field Parameters:

Temperature (°C):	13.95	ORP (mV):	61.8
Conductivity (µS/cm):	505.	**Test Kit Results:**	
pH:	6.90	Hardness:	598.5
TDS (mg/L):	—	Free Chlorine (mg/L):	No Chlorine
DO (mg/L):	—	Total Chlorine (mg/L):	〃

Remarks:

Photo Number: ______

Sampler's Initials: DO

10-22-09 @ 15:30

38.06873, -90.71959

As: 2.15 μg/L
Ba: 50.35 μg/L
Cd: ND
Pb: 23.55
(5/18/06)

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS

Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: 30412, SA13

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

?

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

Challenger Brand 30 gal 40/60 psi

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

4 yrs old, copper

5. Water softener (describe: connections/faucets, maintenance done, etc.)

Ecowater system - whole house
except 1 outside faucet (sampled as well)

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

NONE

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

8.6 L/min

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-9
Sample Date: 10-23-09
Sample Time: 0820

Property Identification Number: ____________ Study Area: ____________

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: ____________

Tenant's Name: See ORD-124 Tenant's Phone Number: ____________

Property Address: ____________

Residence owner occupied: ____________ Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: ____________ Children under 6 yrs: ____________

Well Depth: ____________ Pump Depth: ____________ Well Age: ____________

Flow Rate at House: ____________ Flow Rate at PoU: 0.95 L/min

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: Unpurged 10+ hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ____________
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______
Longitude: ______

Sample Number: ORD-10__
Sample Date: 10-23-09
Sample Time: 0920

Property Identification Number: ______ Study Area: ______

Owners Name: ______ Owners Phone Number: ______

Mailing Address: ______

Tenant's Name: See ORD-124 Tenant's Phone Number: ______

Property Address: ______

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at PoU: ______

Holding Tank Make/Volume: ______

Treatment System(s): ______

Sample Collection Description: ______

Purge Time or Volume: Purged 1hr

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Purged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Purged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ______
Sampler's Initials: GB

Pb: 110 µg/L
Cd: 1U
Ba
As: 1U

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 37.9841667
Longitude: -90.7604583

Sample Number: ORD-124
Sample Date: 10-23-09
Sample Time: 0820

Property Identification Number: 20613 Study Area: 3

Owners Name: [redacted] Owners Phone Number [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: / Well shared with other residence(s): no

Number of Occupants or persons supplied by well: 1 Children under 6 yrs: 0

Well Depth: 205' Pump Depth: 195' Well Age: 10 yrs

Flow Rate at House: ? Flow Rate at PoU: 3.8 L/min

Holding Tank Make/Volume: 42 gal

Treatment System(s): Culligan filter (EPA provided)

Sample Collection Description:

Purge Time or Volume: Unpurged 10+ hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number:
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-125
Sample Date: 10-23-09
Sample Time: ~~0820~~ 0920 CB

Property Identification Number: ____________ **Study Area:** ____________
Owners Name: ____________ **Owners Phone Number:** ____________
Mailing Address: ____________
Tenant's Name: See ORD-124 **Tenant's Phone Number:** ____________
Property Address: ____________
Residence owner occupied: ________ **Well shared with other residence(s):** ____________
Number of Occupants or persons supplied by well: ________ **Children under 6 yrs:** ________

Well Depth: ________ **Pump Depth:** ________ **Well Age:** ________
Flow Rate at House: ________ **Flow Rate at POU:** 3.8 L/min

Holding Tank Make/Volume: ____________
Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: Purged 1 hr.

Field Parameters: (New YSI556 used – YSI#0635)

Temperature (°C):	12.54	ORP (mV):	288.0
Conductivity (µS/cm):	300	**Test Kit Results:**	
pH:	7.24 (pH mV -13.3)	Hardness:	
TDS (mg/L):	–	Free Chlorine (mg/L):	Not Present
DO (mg/L):	5.90 (54.0%)	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ________
Sampler's Initials: CB

Scheduled: 10-23-09, 8:00 am

[Cut and paste from the Shaw fieldsheets. Forms 3-5 and 4-5: extract the field analytical data elements and combine into one datasheet, as page 2 below. This page 1 listing replaces entirely: Forms 1-5, 2-5, 3-5 and the balance of Forms 3-5 and 4-5. Put into similar tabular format].

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

EPA ID: 20613 [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

Location: 10 ft from house Front Yard

AAA drilling, June '99, no maintenance, ~~[illegible]~~, 205' well, 105' steel casing, well at 195', 3/4 hp pump, ~~42 gal~~ 45 gal tank

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

~~42 gal tank~~

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

10 yrs old, PVC, no repairs

5. Water softener (describe: connections/faucets, maintenance done, etc.)

NONE

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, ~~maintenance done and~~ cost, homeowner satisfaction, etc.) She Loves it

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

3.8 L/min at faucet, 0.95 L/min at Tap

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

icemaker, 1 glass/day

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

Back yard, ? no maintenance

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

Pb: 55 µg/L

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 37.87123
Longitude: -90.73136

Sample Number: ORD-126
Sample Date: 10-23-09
Sample Time: 1040

Property Identification Number: FRCK636 Study Area: FRCK
Owners Name: [redacted] Owners Phone Number: [redacted]
Mailing Address: [redacted]
Tenant's Name: — Tenant's Phone Number: —
Property Address: Same
Residence owner occupied: Y Well shared with other residence(s): No
Number of Occupants or persons supplied by well: 4 Children under 6 yrs: —

Well Depth: 25 ft (spring) Pump Depth: Well Age:
Flow Rate at House: Flow Rate at PoU: 3.1 L/min

Holding Tank Make/Volume: ?
Treatment System(s): None

Sample Collection Description:

Purge Time or Volume: unpurged 12+ hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number:
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-127
Sample Date: 10-23-09
Sample Time: 1110

Property Identification Number: ____________ Study Area: ____________
Owners Name: ____________ Owners Phone Number: ____________
Mailing Address: SEE ORD-126
Tenant's Name: ____________ Tenant's Phone Number: ____________
Property Address: ____________
Residence owner occupied: ______ Well shared with other residence(s): ____________
Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______
Flow Rate at House: ______ Flow Rate at POU: ______

Holding Tank Make/Volume: ____________
Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: Purged 22 min

Field Parameters:

Temperature (°C):	13.15	ORP (mV):	~~238~~ 242.4
Conductivity (µS/cm):	526	**Test Kit Results:**	
pH:	7.15	Hardness:	461.7
TDS (mg/L):	—	Free Chlorine (mg/L):	Not Present
DO (mg/L):	8.79 (83.0%)	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ______
Sampler's Initials: CB

10-23-09, 10:30

[Cut and paste from the Shaw fieldsheets. Forms 3-5 and 4-5: extract the field analytical data elements and combine into one datasheet, as page 2 below. This page 1 listing replaces entirely: Forms 1-5, 2-5, 3-5 and the balance of Forms 3-5 and 4-5. Put into similar tabular format].

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS

Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7

Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

EPA FRCK-636 1. Home (describe: name, address, phone number, ID number, mine area, etc.)

[redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

E. side of house, about 3 ft off house, ~25 ft (spring water), 2002 had work done

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

~~25-35psi~~ 20-40psi off/on

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

mostly PVC, some copper

5. Water softener (describe: connections/faucets, maintenance done, etc.)

No softener

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

none

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

icemaker, buys ice from store

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

Back of house concrete tank w/ drain field

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

no problems w/ bottled water, her water pressure is very low, so she may not be able to have a filter.

Pb: 47.2 mg/L
Cd: 1U
Ba 50

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: 37.9629900
Longitude: -90.8149400

Sample Number: ORD-11
Sample Date: 10-23-09
Sample Time: 1355

Property Identification Number: 24055 Study Area: 1

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: 3 Well shared with other residence(s): NO

Number of Occupants or persons supplied by well: 3 Children under 6 yrs: 0

Well Depth: ~100ft Pump Depth: ? Well Age: 29

Flow Rate at House: ? Flow Rate at PoU: 1.5 L/min

Holding Tank Make/Volume: Well-Rite / 30gal

Treatment System(s): EPA Provided Culligan Filter

Sample Collection Description:

Purge Time or Volume: unpurged for 8 hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	125 ml HDPE

Remarks:

Photo Number:
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study — **Sample Number:** ORD-12__
Latitude: ______________ — **Sample Date:** 10-23-09
Longitude: ______________ — **Sample Time:** 1430

Property Identification Number: 24055 Study Area: 1

Owners Name: ______________ Owners Phone Number: ______________

Mailing Address: ______________

Tenant's Name: SEE ORD-11 Tenant's Phone Number: ______________

Property Address: ______________

Residence owner occupied: ________ Well shared with other residence(s): ______________

Number of Occupants or persons supplied by well: ________ Children under 6 yrs: ________

Well Depth: ____________ Pump Depth: ____________ Well Age: ________

Flow Rate at House: ______________ Flow Rate at PoU: ______________

Holding Tank Make/Volume: ______________

Treatment System(s): ______________

Sample Collection Description: ______________

Purge Time or Volume: purged 35 min

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Purged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Purged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ________
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______
Longitude: ______

Sample Number: **ORD-128**
Sample Date: 10-23-09
Sample Time: 1358

Property Identification Number: 24055 Study Area: 1

Owners Name: ______ Owners Phone Number: ______

Mailing Address: ______

Tenant's Name: SEE ORD-11 Tenant's Phone Number: ______

Property Address: ______

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at PoU: 5.3 L/min

Holding Tank Make/Volume: ______

Treatment System(s): ______

Sample Collection Description: Odd film or foam (slight) formed on top of faucet filtered sample for a minute - did not observe this on the Tap sample

Purge Time or Volume: Unpurged for 8 hrs

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ______
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study

Sample Number: ORD-129

Latitude: ______

Sample Date: 10-23-09

Longitude: ______

Sample Time: 1430

Property Identification Number: 24055 **Study Area:** 1

Owners Name: ______ **Owners Phone Number:** ______

Mailing Address: SEE ORD-11

Tenant's Name: ______ **Tenant's Phone Number:** ______

Property Address: ______

Residence owner occupied: ______ **Well shared with other residence(s):** ______

Number of Occupants or persons supplied by well: ______ **Children under 6 yrs:** ______

Well Depth: ______ **Pump Depth:** ______ **Well Age:** ______

Flow Rate at House: ______ **Flow Rate at POU:** 5.3 L/min

Holding Tank Make/Volume: ______

Treatment System(s): ______

Sample Collection Description: Slight film formed on faucet filtered sample, but not from the tap filtered sample.

Purge Time or Volume: Purged for 35 min

Field Parameters:

Temperature (°C):	13.54	ORP (mV):	202.5
Conductivity (µS/cm):	487	Test Kit Results:	
pH:	7.11	Hardness:	359.1
TDS (mg/L):	—	Free Chlorine (mg/L):	Not Present
DO (mg/L):	6.86 (65.5%)	Total Chlorine (mg/L):	"

Remarks:

Photo Number: ______

Sampler's Initials: CB

10-23-09 @ 13:00

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: SA1, EPA 24055

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

Front Yard ~80ft from house, ~400ft deep

Driller - Marshal Eye, drilled in 1980-81, bladder burst 3-4 years ago

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

Well-Rite, 40 off/50 on, 30 gal

GM-2
197/323

Pb: 7.95 ug/L
Cd: 6.41
B
As: 'U

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____
Longitude: ____

Sample Number: ORD-130
Sample Date: 10-26-09
Sample Time: 0820

Property Identification Number: 30924 Study Area: 17

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: 2 Well shared with other residence(s): NO

Number of Occupants or persons supplied by well: 2 Children under 6 yrs: 0

Well Depth: 140' Pump Depth: ? Well Age: 12yrs

Flow Rate at House: ? Flow Rate at PoU: 5.5 L/min

Holding Tank Make/Volume: 20 gal

Treatment System(s): "Whirlpool" Mechanical Reduction Filter - whole house pre-filtration system

Sample Collection Description: Kitchen sink samples were taken for unpurged, purged (filtered & unfiltered). A bypass for the filter was used turned before collecting the unfiltered samples (purged an additional 10 min).

Purge Time or Volume: unpurged 10+ laus

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ____
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______
Longitude: ______

Sample Number: ORD-131 (filtered)
Sample Date: 10-26-09
Sample Time: 0900
(Label on samples reads "ORD-131")

Property Identification Number: 30924 **Study Area:** ______
Owners Name: ______ **Owners Phone Number:** ______
Mailing Address: SEE ORD-130
Tenant's Name: ______ **Tenant's Phone Number:** ______
Property Address: ______
Residence owner occupied: ______ **Well shared with other residence(s):** ______
Number of Occupants or persons supplied by well: ______ **Children under 6 yrs:** ______

Well Depth: ______ **Pump Depth:** ______ **Well Age:** ______
Flow Rate at House: ______ **Flow Rate at POU:** ______

Holding Tank Make/Volume: ______
Treatment System(s): ______

Sample Collection Description: Sample is filtered (whole house system)

Purge Time or Volume: Purged for 40 min

Field Parameters:

Temperature (°C):	14.09	ORP (mV):	285.7
Conductivity (µS/cm):	541	**Test Kit Results:**	
pH:	Meter broken	Hardness:	
TDS (mg/L):	—	Free Chlorine (mg/L):	
DO (mg/L):	5.39 (52.0%)	Total Chlorine (mg/L):	

Remarks:

Photo Number: ______
Sampler's Initials: LB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study

Sample Number: ORD ~~157~~ 131 (unfiltered)
Sample Date: 10-26-09 CB
Sample Time: 1010
(Label on samples reads "ORD-31UF")

Latitude: ______
Longitude: ______

Property Identification Number: 3094 **Study Area:** ______
Owners Name: ______ **Owners Phone Number:** ______
Mailing Address: SEE ORD-130
Tenant's Name: ______ **Tenant's Phone Number:** ______
Property Address: ______
Residence owner occupied: ______ **Well shared with other residence(s):** ______
Number of Occupants or persons supplied by well: ______ **Children under 6 yrs:** ______

Well Depth: ______ **Pump Depth:** ______ **Well Age:** ______
Flow Rate at House: ______ **Flow Rate at POU:** ______

Holding Tank Make/Volume: ______
Treatment System(s): ______

Sample Collection Description: Unfiltered samples (whole house system bypassed)

Purge Time or Volume: lines purged an additional 10 minutes

Field Parameters:

Temperature (°C):	13.18	ORP (mV):	277.3
Conductivity (µS/cm):	531	Test Kit Results:	
pH: (pH paper?)	— Probe broken in water	Hardness:	427.5
TDS (mg/L):	—	Free Chlorine (mg/L):	Not Present
DO (mg/L):	5.08 48.0	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ______
Sampler's Initials: CB

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: SA17 EPA 30924

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

Well 140' BGS 1 hp pump ≈8 gpm
80' casing Marshall Eye, drilled the well in 1997
Well is located in front of house

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

20 gallon pressure tank

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

Plastic plumbing built in 2006

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

Bottled water - Owner has whole house pre-filtration system by Whirlpool - Mechanical Reduction filter

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

5.5 L/min

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

Icemaker use about a container per week

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

located ≈ 75' in front of house

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

Unhappy with bottled water, allergy to Sulfites

- Property owner mentioned a film on her water sometimes

Sketch or other notes:

Pb: 59.6 ug/L
Ba: 394
Cd: 2.13
(8-13-08)

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______
Longitude: ______

Sample Number: ORD-13
Sample Date: 10-26-09
Sample Time: 1140

Property Identification Number: 123 Study Area: 3

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: / Well shared with other residence(s): no

Number of Occupants or persons supplied by well: 1 Children under 6 yrs: 0

Well Depth: ~130' Pump Depth: ______ Well Age: 55 yrs

Flow Rate at House: ? Flow Rate at PoU: 0.8L/min

Holding Tank Make/Volume: ?

Treatment System(s): EPA Culligan filter

Sample Collection Description: ______

Purge Time or Volume: Unpurged for 11 hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
		~~1~~	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~

Remarks:

Photo Number: ______
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______________
Longitude: ______________

Sample Number: ORD-14
Sample Date: 10-26-09
Sample Time: 1205

Property Identification Number: 123 Study Area: ______________

Owners Name: ______________ Owners Phone Number: ______________

Mailing Address: SEE ORD 13

Tenant's Name: ______________ Tenant's Phone Number: ______________

Property Address: ______________

Residence owner occupied: ______ Well shared with other residence(s): ______________

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______________ Pump Depth: ______________ Well Age: ______________

Flow Rate at House: ______________ Flow Rate at PoU: ______________

Holding Tank Make/Volume: ______________

Treatment System(s): ______________

Sample Collection Description: ______________

Purge Time or Volume: Purged 25 min

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Purged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Purged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
		~~1~~	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~

Remarks:

Photo Number: ______________
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______
Longitude: ______

Sample Number: ORD-132
Sample Date: 10-26-09
Sample Time: 1140

Property Identification Number: 123 Study Area: ______

Owners Name: ______ Owners Phone Number: ______

Mailing Address: ______

Tenant's Name: SEE ORD-13 Tenant's Phone Number: ______

Property Address: ______

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at PoU: ~~6.8/L~~ CB 6.8L/min

Holding Tank Make/Volume: ______

Treatment System(s): ______

Sample Collection Description: ______

Purge Time or Volume: Unpurged 11 hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
		~~1~~	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~

Remarks:

Photo Number: ______
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-133
Sample Date: 10-26-09
Sample Time: 1205

Property Identification Number: ____________ Study Area: ____________
Owners Name: ____________ Owners Phone Number: ____________
Mailing Address: ____________
Tenant's Name: SEE ORD 13 Tenant's Phone Number: ____________
Property Address: ____________
Residence owner occupied: ______ Well shared with other residence(s): ____________
Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______
Flow Rate at House: ______ Flow Rate at POU: ______

Holding Tank Make/Volume: ____________
Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: Purged 25 min

Field Parameters:

Temperature (°C):	12.69	ORP (mV):	210.9
Conductivity (µS/cm):	503	**Test Kit Results:**	
pH:	— (pH paper ~7)	Hardness:	359.1
TDS (mg/L):	—	Free Chlorine (mg/L):	Non Present
DO (mg/L):	7.54 (70.4)	Total Chlorine (mg/L):	

Remarks:

Photo Number: ______
Sampler's Initials: CB

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: SA3, EPA 123

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.) Marshall Eye - Driller

Back yard ~25 ft from house, ~130 ft deep, ~1954

pump replaced in 1970's

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

?

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

1958 copper / plastic, outside plastic pipes replaced 30 years ago.

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

EPA Culligan filter

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

0.8 L/min at culligan filter (Tap)

6.8 L/min at faucet

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

2 trays 1/week in the summertime

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

N/E Side of house ~20 ft from house

Concrete tank w/ drainfield

whole system replaced 5 years ago.

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

Wishes her filter had better flow rate

Sketch or other notes:

Pb: 33.3 µg/L
Cd: 1U
Ba: 1010
As ( ) U
(3/20/06)

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-134
Sample Date: 10-26-09
Sample Time: 1615

Property Identification Number: 20158 Study Area: 10

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: ____________

Residence owner occupied: ? Well shared with other residence(s): ?

Number of Occupants or persons supplied by well: ? Children under 6 yrs: 4

Well Depth: 350ft Pump Depth: ? Well Age: 14

Flow Rate at House: ? Flow Rate at PoU: 1.5 L/min

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: Unpurged – owner was washing dishes when we arrived. She said she hadn't used much water.

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, ~~Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
		~~1~~	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~

Remarks:

Photo Number: ____________
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______
Longitude: ______

Sample Number: ORD-135
Sample Date: 10-26-09
Sample Time: ~~1035~~ 1035 CB

Property Identification Number: 20158 Study Area: ______
Owners Name: ______ Owners Phone Number: ______
Mailing Address: SEE ORD-134
Tenant's Name: ______ Tenant's Phone Number: ______
Property Address: ______
Residence owner occupied: ______ Well shared with other residence(s): ______
Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______
Flow Rate at House: ______ Flow Rate at POU: ______

Holding Tank Make/Volume: ______
Treatment System(s): ______

Sample Collection Description: ______

Purge Time or Volume: Purged

Field Parameters:

Temperature (°C):	13.41	ORP (mV):	149.8
Conductivity (µS/cm):	447	Test Kit Results:	
pH:	— (pH paper ~7)	Hardness:	307.8
TDS (mg/L):	—	Free Chlorine (mg/L):	Not Present
DO (mg/L):	8.08 (77.4%)	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ______
Sampler's Initials: CB

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: SA 10, 20158

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

Front ~20ft from house, ~350ft deep, ~1995

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

1995, PVC, redid bathroom in 2007 - copper.

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

None

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

Trays, 2/day

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

~15ft ~~from~~ house on opposite side from ~~and~~ of house from ~~house~~ well. Concrete.

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

Likes bottled – would prefer filter water

Sketch or other notes:

Ba: 303 ug/L
Cd: 2.69 (1/25/07)
Pb: 30.5

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____
Longitude: ____

Sample Number: ORD-136
Sample Date: 10-27-09
Sample Time: 0820

Property Identification Number: 23428 Study Area: 5

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: ____ Well shared with other residence(s): ____

Number of Occupants or persons supplied by well: ____ Children under 6 yrs: ____

Well Depth: ? Pump Depth: ? Well Age: ?

Flow Rate at House: ? Flow Rate at PoU: 3.6 L/min

Holding Tank Make/Volume: 20 gal

Treatment System(s): None

Sample Collection Description: ____

Purge Time or Volume: Unpurged for 10+ hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
		~~1~~	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~

Remarks:

Photo Number: ____
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-137 / ORD-137FD
Sample Date: 10-27-09
Sample Time: 0845

Property Identification Number: 23428 Study Area: 5
Owners Name: ____________ Owners Phone Number: ____________
Mailing Address: SEE ORD-136
Tenant's Name: ____________ Tenant's Phone Number: ____________
Property Address: ____________
Residence owner occupied: ____________ Well shared with other residence(s): ____________
Number of Occupants or persons supplied by well: ____________ Children under 6 yrs: ____________

Well Depth: ____________ Pump Depth: ____________ Well Age: ____________
Flow Rate at House: ____________ Flow Rate at POU: ____________

Holding Tank Make/Volume: ____________
Treatment System(s): ____________

Sample Collection Description: D.O. value stable for only the second time - probably due to sink faucet not being aerated.

Purge Time or Volume: Purged for 25 min

Field Parameters:

Temperature (°C):	13.02	ORP (mV):	292.8
Conductivity (µS/cm):	585	**Test Kit Results:**	
pH:	—	Hardness:	427.5
TDS (mg/L):	—	Free Chlorine (mg/L):	Not Present
DO (mg/L):	5.53 (52.3%)	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ____________
Sampler's Initials: CB

~~10-22-09, 1030~~ Rescheduled for 10-27-09 @ 0800

37.92219, -90.75924

[Cut and paste from the Shaw fieldsheets. Forms 3-5 and 4-5: extract the field analytical data elements and combine into one datasheet, as page 2 below. This page 1 listing replaces entirely: Forms 1-5, 2-5, 3-5 and the balance of Forms 3-5 and 4-5. Put into similar tabular format]

Ba: 303 ug/L
Cd: 2.69
Pb: 30.5
(1/25/07)

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS

Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

EPA 23428 [redacted]

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

[redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

Well located inside house,

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

20 gallon tank, on pair pressure port system

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

Original plumbing, replaced hard water heater, copper/plastic

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

Bottled water

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

3.6 L/min

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

Ice trays, uses bottled water 3 trays per day

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

East side of house at least 75' from house

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______
Longitude: ______

Sample Number: ORD-138
Sample Date: 10-27-09
Sample Time: 1035

Property Identification Number: 40140 Study Area: 10

Owners Name: ______ Owners Phone Number: ______

Mailing Address: SEE ORD-139

Tenant's Name: ______ Tenant's Phone Number: ______

Property Address: ______

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at PoU: ______

Holding Tank Make/Volume: ______

Treatment System(s): ______

Sample Collection Description: ______

Purge Time or Volume: Unpurged for 12 + hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ______
Sampler's Initials: CB

Pb: 25.2 µg/L
Cd: 1U
Ba (940)
As: 1U

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____
Longitude: ____

Sample Number: ORD-139 / ORD-139 FD
Sample Date: 10-27-09
Sample Time: 1052

Property Identification Number: 40140 Study Area: 10
Owners Name: [redacted] Owners Phone Number: [redacted]
Mailing Address: [redacted]
Tenant's Name: — Tenant's Phone Number: —
Property Address: Same
Residence owner occupied: / Well shared with other residence(s): ____
Number of Occupants or persons supplied by well: ____ Children under 6 yrs: ____

Well Depth: 280' Pump Depth: ? Well Age: 4 yrs
Flow Rate at House: ? Flow Rate at POU: 8.6 L/min

Holding Tank Make/Volume: 20 gal
Treatment System(s): None

Sample Collection Description: ____

Purge Time or Volume: Purged for 17+

Field Parameters:

Temperature (°C):	12.92	ORP (mV):	216.2
Conductivity (µS/cm):	467	**Test Kit Results:**	
pH:	— (~7 paper test)	Hardness:	
TDS (mg/L):	—	Free Chlorine (mg/L):	
DO (mg/L):	6.43 (60.0)	Total Chlorine (mg/L):	

Remarks:

Photo Number: ____
Sampler's Initials: CB

Pb: 25.2 µg/L
Cd: 1U
Ba: 1790
As: 1U

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS

Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: EPA 40140, SA10

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

280' ft deep, Marshall Eye, Aug, 2005 - drilled.
at yard ~30' from home   No maintenance.

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

20 gal, buried

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

under trailer in 1987, to well 2005

All PVC, copper by hot water tank

new hot water tank in 2005.

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

None

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

no ice.

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

lagoon, no maintenance

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

likes bottled water, would prefer filter.

Sketch or other notes:

Pb: 68.8 ug/L
Cd: 1U
Ba: ( )
As: 1U

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: **ORD-140**
Sample Date: 10-27-09
Sample Time: 1400

Property Identification Number: 30541 Study Area: SA19

Owners Name: [redacted] Owners Phone Number: ____________

Mailing Address: [redacted]

Tenant's Name: [redacted] Tenant's Phone Number: [redacted]

Property Address: [redacted]

Residence owner occupied: 7 Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: 7 Children under 6 yrs: 4

Well Depth: 180 ft Pump Depth: 180 ft Well Age: 6 yrs

Flow Rate at House: 12 gpm Flow Rate at PoU: 7.4 L/min

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: Unpurged 6 hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ____________
Sampler's Initials: GB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-141
Sample Date: 10-27-09
Sample Time: 1415

Property Identification Number: 30541 Study Area: 19

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: ____________

Tenant's Name: SEE ORD-140 Tenant's Phone Number: ____________

Property Address: ____________

Residence owner occupied: ________ Well shared with other residence(s): ________

Number of Occupants or persons supplied by well: ________ Children under 6 yrs: ________

Well Depth: ________ Pump Depth: ________ Well Age: ________

Flow Rate at House: ________ Flow Rate at POU: ________

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: Purged 15 min

Field Parameters:

Temperature (°C):	12.84	ORP (mV):	135.0
Conductivity (µS/cm):	449	**Test Kit Results:**	
pH:	—	Hardness:	
TDS (mg/L):	—	Free Chlorine (mg/L):	
DO (mg/L):	10.82 (100.0%)	Total Chlorine (mg/L):	

Remarks:

Photo Number: ________
Sampler's Initials: CB

Need to call owner for info - Tenant knows little

Pb: ○ 9.8 µg/L
Cd: ND
Zn: 787
Fe: ND

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: SA19, 30541

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

North side of home ~5 ft from Trailer

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

1990

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

None

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

Trays, 1/2 Tray/day

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

would rather have filter

7. 4<Reynold #

Sketch or other notes:

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ________
Longitude: ________

Sample Number: ORD-142
Sample Date: 10-27-09
Sample Time: 1545

Property Identification Number: 4B159 Study Area: 10

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: ________

Residence owner occupied: 2 Well shared with other residence(s): no

Number of Occupants or persons supplied by well: 2 Children under 6 yrs: —

Well Depth: 180' Pump Depth: 180' Well Age: 6

Flow Rate at House: ________ Flow Rate at PoU: 6.0 L/min

Holding Tank Make/Volume: ________

Treatment System(s): Softened, filtered

Sample Collection Description: Discovered property had a whole-house filtration system toward end of sampling - not enough time/containers to collect full range of samples for the unfiltered - just collected total + dissolved

Purge Time or Volume: ~~Unpurged but hours~~ GB

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
		~~1~~	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~

Remarks:

Photo Number: ________
Sampler's Initials: GB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study

Latitude: ____________

Longitude: ____________

Sample Number: ORD-143-S (filtered)

Sample Date: 10-27-09

Sample Time: 1600

Property Identification Number: 40159 Study Area: ____________

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: SEE ORD-140

Tenant's Name: ____________ Tenant's Phone Number: ____________

Property Address: ____________

Residence owner occupied: ____________ Well shared with other residence(s): ____________

Number of Occupants or persons supplied by well: ____________ Children under 6 yrs: ____________

Well Depth: ____________ Pump Depth: ____________ Well Age: ____________

Flow Rate at House: ____________ Flow Rate at POU: ____________

Holding Tank Make/Volume: ____________

Treatment System(s): Softened, filtered

Sample Collection Description: ____________

Purge Time or Volume: purged 15 min

Field Parameters:

Temperature (°C):	13.25	ORP (mV):	111.5
Conductivity (μS/cm):	546	**Test Kit Results:**	
pH:		Hardness:	0 - soft
TDS (mg/L):		Free Chlorine (mg/L):	Not Present
DO (mg/L):	8.17 (77.6%)	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ____________

Sampler's Initials: GB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-~~155~~ 143 -US (filtered)
Sample Date: 08
Sample Time: 1635

Property Identification Number: 40159 Study Area: ____________
Owners Name: ____________ Owners Phone Number: ____________
Mailing Address: ____________
Tenant's Name: ____________ Tenant's Phone Number: ____________
Property Address: SEE ORD-140
Residence owner occupied: ________ Well shared with other residence(s): ____________
Number of Occupants or persons supplied by well: ________ Children under 6 yrs: ________

Well Depth: ________ Pump Depth: ________ Well Age: ________
Flow Rate at House: ________ Flow Rate at POU: ________

Holding Tank Make/Volume: ____________
Treatment System(s): Unsoftened, filtered

Sample Collection Description: Ran short of 250 ml HDPE's, Collected TOC's in 2x125 mL ~~Disconnected to~~

Purge Time or Volume: Purged an additional 15 minutes after bypass

Field Parameters:

Temperature (°C):	13.06	ORP (mV):	166.6
Conductivity (µS/cm):	471	Test Kit Results:	
pH:	–	Hardness:	342
TDS (mg/L):	–	Free Chlorine (mg/L):	~~As Cl~~ Not Present
DO (mg/L):	8.06 (76.2%)	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ________
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______________
Longitude: ______________

Sample Number: ORD-~~188~~ 143-USUF
Sample Date: 10-27-09
Sample Time: 1705

Property Identification Number: 40159 Study Area: 10

Owners Name: ______________ Owners Phone Number: ______________

Mailing Address: SEE ORD-~~142B~~ -142

Tenant's Name: ______________ Tenant's Phone Number: ______________

Property Address: ______________

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at PoU: ______

Holding Tank Make/Volume: ______________

Treatment System(s): unsoftened, unfiltered

Sample Collection Description: only unfiltered samples

Purge Time or Volume: Purged 5 minutes

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Hydrant ~~Faucet,~~ ~~Un~~purged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
		1	~~Filtered, SPME~~	~~HNO_3 to pH~~ <2	125 ml HDPE

Remarks:

Photo Number: ______
Sampler's Initials: CB

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: 40159, SA10

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

Back yard - ~30 ft from house 180 ft deep 3/4 hp pump 12 gpm
80 ft PVC casing Bladder tank

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

30 gal - Champion brand
40 psi

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

6yrs old, PVC, ~~the~~ repaired trap under kitchen sink

5. Water softener (describe: connections/faucets, maintenance done, etc.)

Yes connected to whole house

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

Omnifilter - whole home
model:U25
20 micron filter

Changes ~2 times/year - has not been changed for 6 months

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

6.0 L/min

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

Ice make, 15 cubes/day

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

Front yard ~ 30 feet from house,
Concrete tanks, leach field

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

Bottled water is ok, would prefer filter

Sketch or other notes:

Pb: 9.5 ug/L
Cd: ND
Ba: 217
As: ND

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-144
Sample Date: 10-28-09
Sample Time: 0805

Property Identification Number: 30513 Study Area: 15

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: 2 Well shared with other residence(s): No

Number of Occupants or persons supplied by well: 2 Children under 6 yrs: 0

Well Depth: ? Pump Depth: ? Well Age: ?

Flow Rate at House: ? Flow Rate at PoU: 7.5 L/min

Holding Tank Make/Volume: 30 gal

Treatment System(s): None

Sample Collection Description: ____________

Purge Time or Volume: 12+ unpurged

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ____________
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-145__
Sample Date: 10-28-09
Sample Time: 0830

Property Identification Number: ____________ **Study Area:** ____________
Owners Name: ____________ **Owners Phone Number:** ____________
Mailing Address: ____________
Tenant's Name: ____________ **Tenant's Phone Number:** ____________
Property Address: SEE ORD144
Residence owner occupied: ________ **Well shared with other residence(s):** ____________
Number of Occupants or persons supplied by well: ________ **Children under 6 yrs:** ________

Well Depth: ________ **Pump Depth:** ________ **Well Age:** ________
Flow Rate at House: ________ **Flow Rate at POU:** ________

Holding Tank Make/Volume: ____________
Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: 25 min purged

Field Parameters:

Temperature (°C):	12.54	ORP (mV):	262.9
Conductivity (µS/cm):	610	Test Kit Results:	
pH:	~ ~7	Hardness:	547.2
TDS (mg/L):	~	Free Chlorine (mg/L):	not present
DO (mg/L):	6.26 (58.7%)	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ________
Sampler's Initials: CB

1

Pb 25.5 ug/L
Cd 1U
Ba: 217
As: 1U

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: EPA 30573, SA 15

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

~ 200 ft (maybe)

replaced bladder w/ holding tank 5 yrs ago.

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

30 gal

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

1997, PVC, no maintenance

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

None

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

7.5 L/min

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

Trays, 4 trays/day

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

Back yard ~5 ft from home,

Concrete w/ drainfield.

2004 pipes from house to tank replaced.

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

OK, but would prefer filter

Sketch or other notes:

Pb: 23.4 µg/L
Cd: 14
( ) 71.4
As: N/A

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ________
Longitude: ________

Sample Number: ORD-15
Sample Date: 10-28-09
Sample Time: 1015

Property Identification Number: 40015 Study Area: 10
Owners Name: [redacted] Owners Phone Number: [redacted]
Mailing Address: [redacted]
Tenant's Name: — Tenant's Phone Number: —
Property Address: Same
Residence owner occupied: 3 Well shared with other residence(s): NO
Number of Occupants or persons supplied by well: 3 Children under 6 yrs: 0

Well Depth: 345ft Pump Depth: ? Well Age: ________
Flow Rate at House: ? Flow Rate at PoU: 5.4/min

Holding Tank Make/Volume: 30 gal
Treatment System(s): None

Sample Collection Description: ________

Purge Time or Volume: Unpurged 12 hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Unpurged	Total Metals	1.	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ________
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ______
Longitude: ______

Sample Number: ORD-16
Sample Date: 10-28-09
Sample Time: 1015

Property Identification Number: 40015 Study Area: ______

Owners Name: SEE Owners Phone Number: ______

Mailing Address: ______

Tenant's Name: ORD-15 Tenant's Phone Number: ______

Property Address: ______

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at PoU: 1.6 min/L

Holding Tank Make/Volume: ______

Treatment System(s): ______

Sample Collection Description: ______

Purge Time or Volume: Unpurged 12 hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Purged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Tap, Purged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
		~~1~~	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~

Remarks:

Photo Number: ______
Sampler's Initials: GB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-146__
Sample Date: 10-28-09
Sample Time: 1030

Property Identification Number: 40015 Study Area: 10

Owners Name: SEE ORD-15 Owners Phone Number: ____________

Mailing Address: ____________

Tenant's Name: ____________ Tenant's Phone Number: ____________

Property Address: ____________

Residence owner occupied: ________ Well shared with other residence(s): ________

Number of Occupants or persons supplied by well: ________ Children under 6 yrs: ________

Well Depth: ________ Pump Depth: ________ Well Age: ________

Flow Rate at House: ________ Flow Rate at PoU: ________

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: purged 15 min

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	125 ml HDPE

Remarks:

Photo Number: ________
Sampler's Initials: GB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study

Latitude: ____________

Longitude: ____________

Sample Number: ORD-147

Sample Date: 10-28-09

Sample Time: 1030

Property Identification Number: 40015 Study Area: 10

Owners Name: ____________ Owners Phone Number: ____________

Mailing Address: ____________

Tenant's Name: SEE ORD-15 Tenant's Phone Number: ____________

Property Address: ____________

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at POU: ______

Holding Tank Make/Volume: ____________

Treatment System(s): ____________

Sample Collection Description: ____________

Purge Time or Volume: purged 15 min

Field Parameters:

Temperature (°C):	14.23	ORP (mV):	177.0
Conductivity (µS/cm):	~771	**Test Kit Results:**	
pH:	— ~7	Hardness:	564.3
TDS (mg/L):	—	Free Chlorine (mg/L):	Not Present
DO (mg/L):	3.41 (32.3%)	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ______

Sampler's Initials: CCB

Scheduled 10-27-09, 1530

Pb: ...14 ug/L
Cd: ND
Ba: 71.4
As: N/A

[Cut and paste from the Shaw fieldsheets. Forms 3-5 and 4-5: extract the field analytical data elements and combine into one datasheet, as page 2 below. This page 1 listing replaces entirely: Forms 1-5, 2-5, 3-5 and the balance of Forms 3-5 and 4-5. Put into similar tabular format].

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS

Homeowner Interview Data Checklist - **Draft 10/5/08 EPA R7**

Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

EPA 40015 [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

location: 7 feet off w. side of house, 345 ft, 1993 - 16 yrs old, 1hp pump replaced in 2005

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

30 gal, 30/40 psi

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

PVC from well to house 1993 - 16 yrs, copper, no maintenance

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

better than bottled water

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

buy from store

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

East side of house by garage, concrete w/ drain field, 1000 gallon tank

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

Satisfied w/ filter

Pb: 32.8 μg/L
[illegible]: 1U
[illegible]: 136
As: 1U

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-148
Sample Date: 10-28-09
Sample Time: 1455

Property Identification Number: 40034 Study Area: 10

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: 2 Well shared with other residence(s): NO

Number of Occupants or persons supplied by well: 2 Children under 6 yrs: 0

Well Depth: ~160' Pump Depth: ____________ Well Age: 30+ yrs.

Flow Rate at House: ____________ Flow Rate at PoU: 4.4 L/min

Holding Tank Make/Volume: 80 gal

Treatment System(s): None

Sample Collection Description: ____________

Purge Time or Volume: 12+ hours

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	1	Unfiltered, SPME	HNO_3 to pH <2	125 ml HDPE
		1	Filtered, SPME	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ____________
Sampler's Initials: CBB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-149
Sample Date: 10-28-09
Sample Time: 1510

Property Identification Number: 40034 Study Area: ____________
Owners Name: ____________ Owners Phone Number: ____________
Mailing Address: ____________
Tenant's Name: SEE ORP-148 Tenant's Phone Number: ____________
Property Address: ____________
Residence owner occupied: ______ Well shared with other residence(s): ____________
Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______
Flow Rate at House: ______ Flow Rate at POU: ______

Holding Tank Make/Volume: ____________
Treatment System(s): ____________

Sample Collection Description: New YSI picked up

Purge Time or Volume: purged 15 min

Field Parameters:

Temperature (°C):	14.57	ORP (mV):	62.2
Conductivity (µS/cm):	584	**Test Kit Results:**	
pH: (new probe)	7.24	Hardness:	427.5
TDS (mg/L):	—	Free Chlorine (mg/L):	Not present
DO (mg/L):	10.52 (103.5%)	Total Chlorine (mg/L):	↓

Remarks:

Photo Number: ______
Sampler's Initials: CB

P 32.8
Cd. 1U
Ba 436
As 1U

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: SA 10, 40034

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

25' west of house, ≈160', at least 30 yrs. old, 3/4 hp pump
replaced pump 3 times (last time ≈ 7 yrs ago)

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

80 gallon tank, metal 40 psi

GM-2
255/323

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

Copper plumbing w/ PVC

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

Unhappy with the bottled water. Says it has poor taste

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

Ice maker, amount used varies

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

Lagoon & septic on east side of house, Concrete [illegible] tank

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

Don't like the taste of water

Sketch or other notes:

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
Latitude: ____________
Longitude: ____________

Sample Number: ORD-150
Sample Date: 10-29-09
Sample Time: ____________

Property Identification Number: 20199 Study Area: 17

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: 3 Well shared with other residence(s): NO

Number of Occupants or persons supplied by well: 3 Children under 6 yrs: 1

Well Depth: ~300 ft Pump Depth: ? Well Age: 9 yrs

Flow Rate at House: ? Flow Rate at PoU: 4.74/m

Holding Tank Make/Volume: 30 gal

Treatment System(s): None

Sample Collection Description: ____________

Purge Time or Volume: ~ 10 hours unpurged

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	HNO_3 to pH <2	125 ml HDPE
		~~1~~	~~Filtered, SPME~~	HNO_3 to pH <2	125 ml HDPE

Remarks:

Photo Number: ____________
Sampler's Initials: GB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study

Sample Number: ORD-151

Latitude: ______

Sample Date: 10-29-09

Longitude: ______

Sample Time: ______

Property Identification Number: ______ Study Area: ______

Owners Name: ______ Owners Phone Number: ______

Mailing Address: ______

Tenant's Name: SEE ORD-150 Tenant's Phone Number: ______

Property Address: ______

Residence owner occupied: ______ Well shared with other residence(s): ______

Number of Occupants or persons supplied by well: ______ Children under 6 yrs: ______

Well Depth: ______ Pump Depth: ______ Well Age: ______

Flow Rate at House: ______ Flow Rate at POU: ______

Holding Tank Make/Volume: ______

Treatment System(s): ______

Sample Collection Description: ______

Purge Time or Volume: ______

Field Parameters:

Temperature (°C):	13.68	ORP (mV):	36.0
Conductivity (µS/cm):	535	**Test Kit Results:**	
pH:	7.02	Hardness:	393.3
TDS (mg/L):	–	Free Chlorine (mg/L):	Not Present
DO (mg/L):	12.02 (116.2%)	Total Chlorine (mg/L):	⸗

Remarks:

Photo Number: ______

Sampler's Initials: CB

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: SA-17, 20199

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump-hp and gpm, maintenance done, etc.)

April, 2000, ~300', Patterson's Drilling

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

30 gal, Replaced tank ~2 years ago

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

1990, have replaced pipes every winter, PVC (when one breaks)

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

None

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

4.7 L/min at faucet

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

Trays, 1 tray / 2 weeks

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

~30 ft. from house, concrete tank w/ leach field, owner says it leaks

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

Like the water (bottled)

Doesn't matter / no preference for bottled water or filter.

Sketch or other notes:

Pb: 44.2 ug/L
Cd: 2.69
( ) 275
As: 10

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study
~~Latitude:~~ ______
~~Longitude:~~ ______

Sample Number: ORD-152
Sample Date: 10-29-09
Sample Time: 1020

Property Identification Number: 20517 Study Area: 4

Owners Name: [redacted] Owners Phone Number: [redacted]

Mailing Address: [redacted]

Tenant's Name: — Tenant's Phone Number: —

Property Address: Same

Residence owner occupied: 6 Well shared with other residence(s): NO

Number of Occupants or persons supplied by well: 6 Children under 6 yrs: 1

Well Depth: ? Pump Depth: ? Well Age: ~70 yrs

Flow Rate at House: ? Flow Rate at PoU: 6L/min

Holding Tank Make/Volume: ?

Treatment System(s): None

Sample Collection Description: ______

Purge Time or Volume: Unpurged ~12 hrs

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
~~Faucet, Unpurged~~	~~Arsenic III/V~~	~~1~~	~~Unfiltered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~
		~~1~~	~~Filtered, SPME~~	~~HNO_3 to pH <2~~	~~125 ml HDPE~~

Remarks:

Photo Number: ______
Sampler's Initials: CB

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study | Sample Number: ORD-153
Latitude: | Sample Date: 10-29-09
Longitude: | Sample Time: 1040

Property Identification Number: 20517 Study Area:
Owners Name: Owners Phone Number:
Mailing Address: SEE ORD -152
Tenant's Name: Tenant's Phone Number:
Property Address:
Residence owner occupied: Well shared with other residence(s):
Number of Occupants or persons supplied by well: Children under 6 yrs:

Well Depth: Pump Depth: Well Age:
Flow Rate at House: Flow Rate at POU:

Holding Tank Make/Volume:
Treatment System(s):

Sample Collection Description:

Purge Time or Volume: Purged 20 min

Field Parameters:

Temperature (°C):	14.14	ORP (mV):	30.4
Conductivity (µS/cm):	758	Test Kit Results:	
pH:	6.92	Hardness:	427.5
TDS (mg/L):	—	Free Chlorine (mg/L):	Not Present
DO (mg/L):	5.34 (52.0%)	Total Chlorine (mg/L):	↓

Remarks:

Photo Number:
Sampler's Initials: CB

10-29-09, 1030

P: 44.2 ug/L
Cu: 2.69
Ba: 265
As: 1U
(10-31-09)

SAMPLING AND ANALYSIS OF HOUSEHOLD
WELL WATER IN MINE WASTE AREAS
Homeowner Interview Data Checklist - Draft 10/5/08 EPA R7
Drinking Water Well and Existing Point of Use (PoU) Treatment Unit

1. Home (describe: name, address, phone number, ID number, mine area, etc.)

Mine Area and ID Number: SA 4, 20517

Name of Person(s) Interviewed: [redacted]

Address: [redacted]

Telephone: [redacted]

2. Well information (describe: location, depth, construction details, driller, date, pump hp and gpm, maintenance done, etc.)

?, Shallow, close to 70 years old,

3. Pressure tank (describe: volume, gauge pressure on and pressure off, etc.)

?,

4. Plumbing (describe: date/age, specify copper/galvanized/plastic, repairs done, etc.)

Replaced w/PVC, 7 years ago

Same iron pipe

5. Water softener (describe: connections/faucets, maintenance done, etc.)

None

6. Existing water PoU treatment (describe: EPA Culligan carbon filter, other PoU unit - specify, type and size of waterline connection, maintenance done and cost, homeowner satisfaction, etc.)

None

7. Flow rate (describe: measure sink faucet gpm and pressure, measure PoU filter sinktap gpm, homeowner comments, etc.)

6 L/min at faucet

8. Ice cubes (describe: ice trays, icemaker, quantity used, etc.)

trays, 3 trays/day

9. Septic tank (describe: location, type, maintenance, homeowner comments, etc.)

Concrete, drain field.

30-50ft from house

10. Other homeowner comments (describe: alternate contact information, well water problems, bottled water problems, preference for PoU unit, any other complaints/compliments/comments, etc.)

Likes the water (bottled Culligan)

no preference for filter or bottled water

Sketch or other notes:

APPENDIX D

TRANSMITTAL OF SAMPLE ANALYSIS RESULTS FOR ASR # 4693

United States Environmental Protection Agency
Region 7
901 N. 5th Street
Kansas City, KS 66101

Date: 11/10/2009

Subject: Transmittal of Sample Analysis Results for ASR #: 4693

Project ID: CSA78D00

Project Description: Washington County Lead District - Potosi sampling

From: Michael F. Davis, Chief
Chemical Analysis and Response Branch, Environmental Services Division

To: Craig Smith
SUPR/STAR

Enclosed are the analytical data for the above-referenced Analytical Services Request (ASR) and Project. The Regional Laboratory has reviewed and verified the results in accordance with procedures described in our Quality Manual (QM). In addition to all of the analytical results, this transmittal contains pertinent information that may have influenced the reported results and documents any deviations from the established requirements of the QM.

Please contact us within 14 days of receipt of this package if you determine there is a need for any changes. Please complete the enclosed Customer Satisfaction Survey and Data Disposition/Sample Release memo for this ASR as soon as possible. The process of disposing of the samples for this ASR will be initiated 30 days from the date of this transmittal unless an alternate release date is specified on the Data Disposition/Sample Release memo.

If you have any questions or concerns relating to this data package, contact our customer service line at 913-551-5295.

Enclosures

cc: Analytical Data File.

Project Manager: Craig Smith **Org:** SUPR/STAR **Phone:** 913-551-7683

Project ID: CSA78D00

Project Desc: Washington County Lead District - Potosi sampling

Location: Potosi **State:** Missouri **Program:** Superfund

Site Name: WASHINGTON COUNTY LEAD DISTRICT - POTOSI - SITEWIDE **Site ID:** A78D **Site OU:** 00

GPRA PRC: 302DD2C

Purpose: Site Preliminary Assessment

C. Smith Cell number: 913-548-7000.

Explanation of Codes, Units and Qualifiers used on this report

Sample QC Codes: QC Codes identify the type of sample for quality control purpose.

__ = Field Sample

Units: Specific units in which results are reported.

ug/L = Micrograms per Liter

Data Qualifiers: Specific codes used in conjunction with data values to provide additional information on the quality of reported results, or used to explain the absence of a specific value.

(Blank)= Values have been reviewed and found acceptable for use.

J = The identification of the analyte is acceptable; the reported value is an estimate.

U = The analyte was not detected at or above the reporting limit.

UJ = The analyte was not detected at or above the reporting limit. The reporting limit is an estimate.

Project ID: CSA78D00 **Project Desc:** Washington County Lead District - Potosi sampling

Sample No	QC Code	Matrix	Location Description	External Sample No	Start Date	Start Time	End Date	End Time	Receipt Date
1 -	___	Water	30412 - Unpurged, faucet, inside, softened		10/22/2009	15:45			10/27/2009
2 -	___	Water	30412 - Purged, faucet, inside, softened		10/22/2009	16:00			10/27/2009
3 -	___	Water	30412 - Outside, purged, unsoftened		10/22/2009	16:25			10/27/2009
4 -	___	Water	EPA 20613, Faucet - unpurged		10/23/2009	08:20			10/27/2009
5 -	___	Water	EPA 20613, Faucet - purged		10/23/2009	09:20			10/27/2009
6 -	___	Water	FRCK-636, Faucet - unpurged		10/23/2009	10:48			10/27/2009
7 -	___	Water	FRCK-636, Faucet - purged		10/23/2009	11:10			10/27/2009
8 -	___	Water	EPA 24055, Faucet - unpurged		10/23/2009	13:55			10/27/2009
9 -	___	Water	EPA 24055, Faucet - purged		10/23/2009	14:30			10/27/2009

Analysis **Comments About Results For This Analysis**

1 Metals - Dissolved, in Water by ICP/MS

Lab: Contract Lab Program (Out-Source)

Method: CLP Statement of Work

Samples: 1-__ 2-__ 3-__ 4-__ 5-__ 6-__ 7-__ 8-__ 9-__

Comments:

Slight lead contamination was found in the preparation and/or calibration blanks. Only samples containing this analyte at a level greater than ten times the contamination level of the blank are reported without being qualified. All samples that contained this analyte but at a level less than ten times the contamination in the blank have the result U-coded indicating that the reporting limit has been raised to the level found in the sample. Samples affected were: lead in -1.

Zinc in samples -1 through -9 was J-coded. Although the analyte in question has been positively identified in these samples, the quantitations are an estimate (J-coded) due to the serial dilution percent difference (11%) being above the control limits (10%). The actual concentrations for zinc may be higher than the reported values.

1 Metals in Water by ICP/MS

Lab: Contract Lab Program (Out-Source)

Method: CLP Statement of Work

Samples: 1-__ 2-__ 3-__ 4-__ 5-__ 6-__ 7-__ 8-__ 9-__

Comments:

Lead in samples -1 and -2 was UJ-coded and lead in samples -3 through -9 was J-coded. Positive results were J-coded and non-detect results were UJ-coded due to the serial dilution percent difference (Pb: 33%) being above the control limits (10%). The actual concentrations for lead may be lower than the reported values.

Analysis/ Analyte	Units	1-___	2-___	3-___	4-___
1 Metals - Dissolved, in Water by ICP/MS					
Antimony	ug/L	2.00 U	2.00 U	2.00 U	2.00 U
Arsenic	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Barium	ug/L	10.0 U	10.0 U	53.0	504
Beryllium	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Cadmium	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Chromium	ug/L	2.00 U	2.00 U	2.00 U	2.00 U
Cobalt	ug/L	1.00 U	1.00 U	2.47	1.00 U
Copper	ug/L	6.38	2.14	2.00 U	13.0
Lead	ug/L	1.11 U	1.00 U	17.4	10.6
Manganese	ug/L	1.00 U	1.00 U	8.97	1.00 U
Nickel	ug/L	1.00 U	1.00 U	9.02	1.75
Selenium	ug/L	5.00 U	5.00 U	5.00 U	5.00 U
Silver	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Thallium	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Vanadium	ug/L	5.00 U	5.00 U	5.00 U	5.00 U
Zinc	ug/L	15.7 J	6.78 J	806 J	534 J
1 Metals in Water by ICP/MS					
Antimony	ug/L	2.00 U	2.00 U	2.00 U	2.00 U
Arsenic	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Barium	ug/L	10.0 U	10.0 U	54.1	510
Beryllium	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Cadmium	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Chromium	ug/L	2.00 U	2.00 U	2.00 U	2.00 U
Cobalt	ug/L	1.00 U	1.00 U	2.00	1.00 U
Copper	ug/L	4.31	2.20	2.26	23.6
Lead	ug/L	1.00 UJ	1.00 UJ	19.4 J	11.3 J
Manganese	ug/L	1.00 U	1.00 U	8.77	1.00 U
Nickel	ug/L	1.00 U	1.00 U	8.25	2.02
Selenium	ug/L	5.00 U	5.00 U	5.00 U	5.00 U
Silver	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Thallium	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Vanadium	ug/L	5.00 U	5.00 U	5.00 U	5.00 U
Zinc	ug/L	6.24	4.39	871	566

Analysis/ Analyte	Units	5-___	6-___	7-___	8-___
1 Metals - Dissolved, in Water by ICP/MS					
Antimony	ug/L	2.00 U	2.00 U	2.00 U	2.00 U
Arsenic	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Barium	ug/L	477	453	459	1240
Beryllium	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Cadmium	ug/L	1.00 U	1.00 U	1.00 U	1.11
Chromium	ug/L	2.00 U	2.00 U	2.00 U	2.00 U
Cobalt	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Copper	ug/L	2.00 U	56.2	4.24	12.5
Lead	ug/L	8.73	49.2	51.7	46.1
Manganese	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Nickel	ug/L	1.45	2.49	1.73	4.03
Selenium	ug/L	5.00 U	5.00 U	5.00 U	5.00 U
Silver	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Thallium	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Vanadium	ug/L	5.00 U	5.00 U	5.00 U	5.00 U
Zinc	ug/L	525 J	88.3 J	52.4 J	272 J
1 Metals in Water by ICP/MS					
Antimony	ug/L	2.00 U	2.00 U	2.00 U	2.00 U
Arsenic	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Barium	ug/L	504	473	479	1260
Beryllium	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Cadmium	ug/L	1.00 U	1.00 U	1.00 U	1.18
Chromium	ug/L	2.00 U	2.00 U	2.00 U	2.00 U
Cobalt	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Copper	ug/L	2.00 U	57.0	4.48	8.26
Lead	ug/L	9.46 J	52.6 J	54.2 J	46.0 J
Manganese	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Nickel	ug/L	1.36	2.62	1.70	3.45
Selenium	ug/L	5.00 U	5.00 U	5.00 U	5.00 U
Silver	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Thallium	ug/L	1.00 U	1.00 U	1.00 U	1.00 U
Vanadium	ug/L	5.00 U	5.00 U	5.00 U	5.00 U
Zinc	ug/L	551	92.8	51.6	267

Analysis/ Analyte	Units	9-___
1 Metals - Dissolved, in Water by ICP/MS		
Antimony	ug/L	2.00 U
Arsenic	ug/L	1.00 U
Barium	ug/L	1230
Beryllium	ug/L	1.00 U
Cadmium	ug/L	1.08
Chromium	ug/L	2.00 U
Cobalt	ug/L	1.00 U
Copper	ug/L	4.08
Lead	ug/L	44.2
Manganese	ug/L	1.00 U
Nickel	ug/L	3.35
Selenium	ug/L	5.00 U
Silver	ug/L	1.00 U
Thallium	ug/L	1.00 U
Vanadium	ug/L	5.00 U
Zinc	ug/L	257 J
1 Metals in Water by ICP/MS		
Antimony	ug/L	2.00 U
Arsenic	ug/L	1.00 U
Barium	ug/L	1220
Beryllium	ug/L	1.00 U
Cadmium	ug/L	1.07
Chromium	ug/L	2.00 U
Cobalt	ug/L	1.00 U
Copper	ug/L	4.89
Lead	ug/L	44.3 J
Manganese	ug/L	1.00 U
Nickel	ug/L	3.45
Selenium	ug/L	5.00 U
Silver	ug/L	1.00 U
Thallium	ug/L	1.00 U
Vanadium	ug/L	5.00 U
Zinc	ug/L	260

United States Environmental Protection Agency
Region VII
901 N. 5th Street
Kansas City, KS 66101

Date: __/__/____

Subject: Data Disposition/Sample Release for ASR #: 4693

Project ID: CSA78D00

Project Description: Washington County Lead District - Potosi sampling

From: Craig Smith
SUPR/STAR

To: Kaye Dollmann
ENSV/RLAB

I have received and reviewed the Transmittal of Sample Analysis Results for the above-referenced Analytical Services Request(ASR) and have indicated my findings below by checking one of the boxes for Data Disposition.

I understand all samples will be disposed upon receipt of this form, unless samples are requested to be held. If I do not return this form all samples will be disposed of on ____________________.

☐ "RELEASED" - Read-only to all Region 7 employees and contractors that have R7LIMS "Customer" account. All Samples may be disposed of upon receipt of this form if not requested to be held.

☐ "Project Manager Accessible" - Available on the LAN in R7LIMS for my use only. All Samples may be disposed of upon receipt of this form if not requested to be held.

☐ "Archived" - THIS DATA IS OF A SENSITIVE NATURE. Any future reports must be requested through the laboratory. All samples may be disposed of upon receipt of the form if not requested to be held.

☐ Hold Samples - I have determined that the samples need to be held until ________________, after which time they will be disposed of in accordance with applicable regulations.
The reason for the hold is:

☐ Samples are associated with a legal proceeding.

☐ Question/Concern with data - possible reanalysis requested.

☐ Other:____

Appendix C

Quality Assurance Project Plan
Shaw

QUALITY ASSURANCE PROJECT PLAN
Measurement Project

SAMPLING AND ANALYSIS OF HOUSEHOLD WELL WATER IN MINE WASTE AREAS

by

Shaw Environmental & Infrastructure, Inc.
5050 Section Avenue
Cincinnati, Ohio 45212

Contract No. EP-C-09-041
Work Assignment No. 0-15
JTN 136277-15

for

U.S. Environmental Protection Agency
Office of Research and Development
National Risk Management Research Laboratory
26 West Martin Luther King Drive
Cincinnati, Ohio 45268

John C. Ireland, Ph.D., Project Officer
Craig L. Patterson, P.E., Work Assignment Manager

Revision 1

October 1, 2009

Shaw Environmental & Infrastructure, Inc. Concurrences:

Program Manager

Signature	**Date**

1. **Rajib Sinha, P.E.**
   Project Leader

Signature	**Date**

2. **Steven Jones**
   Quality Assurance Manager

Signature	**Date**

EPA Endorsement for Implementation:

3. **Craig L. Patterson, P.E.**
   Work Assignment Manager

Signature	**Date**

Stephen Harmon
NRMRL WSWRD Quality Assurance Manager

Signature	**Date**

Quality Assurance Project Plan Distribution List

Craig L. Patterson, P.E.	EPA-WSWRD Work Assignment Manager
Steve Harmon	EPA-WSWRD Quality Assurance Manager
Craig Smith	EPA Region VII Work Assignment Manager
E. Radha Krishnan, P.E.	Shaw Program Manager
Rajib Sinha, P.E.	Shaw Project Leader
Steven Jones	Shaw Quality Assurance Manager
Kit Daniels	Shaw Project Scientist
Jill Webster	Shaw Project Scientist
Lee Heckman	Shaw Project Microbiologist
Nur Muhammad, Ph.D., P.E.	Shaw Project Microbiologist
Shekar Govindaswamy, Ph.D.	Shaw Subcontractor Project Scientist (Lakeshore Engineering Services)
Colin Willits	Tetra Tech EMI Project Manager
Jenna Mead, R.G.	Tetra Tech EMI Project Scientist

TABLE OF CONTENTS

1.0 PROJECT DESCRIPTION AND OBJECTIVES

1.1 ENVIRONMENTAL SYSTEM

U.S. Environmental Protection Agency (EPA) Office of Research and Development (ORD) National Risk Management Research Laboratory (NRMRL) and EPA Region VII are conducting a large scale lead (Pb) in drinking water (DW) alternative water system (AWS) Point of Use (POU) pilot study. Four mine waste areas in Washington County, Missouri have metals in private drinking water wells above the regulatory limits as shown in Table 1-1. Households in Potosi, Richwoods, Old Mines, and Furnace Creek mine waste areas are receiving bottled water as a temporary, short term AWS. Homeowners with contaminated wells will receive POU treatment units as a mid-term AWS until a permanent long-term AWS becomes available. Private wells in representative geologic formations will be sampled to determine the water quality characteristics and the types of POU devices that will be installed in Washington County.

Table 1-1. Well Water Metals Exceeding Action Levels

Analyte	Regulatory Standard	Action Level (µg/L)	Washington County Wells Maximum Concentration (µg/L)
Antimony	MCL	6	10
Barium	MCL	2,000	9,290
Cadmium	MCL	5	31.5
Iron	SMCL	300	613
Lead	MCL	15	808
Manganese	SMCL	50	2,800
Thallium	MCL	2	7

Shaw Environmental and Infrastructure, Inc. (Shaw) will support the EPA through this work assignment to characterize the water quality in a minimum of 27 well waters that are representative of approximately 270 homes in four Missouri mine waste locations in EPA Region VII. The 27 (10% of 270) private well sample locations will be selected in Washington County, Missouri as representative of the hydrogeology in the area.

The Tetra Tech EM, Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) has been tasked by EPA Region VII to provide sampling support for this study. Tetra Tech will obtain access permission from property owners to collect water samples from the 27 drinking water wells. This number will include approximately 8 residences where EPA has installed Culligan POU carbon filtration units at the kitchen sinks. Tetra Tech will coordinate the sampling effort with homeowners as appropriate and record supplemental data regarding the type of water source at these facilities. In order to perform the analysis in a timely manner, Shaw will order sample containers and preservatives to be shipped directly to the sampling locations for use by Tetra Tech.

Shaw will analyze water samples shipped by Tetra Tech for project-specific water quality parameters in accordance with the analytical methods specified in this Quality Assurance Project Plan (QAPP). These water samples will be analyzed at the laboratories located in the EPA Test & Evaluation (T&E) Facility in Cincinnati, Ohio. Field parameters will be analyzed by Tetra

Tech at the sampling locations.

1.2 PROJECT OBJECTIVES

The objectives of this project are to collect water samples from the selected households in the mine waste area, conduct field measurements of the collected water samples, and to analyze the collected water samples for total metals, dissolved metals, anions, inorganic parameters, total organic carbon (TOC), microbiological parameters, and volatile and semi-volatile organic compound (VOC and SVOC) parameters.

2.0 ORGANIZATION AND RESPONSIBILITIES

2.1 PROJECT ORGANIZATION

Figure 2-1 depicts the project organizational chart for this study. Table 2-1 presents the roles and responsibilities of the various project personnel. Dr. John C. Ireland serves as the EPA T&E Contract Project Officer. Mr. Craig L. Patterson, P.E., the EPA Work Assignment Manager (WAM) for this study, is responsible for overall technical direction and adhering to the guidelines of the QAPP. Mr. Steve Harmon, the EPA Quality Assurance Manager (QAM), is responsible for review of QA documents and QA project assessments. Mr. Craig Smith from EPA Region VII will provide direction and coordination with EPA Region VII for this project.

Mr. Radha Krishnan, P.E., serves as the Shaw Program Manager for the T&E Contract. Mr. Krishnan's QA responsibilities include project coordination and planning and document peer review. Mr. Rajib Sinha, P.E., Shaw's Project Leader (PL), is responsible for ensuring daily implementation of the requirements of the QAPP, daily project coordination and planning for Shaw personnel, preparation of project documents, coordination of Shaw personnel training concerning the requirements of the QAPP, and coordinating daily project activities. Mr. Steven Jones is the Shaw QAM. Mr. Jones is responsible for QA review of documents, nonconformance and/or technical changes, and QA validation (as requested) of generated laboratory data and project assessments.

Contaminant analyses at the T&E Facility will be performed by the following Shaw Project Scientists: Mr. Kit Daniels, Mr. Lee Heckman, Dr. Nur Muhammad, and Ms. Jill Webster. Dr. Shekar Govindaswamy, Lakeshore Engineering Services (LES), Shaw subcontractor, will also be responsible for performing contaminant analyses. The project staff will be responsible for maintaining satisfactory documentation, performing data reduction, and following the requirements of the QAPP in all aspects of this project.

Mr. Colin Willits will serve as the Project Manager for Tetra Tech and will oversee the sampling effort and data integration into existing EPA databases. Ms. Jenna Mead, R.G. of Tetra Tech will provide coordination of the field sampling effort and for required field analyses.

2.2 PROJECT SCHEDULE

Sampling for this study is expected to commence on October 19, 2009, and continue through November 6, 2009. Laboratory analysis will commence upon receiving the samples and will continue until all results have been obtained within the holding time for each method.

Table 2-1. Project Roles and Responsibilities

Name of Person/Affiliation	Project Role	Phone Number, email
John C. Ireland/EPA	EPA Contract Project Officer/ Contract requirements	513-569-7413, Ireland.John@epa.gov
Craig L. Patterson/EPA	EPA Work Assignment Manager/ QAPP, data reduction/reporting	513-487-2805, Patterson.Craig@epa.gov
Steve Harmon/EPA	EPA QA Manager/ QAPP requirements	513-569-7184, Harmon.Stephen@epa.gov
Craig Smith/EPA Region VII	EPA Region VII Work Assignment Manager/Project Coordinator	913-548-7000 Smith.Craig@epamail.epa.gov
E. Radha Krishnan/Shaw	Shaw Program Manager/ Project leadership/peer review	513-782-4730, Radha.Krishnan@shawgrp.com
Rajib Sinha/Shaw	Shaw Project Leader/ Project direction	513-782-4964, Rajib.Sinha@shawgrp.com
Steven Jones/Shaw	Shaw QAM/ QAPP requirements	513-782-4655, Steve.S.Jones@shawgrp.com
Kit Daniels/Shaw	Shaw Project Scientist/ Chemical Analyses	513-569-7018, Kit.Daniels@shawgrp.com
Lee Heckman/Shaw	Shaw Project Scientist/ Microbiological Analyses	513-569-7065, John.Heckman@shawgrp.com
Nur Muhammad/Shaw	Shaw Project Scientist/ Microbiological Analyses	513-487-2808 Nur.Muhammad@shawgrp.com
Jill Webster	Shaw Project Scientist/ Chemical Analyses	513-487-2822 Jill.Webster@shawgrp.com
Shekar Govindaswamy/ LES	LES Project Scientist/ Chemical Analyses	513-569-7459, Govindaswamy.Shekar@epa.gov
Colin Willits/Tetra Tech	Tetra Tech/ Project Manager/Sampling Coordination and Data Management	(816) 412-1785 colin.willits@ttemi.com
Jenna Mead/Tetra Tech	Tetra Tech/Scientist/ Contaminant sampling	816.412.1771 jenna.mead@ttemi.com

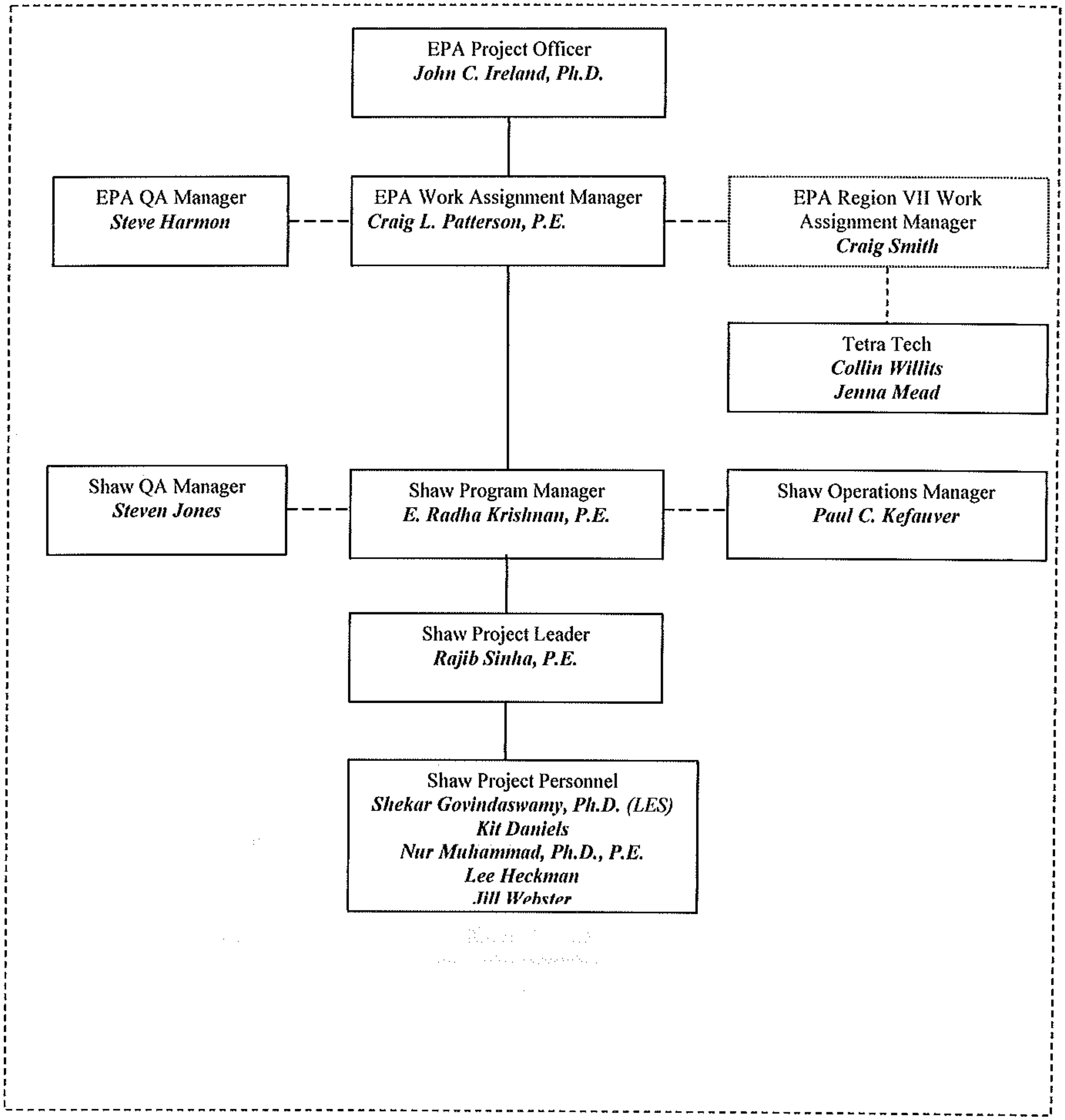


Figure 2-1: Project Organization Chart

3.0 SCIENTIFIC APPROACH

3.1 SAMPLING DESIGN

Figure 3-1 presents a map of the sampling area. Figure 3-2 shows the sampling locations that are currently receiving bottled water. Tetra Tech will collect samples from approximately 27 houses. Of these locations, 8 houses represent locations where EPA Region VII has installed Culligan POU treatment systems. At these locations, four sets of samples will be collected as follows:

- Unpurged samples representing water that has been allowed to sit in the system for at least 4 hours (overnight preferred) will be collected from the treated tap water from the Culligan unit.
- The Culligan unit will then be purged by running water for at least 5 minutes prior to collecting the purged water samples.
- The untreated water from the kitchen sink faucet will also be collected.
- None of these residences are believed to have water softeners or other owner-installed treatment systems; however, additional samples may be collected if other water treatment systems are identified.

Samples will also be collected from 19 residences where no POU treatment systems have been installed and that are currently provided with bottled water by EPA. At these residences, unpurged water from the kitchen sink faucet will be collected for metals analyses. Following purging of the water lines and holding tank (typically about 5 minutes), a second set of samples for metals analyses (including arsenic) will be collected. Samples of the purged water will then be collected to determine water quality parameters and for additional analyses. Additional samples may need to be collected if any owner-installed treatment systems are identified.

3.2 MEASUREMENTS AND ANALYTES

This project will include a number of field analytes for field measurement and laboratory analysis, as identified in Section 4.

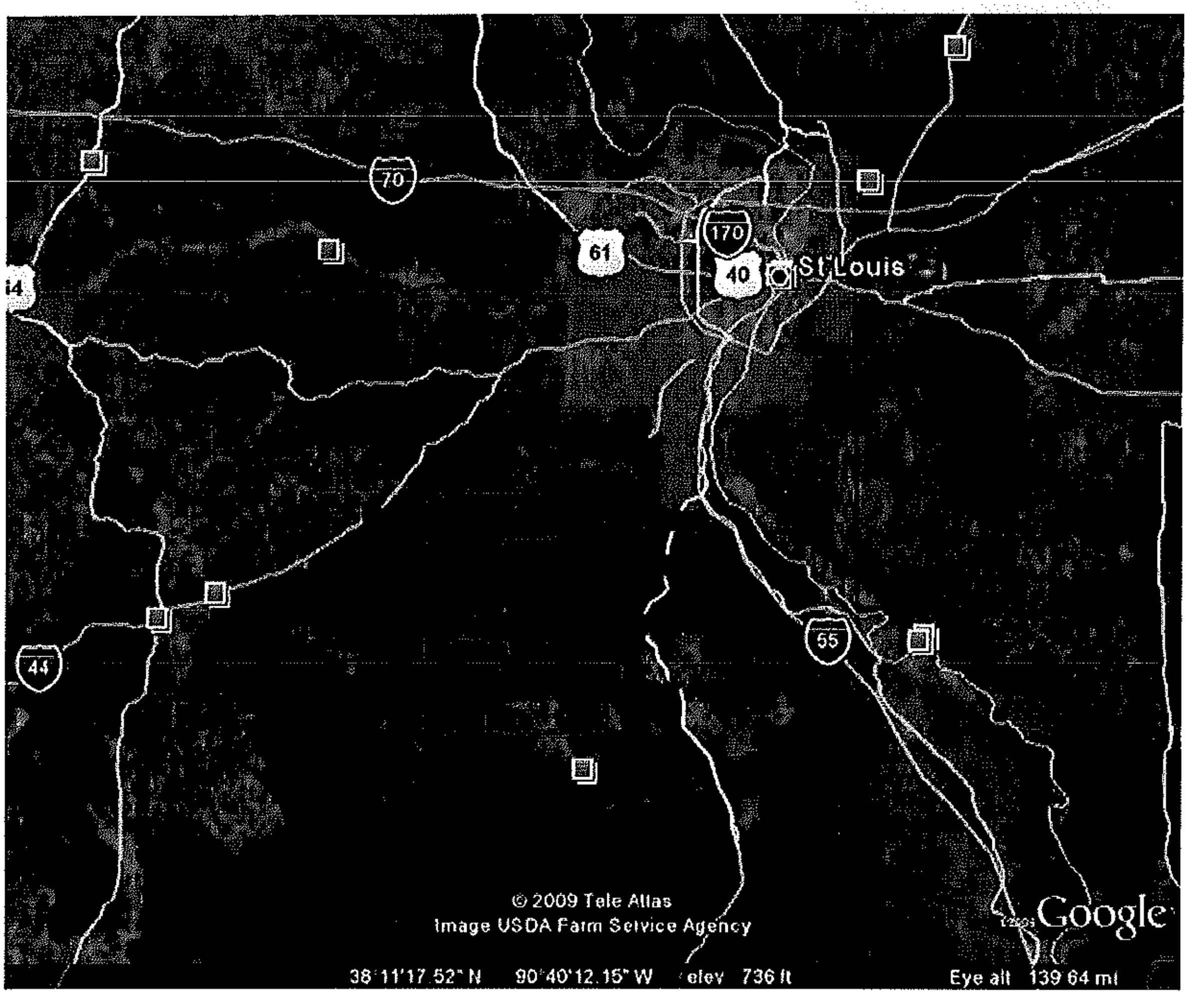


Figure 3-1 Map of Sampling Area

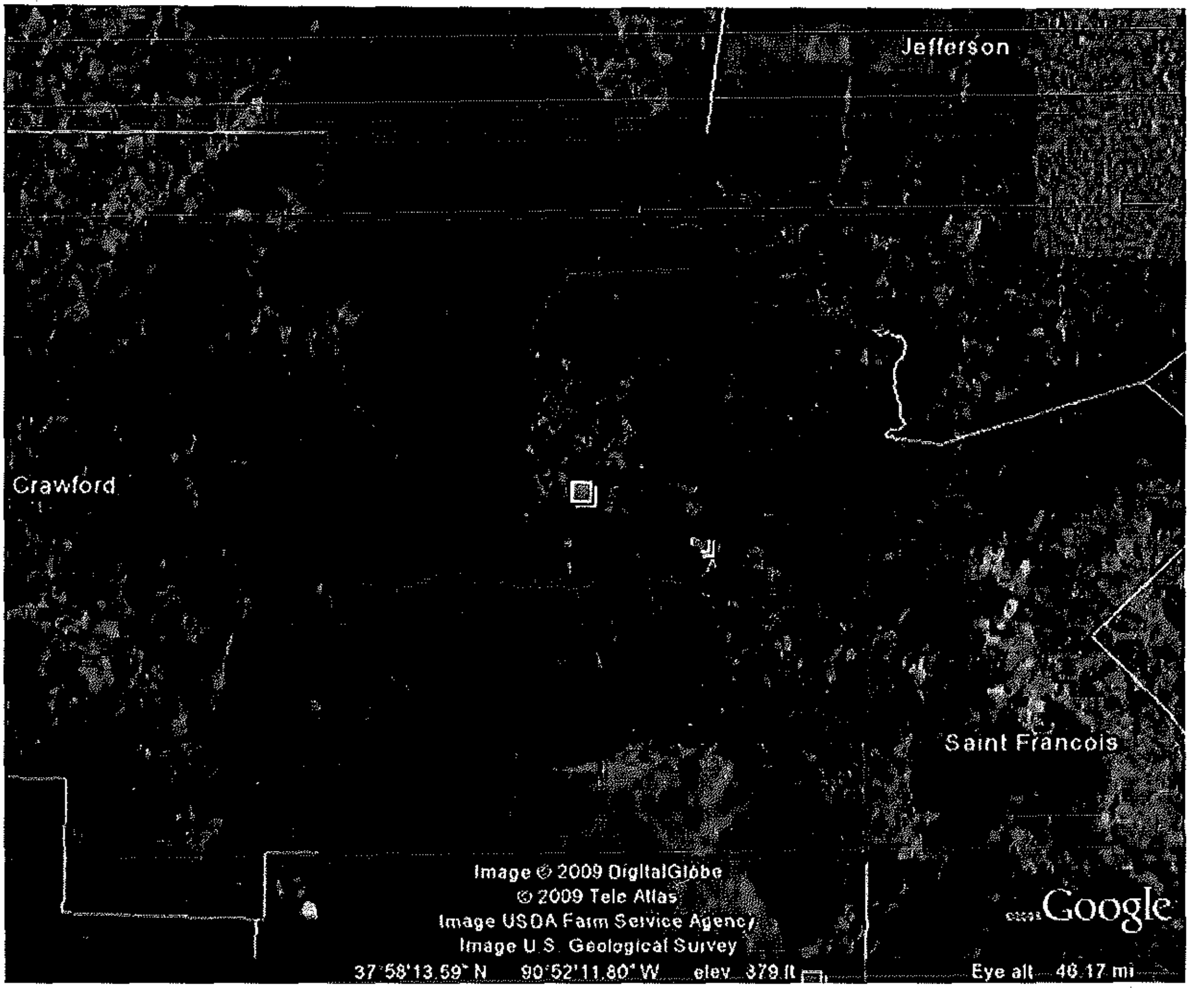


Figure 3-2 Sampling Locations Receiving Bottled Water

4.0 SAMPLING PROCEDURES

4.1 SITE-SPECIFIC FACTORS

Tetra Tech will collect samples for laboratory analysis at the T&E Facility in Cincinnati, Ohio. Shaw will provide Tetra Tech with appropriate sample containers and preservatives. Shaw will also provide solid phase micro-extraction (SPME) cartridges for field extraction for arsenic speciation and Tetra Tech will prepare separate arsenic (III) and arsenic (V) samples using these SPME cartridges while taking samples in the field. Similarly, metals samples will be processed using a 0.45 micron filter to distinguish between total and dissolved lead ions. EPA Region VII laboratory will provide any preservatives (nitric acid, hydrochloric acid, sulfuric acid, sodium thiosulfate, etc.) not provided by Shaw. The appropriate preservative will be added to the sample bottles in the field during sampling.

Samples will be analyzed for Total Organic Carbon (TOC) in lieu of analyzing for VOCs and SVOCs. If TOC samples exceed 5 ppm, VOC and SVOC analyses will be performed to characterize the wells containing elevated TOC.

A field sheet will be completed for each sample collected (see Table 4-1). All field sheets will include the sample number, date, and time. In addition, the field sheets will include the unique property identification assigned to the property during site assessment activities, property ownership information, site address, mailing address, exact location and specifics of sample collected (pre- or post-treatment filtration, unpurged, or purged), containers collected, and analyses to be performed. The field sheets for untreated, purged samples will include purge times or estimated purge volumes. The water quality parameters pH, temperature, conductivity, dissolved oxygen (DO), oxygen-reduction potential (ORP), and total dissolved solids (TDS) will be obtained by use of a field instrument (YSI556 water quality meter). Field test kits will be used to measure hardness and chlorine (free and total), and these results will also be recorded on the field sheet. No water quality parameters will be recorded for unpurged metals samples.

4.2 SAMPLING PROCEDURES

Tap, Unpurged (Culligan POU Treatment Unpurged Samples)

Complete field sheet property identification and homeowner questionnaire. Determine approximate time that has elapsed since the POU carbon filtration unit was last used (4 or more hours, if possible). Record this information on the field sheet along with the approximate date that the filter was last replaced.

1. Turn on the POU system tap water and immediately fill one 125-milliliter (mL) high density polyethylene (HDPE) container and preserve with nitric acid (HNO_3) for analysis for total metals (this is the "Tap, unpurged, total metals, unfiltered" sample).

2. Fill a 0.45-micron nalgene filter container with unpurged water from the POU filtration unit. Draw unfiltered water from the nalgene container using a new syringe. Attach a SPME cartridge to the syringe and push water, either manually or by using a peristaltic

pump, through the SPME cartridge at a rate of 3 mL/min to collect a 20 mL sample in a 125-mL HDPE container and preserve with HNO_3 for total arsenic III/V analysis (this is the "Tap, unpurged, Arsenic III/V, unfiltered" sample).

3. Filter the remaining water through the 0.45-micron nalgene filter using a hand pump. Draw a sample of the filtered water through a new syringe. Attach a SPME cartridge to the syringe and push water through the SPME cartridge, either manually or by using a peristaltic pump, at a rate of 3 mL/min to collect a 20 mL sample in a 125-mL HDPE container. Preserve the sample with HNO_3 for dissolved arsenic III/V analysis (this is the "Tap, unpurged, Arsenic III/V, filtered" sample).

4. Transfer the remaining filtered water to one 125-mL HDPE container and preserve with HNO_3 for analysis for dissolved metals (this is the "Tap, unpurged, total metals, filtered" sample).

Tap, Purged (Culligan POU Treatment Purged Samples)

Before filling the appropriate sample containers with purged water, allow water to run through the POU filtration unit for at least 5 minutes to ensure that the filtration unit and any water lines or holding tanks have been purged and the well is drawing water from the aquifer.

1. Repeat the procedure as outlined above for collection of the unpurged samples. Collect one 125-mL HDPE container and preserve with HNO_3 for total metals analysis (this is the "Tap, purged, total metals, unfiltered" sample).

2. Fill a new 0.45-micron nalgene filter container with purged water from the filtration unit. Draw unfiltered water from the nalgene container using a new syringe. Attach a SPME cartridge to the syringe and push water through the SPME cartridge, either manually or by using a peristaltic pump, at a rate of 3 mL/min to collect a 20 mL sample in a 125-mL HDPE container. Preserve the sample with HNO_3 for dissolved arsenic III/V analysis (this is the "Tap, purged, Arsenic III/V, unfiltered" sample).

3. Filter remaining water through the nalgene filter using a hand pump. Draw a sample of the filtered water through a new syringe. Attach a SPME cartridge to the syringe and push water through the SPME cartridge, either manually or by using a peristaltic pump, at a rate of 3 mL/min to collect a 20 mL sample in a 125-mL HDPE container. Preserve the sample with HNO_3 for dissolved arsenic III/V analysis (this is the "Tap, purged, Arsenic III/V, filtered" sample).

4. Transfer the remaining filtered water to one 125-mL HDPE container and preserve with HNO_3 for analysis for dissolved metals (this is the "Tap, purged, total metals, filtered" sample).

Faucet, Unpurged (Unpurged, Untreated Well Water Samples)

Complete field sheet property identification and homeowner questionnaire. Indicate whether water has been in use or approximately how long it has been since water was last used.

1. Turn on water and immediately fill one 125-mL HDPE container and preserve with HNO_3 for analysis for total metals.

2. Fill a new 0.45-micron nalgene filter container with unpurged water from kitchen faucet. Draw unfiltered water from the nalgene container using a new syringe. Attach a SPME cartridge to the syringe and push water through the SPME cartridge, either manually or by using a peristaltic pump, at a rate of 3 mL/min to collect a 20 mL sample in a 125-mL HDPE container. Preserve the sample with HNO_3 for dissolved arsenic III/V analysis.

3. Filter the remaining water through the nalgene filter using a hand pump. Draw a sample of the filtered water through a new syringe. Attach a SPME cartridge to the syringe and push water through the SPME cartridge, either manually or by using a peristaltic pump, at a rate of 3 mL/min to collect a 20 mL sample in a 125-mL HDPE container. Preserve the sample with HNO_3 for dissolved arsenic III/V analysis.

4. Transfer the remaining filtered water to one 125-mL HDPE container and preserve with HNO_3 for analysis for dissolved metals.

<u>Faucet, Purged (Purged, Untreated Well Water Samples)</u>

Before filling the appropriate sample containers with purged water, allow water to run for at least 5 minutes to ensure that any water lines or holding tanks have been purged and the well is drawing water from the aquifer.

1. Repeat the procedure for collection of the unpurged metals samples. Collect one 125-mL HDPE container and preserve with HNO_3 for total metals analysis.

2. Fill a new 0.45-micron nalgene filter container with purged water from filtration unit. Draw unfiltered water from the nalgene container using a new syringe. Attach a SPME cartridge to the syringe and push water through the SPME cartridge, either manually or by using a peristaltic pump, at a rate of 3 mL/min to collect a 20 mL sample in a 125-mL HDPE container. Preserve the sample with HNO_3 for dissolved arsenic III/V analysis.

3. Filter the remaining water through the nalgene filter using a hand pump. Draw a sample of the filtered water through a new a syringe. Attach a SPME cartridge to the syringe and push water through the SPME cartridge, either manually or by using a peristaltic pump, at a rate of 3 mL/min to collect a 20 mL sample in a 125-mL HDPE container. Preserve the sample with HNO_3 for dissolved arsenic III/V analysis.

4. Transfer the remaining filtered water to one 125-mL HDPE container and preserve with HNO_3 for analysis for dissolved metals.

5. Fill test kit containers for analyses for hardness and chlorine; perform these analyses, and record results on field sheet. Obtain results for chlorine before sampling for VOCs and SVOCs.

6. Collect two unpreserved 40-mL amber vials for anions analysis.

7. Collect sample in YSI water quality meter and allow parameters to stabilize (typically, record at lowest temperature reading).

8. Record the following YSI field parameters on the field sheet:

   - Temperature (°C)
   - pH
   - Conductivity (microsiemens per centimeter [μS/cm])
   - Dissolved Oxygen (mg/L)
   - Oxidation-reduction potential (millivolts [mV])
   - Total dissolved solids (mg/L)

9. Fill two, unpreserved 250-mL HDPE container for inorganic analyses. (This can be done while parameters stabilize.)

10. Fill one 250-mL HDPE container and preserve with H_2SO_4 for analysis for total organic carbon.

11. Collect two 100-mL glass containers and preserve with sodium thiosulfate ($Na_2S_2O_3$) for analysis for *E. coli* bacteria.

12. If no chlorine is present in the water, collect three 40-mL vials and preserve with hydrochloric acid (HCl) for analysis for VOCs. If chlorine is present collect three 40-mL vials and preserve with approximately 25 mgs of ascorbic acid followed by HCl. Allow the ascorbic acid to completely dissolve before adding HCl.

13. If no chlorine is present in the water, collect one 1000-mL amber glass container and preserve with HCl for analysis for SVOC. If chlorine is present collect one 1000-mL amber glass container and preserve with approximately 50 mg of sodium sulfite followed by HCl. Allow the sodium sulfite to completely dissolve before adding HCl.

All water samples will be stored in coolers maintained at or below a temperature of 4°C. An EPA Chain-of-Custody Form will accompany each shipment of samples. Samples will be shipped each day using Federal Express priority overnight to:

U.S. EPA Test & Evaluation Facility
1600 Gest Street
Cincinnati, Ohio 45204
Attn: Kit Daniels
Mobile Phone Number: 513-378-4408

4.3 SAMPLING CONTAINERS, QUANTITIES, AND QC

Sample containers, quantities, and QC sample analysis are shown in Table 4-2.

4.4 SAMPLE PRESERVATION AND HOLDING TIMES

Sample preservation and holding times are shown in Table 4-2.

4.5 SAMPLE NUMBERING

Tetra Tech will provide field sheets and sample labels. Sample labels will indicate the prefix "ORD" and be sequentially numbered. All sample containers from a specific sample will be labeled using the same sequential number, and the date and time of collection. Duplicate samples will be collected from 10 percent of the sample locations (four locations, including one location having a Culligan POU system). Field duplicate samples will be labeled with the same number as the initial sample with –FD following the number. The following is an example label for this task:

Washington County POU Study	
ORD-1	Arsenic III/V
Date: ________	Time: ________

The samples for metals analyses from the Culligan POU units will be numbered ORD-1 through ORD-16. Samples of untreated well water (purged and unpurged) will be labeled beginning with ORD-100, with samples ORD-100 through ORD-116 corresponding to locations where samples ORD-1 through ORD-16 were collected.

Table 4-1. Field Parameters Datasheet

SAMPLE COLLECTION FIELD SHEET

Washington County Point of Use Study **Sample Number: ORD-100__**

Latitude: ________________ **Sample Date:** ______________

Longitude: ________________ **Sample Time:** ______________

Property Identification Number: ____________________ Study Area: ______________________________

Owners Name: ________________________________ Owners Phone Number:____________________

Mailing Address: ____

Tenant's Name): _________________________ Tenant's Phone Number: ________________________

Property Address: ____

Residence owner occupied: ________ Well shared with other residence(s): ________________________

Number of Occupants or persons supplied by well: ______________ Children under 6 yrs: _____________

Well Depth: ________________ Pump Depth: ________________ Well Age: ____________

Flow Rate at House: ______________________ Flow Rate at POU: ________________

Holding Tank Make/Volume: ____

Treatment System(s): ____

Sample Collection Description: ____

____

Purge Time or Volume: ____

Field Parameters:

Temperature (°C):		ORP (mV):	
Conductivity (µS/cm):		**Test Kit Results:**	
pH:		Hardness:	
TDS (mg/L):		Free Chlorine (mg/L):	
DO (mg/L):		Total Chlorine (mg/L):	

Remarks:

Photo Number: ________

Sampler's Initials: ____________

Analyses:

Sample Location	Laboratory Analysis	Number of Containers	Sample Processing	Preservative	Container Type
Tap, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Tap, Unpurged	Arsenic III/V	1	Unfiltered, SPME	HNO_3 to pH <2	125 ml HDPE
		1	Filtered, SPME	HNO_3 to pH <2	125 ml HDPE
Tap, Purged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Tap, Purged	Arsenic III/V	1	Unfiltered, SPME	HNO_3 to pH <2	125 ml HDPE
		1	Filtered, SPME	HNO_3 to pH <2	125 ml HDPE
Faucet, Unpurged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, Unpurged	Arsenic III/V	1	Unfiltered, SPME	HNO_3 to pH <2	125 ml HDPE
		1	Filtered, SPME	HNO_3 to pH <2	125 ml HDPE
Faucet, Purged	Total Metals	1	Unfiltered	HNO_3 to pH <2	125 ml HDPE
		1	Filtered	HNO_3 to pH <2	125 ml HDPE
Faucet, Purged	Arsenic III/V	1	Unfiltered, SPME	HNO_3 to pH <2	125 ml HDPE
		1	Filtered, SPME	HNO_3 to pH <2	125 ml HDPE
Faucet, Purged	Anions (fluoride, chloride, phosphate, sulfate)	2	None	4°C	40 ml amber glass
Faucet, Purged	Inorganic Parameters (alkalinity, turbidity, total suspended solids, total dissolved solids)	2		4°C	250-ml HDPE
Faucet, Purged	Total Organic Carbon, Nitrate/Nitrite	1		H_2SO_4 to pH <2, 4°C	250-ml HDPE
Faucet, Purged	*E. coli* bacteria	2		$Na_2S_2O_3$, 4°C	100-ml fecal coliform bottle
Faucet, Purged	Volatile Organic Compounds	3	Quench chlorine with ascorbic acid if necessary, see section 4.2	HCl to pH < 2, 4°C	40 ml amber glass
Faucet, Purged	Semivolatile Organic Compounds	1	Quench chlorine with sodium sulfite if necessary, see section 4.2	HCl to pH < 2, 4°C	1 L amber glass

Tap samples are treated water samples collected after POU treatment
Faucet samples are untreated water samples collected at the field site
Filtered samples filtered through a 0.45μm syringe filter prior to preservation

Table 4-2. Summary of Analytical Procedures.

Matrix	Measurement	Sampling ([1]Faucet, [2]Tap)/ Measurement Method	Analysis Method	Sample Container/ Quantity of Sample	Preservation/ Storage	Holding Time(s)
Water	pH	[1]Faucet	EPA Region 7 4230.10 using YSI 556 MPS	Field Sample	NA	NA
Water	ORP	Faucet	EPA Region 7 4230.10 using YSI 556 MPS	Field Sample	NA	NA
Water	Conductivity	Faucet	EPA Region 7 4230.10 using YSI 556 MPS	Field Sample	NA	NA
Water	D.O.	Faucet	EPA Region 7 4230.10 using YSI 556 MPS	Field Sample	NA	NA
Water	Free chlorine	Faucet	DPD 8021, Standard Method 4500-CLG	Field Sample	NA	NA
Water	Total chlorine	Faucet	DPD 8167	Field Sample	NA	NA
Water	Hardness	Faucet	Standard method 2340C	Field Sample	NA	NA
Water	Total Metals	Purged faucet (*filtered and unfiltered)/ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) (EPA 6010B) (Shaw SOP 402)	125 mL in HDPE bottles	HNO_3 to pH<2.0, store at Room Temperature (RT)	6 months
Water	Total Metals	Faucet without purging (*filtered and unfiltered) /ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) (EPA 6010B) (Shaw SOP 402)	125 mL in HDPE bottles	HNO_3 to pH<2.0, store at RT	6 months
Water	Total Metals	Purged tap (*filtered and unfiltered) /ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) (EPA 6010B) (Shaw SOP 402)	125 mL in HDPE bottles	HNO_3 to pH<2.0, store at RT	6 months
Water	Total Metals	Tap without purging (*filtered and unfiltered) /ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) (EPA 6010B) (Shaw SOP 402)	125 mL in HDPE bottles	HNO_3 to pH<2.0, store at RT	6 months
Water	Arsenic(III) and Arsenic(V) speciated	Faucet samples filtered through SPME ion-exchange cartridges for speciation at field site (*filtered and unfiltered) /ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy (ICP-OES) (EPA 6010B) (Shaw SOP 402 & 403)	50 mL in 125-mL HDPE bottles	HNO_3 to pH<2.0, store at RT	6 months
Water	*E coli* analysis	Purged faucet	Shaw SOP 305 (Hach Method	100 mL in EPA fecal	Sample bottles come	24 hours

			10029)	coliform sampling bottles	with sodium thiosulfate pellet, store at 4°C	
Water	Alkalinity	Purged faucet	EPA 310.1 (Shaw SOP 502)	250 mL polypropylene bottles	4 ±2°C	14 days
Water	VOC	Purged faucet	EPA 524.2		Quenched with 25 mgs ascorbic/vial and then preserved at pH<2.0 using HCl	14 days
Water	SVOC	Purged faucet	EPA 525.2	1 L amber glass	Preserved with 40-50 mg sodium sulfite, pH<2.0 using HCl	14 days
Water	TOC	Purged faucet	EPA 9060A (Shaw SOP 401)	1 x 250 mL polypropylene	4 ±2°C at pH<2.0 with H_2SO_4	28 days
Water	Turbidity, TSS and TDS	Purged faucet	EPA 180.1 for turbidity (Shaw SOP 507) EPA 160.2 for TSS (Shaw SOP 509) EPA 160.1 for TDS (Shaw SOP 510)	2 x 250 mL HDPE bottles	4 ±2°C	48 hours for turbidity, 7 days for TSS TDS
Water	Anions fluoride, chloride, nitrite, nitrate, bromide, phosphate and sulfate	Purged faucet	EPA 300.0 (Shaw SOP 405)	125 mL HDPE bottles	4 ±2°C	48 hours

[1] Faucet samples are untreated water samples collected at the field site [2] Tap samples are treated water samples collected after POU treatment* Samples filtered through 0.45μm syringe filter*

5.0 MEASUREMENT PROCEDURES

5.1 ANALYTICAL METHODS

The analytical procedures are shown in Table 4-2.

5.2 CALIBRATION PROCEDURES

The calibration procedures, linearity checks, and continuing calibration checks listed in the analytical methods/ Shaw Standard Operating Procedures (SOPs) are referenced in Table 4-2. The instrument manual (YSI556) will be followed.

6.0 QUALITY METRICS (QA/QC CHECKS)

6.1 QC CHECKS

The QC checks for each analysis are shown in Table 6-1.

6.2 QC OBJECTIVES

The QC Objectives are found in the attached Shaw SOPs.

Table 6-1. QA/QC Checks

Measurement	Matrix	QA/QC Check	Frequency	Acceptance Criteria	Corrective Action
Field site, pH	Water	Initial calibration Calibration check	Daily Every batch	±0.2 pH units ±0.2 pH units	Check standard buffers for contamination, check electrode for electrolyte, replace probe if required
Field site, ORP	Water	Initial calibration Calibration check	Daily Every batch	±20 mV ±20 mV	Check standards for contamination, check electrode for electrolyte, replace probe if required
Field site, Conductivity	Water	Initial calibration Calibration check	Daily Every batch	±0.5 or reading (or) ±0.001mS/cm whichever is greater	Check standards for contamination, check electrode for electrolyte, replace probe if required
Field site, DO	Water	Initial calibration Calibration check	Daily Every batch	0 – 20 mg/L range: ±2 % reading (or) 0.2 mg/L whichever is greater 20 – 50 mg/L range: ±6 %	Recalibrate, check DO probe, check membrane, replace probe if required
Field site, Chlorine (Free and Total)	Water	Initial calibration Calibration check	Before each batch	 ±10% true value (TV)	Recalibrate
Field site, Hardness	Water	Initial calibration Calibration check	Before each use	±15 % TV	Check calculations, repeat analysis
Metals	2% H_2SO_4	Initial calibration Calibration check	Every batch Every batch	Calibration curve r^2>0.999 ±10% TV	Check standards for contamination, check ICP torch, tubing and replace if necessary
E coli	Water	Perform a positive control and a positive control duplicate test using *E coli* per analysis batch	Every batch	Successful positive and negative control tests	Change growth media/dilution buffer and retest
Alkalinity	Water	Calibration check	1 per batch	±10%	Investigate cause for invalid results, check all calculations, repeat analysis for affected samples
Ammonia	Water	Initial calibration Calibration Check	Before each use	Calibration curve r^2>0.995 ± 10% TV	Recalibrate
VOC	Water	Initial calibration	Beginning of project and	RSD < 20% or have a calibration	Correct GC system configuration, check

Measurement	Matrix	QA/QC Check	Frequency	Acceptance Criteria	Corrective Action
			whenever necessary.	coefficient of greater than or equal to 0.99 for non-linear curves	calculations, and rerun calibration.
		Laboratory Fortified Blank (Continuing Calibration Check)	Beginning and end of every batch and every 10 samples	±15% of TV	Correct GC system configuration, check calculations, rerun calibration checks and/or standards, and rerun affected samples.
		Laboratory Reagent Blank	Every batch of samples extracted	Absence of VOC's	Check for contamination in GC system, re-prepare blank.
		Laboratory Fortified Sample Matrix	Every 20 samples	70-130% recovery	Correct GC system configuration, check calculations, rerun calibration checks and/or standards, and rerun affected samples.
		Matrix Spike/Matrix Spike Duplicate	Every 20 samples	70-130% recovery	Correct GC system configuration, check calculations, rerun calibration checks and/or standards, and rerun affected samples.
SVOC	Water	Initial calibration	Beginning of project and whenever necessary.	RSD < 20% or have a calibration coefficient of greater than or equal to 0.99 for non-linear curves	Rerun standard curve, change Correct GC system configuration, check calculations, and rerun calibration.
		Laboratory Fortified Blank (Continuing Calibration Check)	Beginning and end of every batch and every 10 samples	±15% of TV	Correct GC system configuration, check calculations, rerun calibration checks and/or standards, and rerun affected samples.
		Laboratory Reagent Blank	Every batch of samples extracted	Absence of SVOC's	Check for contamination in GC system, re-prepare blank.
		Laboratory Fortified Sample Matrix	Every 20 samples	70-130% recovery	Correct GC system configuration, check calculations, rerun calibration checks and/or standards, and rerun affected samples.
		Matrix Spike/Matrix Spike Duplicate	Every 20 samples	70-130% recovery	Correct GC system configuration, check calculations, rerun calibration checks and/or standards, and rerun affected samples.

Measurement	Matrix	QA/QC Check	Frequency	Acceptance Criteria	Corrective Action
TOC	Water	Initial calibration	Beginning of every batch or as necessary	r^2>0.995	Rerun standard curve, change standards
		Laboratory Fortified Blank (Continuing Calibration Check)	Beginning of every batch and every 20 samples	± 10% TV	Rerun standard curve, change standards
		Laboratory Reagent Blank	Every batch of samples extracted	Absence of TOC	Check for TOC contamination
		Laboratory Fortified Sample Matrix	Every 20 samples	Spike recovery within 75-125%	Check standards, rerun spike
Turbidity, TSS and TDS	Water	Calibration Check	Prior to analysis, every 10 samples, and at the end of the batch.	± 10% TV	Recalibrate and/or reanalyze affected samples.
		Duplicates	Once per batch or every 10 samples.	RPD<20%	Repeat analysis on the same sample; if sample volume does not allow, choose another sample and document accordingly.
Anions fluoride, chloride, nitrite, nitrate, bromide, phosphate and sulfate	Water	Initial Calibration or as needed.	Every batch	r^2>0.995	Check standards for accuracy of the dimension
		Calibration Blank	Every batch	No appreciable quantities of analytes	Check for IC system contamination, obtain second source of reagent water, and reanalyze affected samples.
		Calibration Check	Beginning and ending every batch and every ten samples.	± 10% TV	Correct IC system configuration, check calculations, rerun calibration checks and/or standards, and rerun affected samples.
		Duplicates	Once per batch or every 10 samples.	RPD<20%	Correct IC system configuration, check calculations, rerun calibration checks and/or standards, and rerun affected samples

7.0 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 DATA REPORTING REQUIREMENTS

All data generated during the study will be presented in tabular format. Graphs of data versus time will also be prepared and presented.

7.2 DATA VALIDATION PROCEDURES

Data will be reviewed by the analyst and Project Leader prior to submission to EPA under the guidelines shown in Shaw T&E SOP 102, Data Review and Verification. The Shaw QA Manager may review data during either a focused data review or during project assessments.

7.3 DATA SUMMARY

Analytical data will be presented in tabular format.

7.4 DATA STORAGE

The following documentation will be maintained in the project central file for this study according to Shaw T&E SOP 101, Central Files.

1. Samples from the experiments will be analyzed, and records will be maintained for all samples collected. Sample result records will be maintained for at least three years for reference.
2. Written experimental progress reports will be included in the monthly reports prepared by Shaw for EPA on a monthly basis.
3. Oral project progress reports will be presented by Shaw at technical team meetings (weekly).

8.0 DATA REPORTING

8.1 DELIVERABLES

Shaw will submit an Interim Summary Report presenting the analytical results from all the samples.

8.2 FINAL PRODUCT

After addressing EPA comments, Shaw will provide a Final Summary Report.

9.0 REFERENCES

Shaw Environmental & Infrastructure, Inc., 2006. T&E Administrative SOP 101, *Central Files.*

Shaw Environmental & Infrastructure, Inc., 2006. T&E SOP 102, *Data Review and Verification.*

Shaw Environmental & Infrastructure, Inc., 2006. T&E SOP 305, *Membrane Filtration Method to Enumerate Total Coliforms and E. coli using "m-ColiBlue24 Broth".*

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Shaw Environmental & Infrastructure, Inc., 2006. T&E SOP 402, *Metals Analysis by ICP.*

Shaw Environmental & Infrastructure, Inc., 2008. T&E SOP 405, *Anions Analysis by Ion Chromatography.*

Shaw Environmental & Infrastructure, Inc., 2006. T&E SOP 502, *Total Alkalinity.*

Shaw Environmental & Infrastructure, Inc., 2006. T&E SOP 509, *Total Suspended Solids.*

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Shaw Environmental & Infrastructure, Inc., 2006. T&E SOP 504, *Total Chlorine Analysis by Hach Method 8167 N,N-diethyl-p-phenylene-diamine (DPD) Colormetric Method.*

Shaw Environmental & Infrastructure, Inc., 2006. T&E SOP 505, *Free Chlorine Analysis by Hach Method 8021 N,N-diethyl-p-phenylene-diamine (DPD) Colormetric Method.*

Shaw Environmental & Infrastructure, Inc., 2008. T&E SOP 512, *Operation of YSI 556 Multi-Probe System in Grab Sample Mode.*

U.S. Environmental Protection Agency, 2008. NRMRL QAPP Requirements for Measurement Projects, Revision 0, 10/2008.

U.S. Environmental Protection Agency. 1990. Methods for the Determination of Organic Compounds in Drinking Water, Supplement I. Office of Research and Development. EPA 600/4-90-020.

APPENDIX A
STANDARD OPERATING PROCEDURES

Appendix D

Permeate Pump Testing at the EPS T&E Facility

POU Installation and Testing at the EPA T&E Facility

An adsorption system and a RO system was procured and installed in a typical under-the-sink cabinet at the T&E Facility. Figure 1 shows the installation of a Culligan Preferred 250 system along with a booster pump and an accumulator. Figure 2 shows the installation of a Watts WP-4V RO system in a test mode. This installation includes a booster pump, an accumulator, and a permeate pump. This appendix presents the installation details for these two systems and highlights some identified considerations from lessons learned from the operation of these two test systems.

D.1 Installation of the Culligan Preferred 250 System

The Culligan Preferred 250 with a pressure booster pump, flow totalizer, and accumulator tank was installed in a typical 36" sink cabinet as shown in Figure 1. The kitchen sink was first installed as it would be in a typical home installation. This installation took approximately 2 hours and included the following items:

1. Secure the 36" sink cabinet on a concrete pad at the T&E Facility.
2. Cut a hole in the countertop to mount the 2-basin sink.
3. Mount the sink in the countertop.
4. Install the faucet and the drain cage onto the sink.
5. Attach the countertop to the sink cabinet.
6. Run a carbon-filtered cold water line to the pressure tank and to the kitchen sink.
7. Sweat shutoff valves on the cold water line.
8. Connect the cold water line to the kitchen sink faucet from the shutoff valve.
9. Attach the garbage disposal to the drain cage.
10. Run the PVC P-trap and drain line.

After the kitchen sink was installed, the adsorption filter and associated hardware were installed. The installation was performed only through the front of the kitchen sink cabinet, as would occur in an actual home. This installation took approximately 3 hours and included the following items:

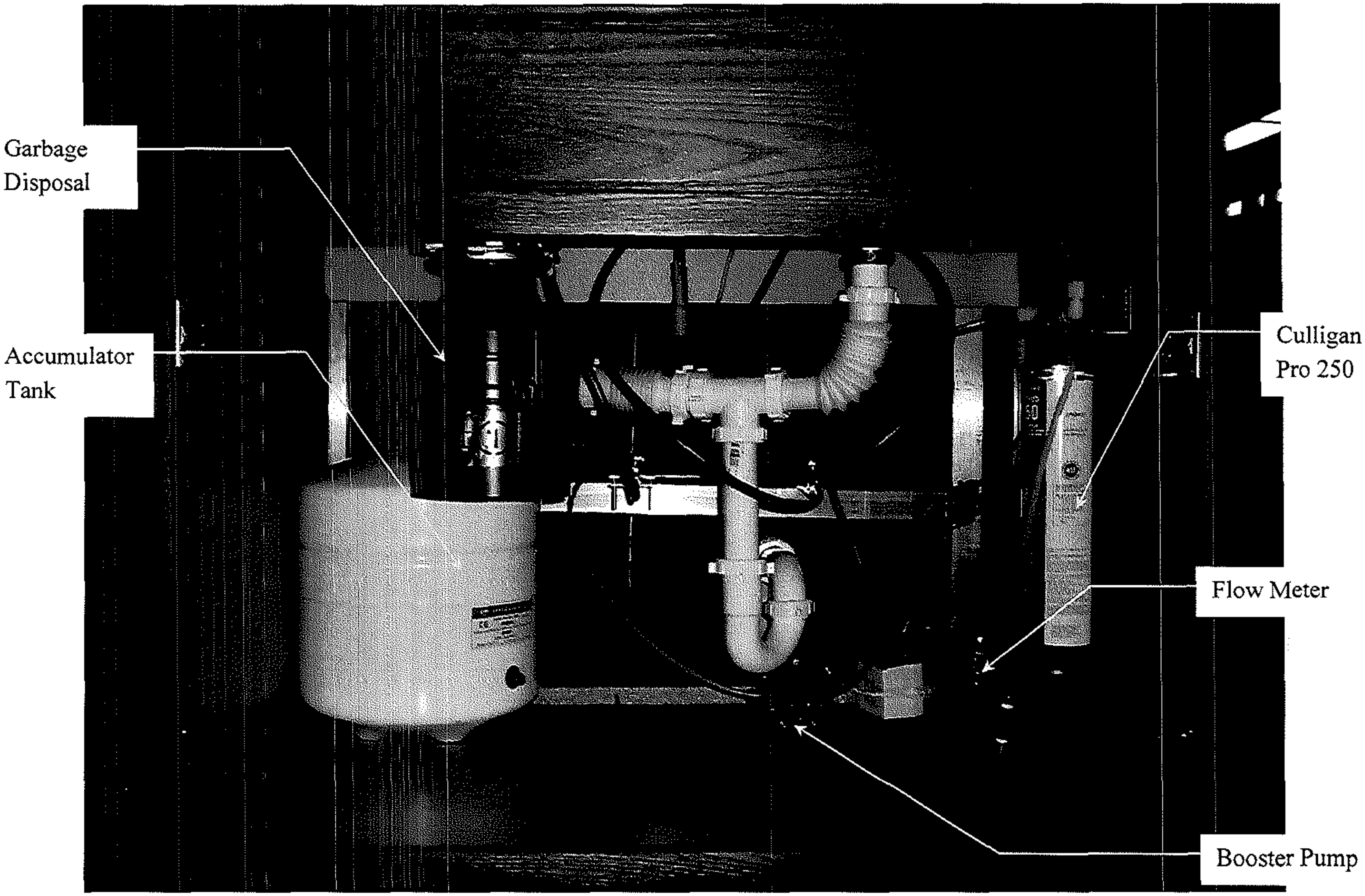
1. Lay out the equipment design inside the kitchen sink cabinet.
2. Connect a brass saddle fitting to the copper cold water feed line. The valve on the saddle fitting was closed.

3. Install a ¼" PVC tee on the accumulator tank. Screw a ¼" MNPT x ¼" compression fitting into one side of the tee and a ¼" MNPT x 3/8" compression fitting into the other side of the tee. Place the accumulator tank in the back corner of the cabinet.
4. Mount the treated water faucet through the sprayer hose hole in the sink.
5. Place the booster pump in the bottom back of the cabinet.
6. Attach the following fittings to each end of the totalizer:
    a. ¾" PVC coupling
    b. ¾" – ¼" PVC reducer bushing
    c. ¼" MNPT x ¼" compression fitting
7. Place the flow totalizer on the floor of the cabinet.
8. Attach the 2 elbows included with the filter head to the filter head assembly.
9. Secure the filter head assembly to the cabinet wall with two ½" screws.
10. Install the filter cartridge to the filter head assembly.
11. Use ¼" OD PE tubing to make the following connections:
    a. From the saddle fitting (compression fitting) to the booster pump (quick connect)
    b. From the booster pump (quick connect) to the filter elbow (compression fitting)
    c. From the filter elbow (compression fitting) to the pressure switch (quick connect)
    d. From the pressure switch (quick connect) to the flow totalizer (compression fitting)
    e. From the flow totalizer (compression fitting) to the accumulator tank (compression fitting)
    f. From the accumulator tank (compression fitting) to the 3/8" faucet tubing (supplied).
12. Open the saddle fitting valve.
13. Make the following connections with the booster pump, pressure switch, and transformer:
    a. Plug the booster pump into the pressure switch.
    b. Plug the transformer into the pressure switch.
    c. Plug the pressure switch into a 110V AC outlet.

Other items that were installed for testing purposes but would not be included in a typical installation were the following:

- A pressure regulating valve to reduce the water pressure entering the sink (to better simulate water pressure from a well).
- A lead feed pump and feed tank to introduce lead into the water for testing the adsorption filter.
- A saddle fitting to connect the feed pump to the water line, and a static mixer to mix the lead solution with the feed water.
- A sample port to collect influent water for analysis before treatment in the adsorption unit.

Figure 1. Typical Adsorption POU Undersink Installation



D.2 Installation of the Watts Premier WP-4V RO System

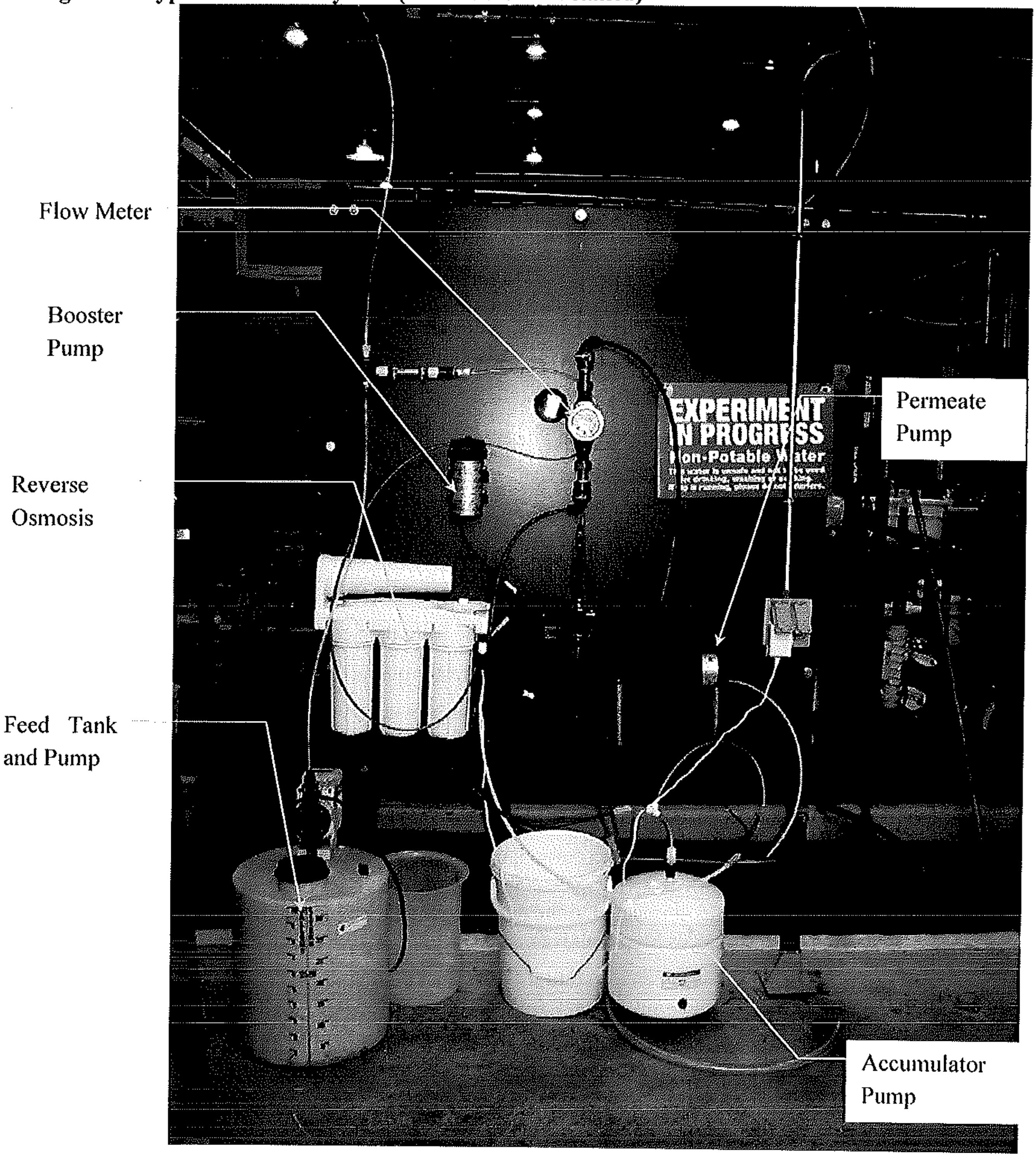
The Watts Premier WP-4V RO system was not installed in a typical kitchen cabinet; it was installed on a panel for easier installation and testing. Figure 2 shows the RO system as it was tested. Installation of the RO system consisted of the following steps:

1. Run carbon-filtered water to a PVC tee.
2. Connect a lead-water feed pump to the PVC tee.
3. Connect a static mixer to the outlet of the PVC tee.
4. Run ¼" PE tubing from the static mixer to the booster pump.
5. Connect the booster pump to the inlet of the RO system (green tubing – supplied with RO system).
6. Connect the red tubing from the RO system (drain) to the faucet (supplied with the RO system).
7. Connect the black tubing from the faucet to the drain (supplied with the RO system).
8. Install a PE tee on the accumulator tank.
9. Connect the white tubing from the RO outlet to the accumulator tank.
10. Connect the blue tubing from the accumulator tank to the flow totalizer.
11. Connect the blue tubing from the flow totalizer to the faucet.
12. Place a plug in the RO system where the line from the accumulator tank normally returns.
13. Make the following connections with the booster pump, pressure switch, and transformer:
    a. Plug the booster pump into the pressure switch.
    b. Plug the transformer into the pressure switch.
    c. Plug the pressure switch into a 110V AC outlet.

In cases where the permeate pump was tested, the following steps were included:

1. The red tubing was connected to the permeate pump, and then connected to the tubing ran to the faucet (replaces Step 6 above).
2. The white tubing was connected to the permeate pump permeate pump, and then connected to the accumulator tank (replaces Step 9 above).

Figure 2. Typical RO POU System (not undersink installed)



D.3 Faucet Flow Rate

The majority of homes in this study area are fed from well pumps connected to an accumulator tank that is typically set to cycle between 20 pounds per square inch (psi) and 60 psi water pressure. This pressure setting can result in a low pressure in the home that is further exacerbated by the pressure drop across POU devices, intended to operate at the higher line pressure that is typical of homes supplied by municipal water systems. Thus, a concern that has been raised is the lack of water flow rate that is produced from the POU systems and the resulting additional time required to fill common household devices such as coffee pots. Additional equipment can be employed to improve the water flow rate through the faucet.

RO systems are typically rated to operate at 40 psi feed pressure. Depending on the equipment at the property (well depth, pump condition, etc.), the line pressure may not reach 40 psi. Since an RO system will not operate below 40 psi, the addition of a booster pump (such as an Aquatec 6800 with a transformer and pressure switch) will increase the line pressure above 40 psi and allow the RO system to operate as designed. Adsorption filter systems may not have the same pressure requirement of RO systems; however, installations with low line pressure can also benefit from the addition of a booster pump to increase the flow rate through the filter. A booster pump will require a 120 VAC outlet under the sink that must be installed if power is not already available at that location.

Including an accumulator tank under the sink with an adsorption system would improve the flow rate of treated water from such systems. The water would flow through the adsorption filter at its normal treated flow rate of approximately 0.5 gallons per minute (gpm) and would be stored in the pressurized accumulator tank. When water is needed, the water flows out of the accumulator tank at a rate of 1 gpm. The accumulator tank would then be refilled as the water is treated by the adsorption filter. The filter media and manifolds control the flow rate of the water through the adsorption filters (rather than the faucets), so that the water will have the required residence time in the media before filling the accumulator tank. However, water quality may deteriorate in the accumulator tank with infrequent use. The Culligan Preferred 250 showed a consistent flow rate of approximately 1 gpm with a full accumulator tank and 0.4 gpm at steady state operation.

Because RO systems produce water at a much slower rate than adsorption systems, they include an accumulator tank that is located under-the-sink to store treated water. The accumulator tank stores water until it is needed and is pressurized to deliver water quickly. After the tank is emptied, it is slowly refilled by the RO system. Although not necessary for the operation of the RO system, a permeate pump can improve the performance of the system. The Aquatec ERP

500 is powered by the hydraulic energy of the reject water lost to the drain (no electricity required). The permeate pump forces product into the storage tank, reducing membrane back pressure and maximizing the available feed pressure. The vendors indicate that these pumps can reduce the reject water from the RO system by up to 80 percent. Other benefits of permeate pumps include higher delivery pressure, faster water production, superior water quality, and extended filter/membrane life. The Watts WP-4V unit at the T&E Facility was tested with a booster pump and a permeate pump. The results of these tests showed that, on average, the presence of a permeate pump improved the permeate recovery (i.e., the ratio of permeate to feed water) by approximately 69% and reduced the time required to produce 1 gallon of treated water by 43% relative to a system without a permeate pump. Details of these tests are presented below:

RO Unit: Watts WP-4V
Accumulator Tank: RO-132
Booster Pump: Aquatec 6800
Permeate Pump: Aquatec ERP 500

Accumulator Tank Working Volume: 2.5 gallons
Time to drain 2 L from tank: 20 seconds (1.6 gpm) – with and without permeate pump
Time to drain entire tank: 3 minutes (0.8 gpm)

Data with Permeate Pump – Tank Empty

	Permeate (ml/min)	Retentate (ml/min)
	145	400
	146	412
	150	380
	144	412
	150	390
	150	404
	148	380
	150	392
Average	148	396

Recovery = 148 / (148 + 396) x 100% = 27%
Rate = 1 gal x 3785 ml/gal / 148 ml/min = 25 min/gal

Data without Permeate Pump – Tank Empty

	Permeate (ml/min)	Retentate (ml/min)
	132	408
	158	420
	158	400
	156	420
	140	404
Average	149	410

Recovery = 149 / (149 + 410) x 100% = 27%
Rate = 1 gal x 3785 ml/gal / 149 ml/min = 25 min/gal

Data with Permeate Pump – Tank Full – Time and Feed Volume to Generate 1 L of Permeate

	Time (min)	Volume (mL)
	7	2660
	7	2730
	8	2890
	8	2850
Average	7.5	2780

Recovery = 1000 / (1000 + 2780) x 100% = 26%
Rate = 1 gal x 3785 ml/gal / 1000 ml/7.5min = 28 min/gal

Data without Permeate Pump – Tank Full – Time and Feed Volume to Generate 1 L of Permeate

	Time (min)	Volume (mL)
	14	5120
	13	5270
Average	13.5	5195

Recovery = 1000 / (1000 + 5195) x 100% = 16%
Rate = 1 gal x 3785 ml/gal / 1000 ml/7.5min = 49 min/gal

Summary
R.O. Unit with and without Permeate Pump – Recovery and Flow Rate Data

	Initial (Tank Empty)		Final (Tank Full)	
	Recovery	Flow Rate	Recovery	Flow Rate
With Permeate Pump	27%	25 min/gal	26%	28 min/gal
Without Permeate Pump	27%	25 min/gal	16%	49 min/gal

With no water in the accumulator tank, there is no difference in performance between the systems with and without the accumulator tank. As the accumulator tank fills with water, though, additional backpressure builds on the RO membrane. The permeate pump pumps water away from the membrane, and the recovery and flow rate are similar to when the tank is empty. By the time the accumulator tank is full, there is a significant difference between the systems with and without the permeate pump installed.

D.4 End-of-Life Indicator Devices

A third-party shutoff device based on the volume of water treated is available from Freshwatersystems.com. Termed the "Waterminder", the system is available to monitor a total flow-through capacity of either 1800 gallons or 3800 gallons. The system can be adjusted in 100-gallon increments and can be restarted as required. A unit was procured and tested at the T&E Facility. Repeated tested revealed that the Waterminder accurately shutoff flow at dialed-in total flow setting.

How Water Filters Work
http://www.explainthatstuff.com/howwaterfilterswork.html
Excerpted on April 15, 2010

Water filters use two different techniques to remove dirt. Physical filtration means straining water to remove larger impurities. In other words, a physical filter is a glorified sieve—maybe a piece of thin gauze or a very fine textile membrane. (If you have an electric kettle, you probably have a filter like this built into the spout to remove particles of limescale.) Another method of filtering, chemical filtration, involves passing water through an active material that removes impurities chemically as they pass through. There are four main types of filtration and they employ a mixture of physical and chemical techniques.

Activated carbon (Adsorption)
The most common household water filters use what are known as activated carbon granules (sometimes called active carbon or AC) based on charcoal (a very porous form of carbon, made by burning something like wood in a reduced supply of oxygen). Charcoal is like a cross between the graphite "lead" in a pencil and a sponge. It has a huge internal surface area, packed with nooks and crannies that attract and trap chemical impurities through a process called adsorption (where liquids or gases become trapped by solids or liquids). But while charcoal is great for removing many common impurities (including chlorine-based chemicals introduced during waste-water purification, some pesticides, and industrial solvents), it can't cope with "hardness" (limescale), heavy metals (unless a special type of activated carbon filter is used), sodium, nitrates, fluorine, or microbes. The main disadvantage of activated carbon is that the filters eventually clog up with impurities and have to be replaced. That means there's an ongoing (and sometimes considerable) cost.

Ion exchange
Ion-exchange filters are particularly good at "softening" water (removing limescale). They're designed to split apart atoms of a contaminating substance to make ions (electrically charged atoms with too many or too few electrons). Then they trap those ions and release, instead, some different, less troublesome ions of their own—in other words, they exchange "bad" ions for "good" ones.

How do they work? Ion exchange filters are made from lots of zeolite beads containing sodium ions. Hard water contains magnesium and calcium compounds and, when you pour it into an ion-exchange filter, these compounds split apart to form magnesium and calcium ions. The filter beads find magnesium and calcium ions more attractive than sodium, so they trap the incoming magnesium and calcium ions and release their own sodium ions to replace them. Without the magnesium and calcium ions, the water tastes softer and (to many people) more pleasant. However, the sodium is simply a different form of contaminant, so you can't describe the end product of ion-exchange filtration as "pure water" (the added sodium can even be problematic for people on low-sodium diets). Another disadvantage of ion-exchange filtration is that you need to recharge the filters periodically with more sodium ions, typically by adding a special kind of salt.

(This is why you have to add "salt" to dishwashers, from time to time: the salt recharges the dishwasher's water softener and helps to prevent a gradual build-up of limescale that can damage the machine.)

Reverse osmosis

Reverse osmosis means forcing contaminated water through a membrane (effectively, a very fine filter) at pressure, so the water passes through but the contaminants remain behind.

If you've studied biology, you've probably heard of osmosis. When you have a concentrated solution separated from a less concentrated solution by a semi-permeable membrane (a kind of filter through which some things can pass, but others can't), the solutions try to rearrange themselves so they're both at the same concentration. Wait, it's simpler than it sounds! Suppose you have a sealed glass bottle full of very sugary water and you stand it inside a big glass jug full of less sugary water. Nothing will happen. But what if the bottle is actually a special kind of porous plastic through which water (but not sugar) can travel? What happens is that water moves from the outer jug through the plastic (effectively, a semi-permeable membrane) into the bottle until the sugar concentrations are equal. The water moves all by itself under what's called osmotic pressure.

That's osmosis, so what about reverse osmosis? Suppose you take some contaminated water and force it through a membrane to make pure water. Effectively, you're making water go in the opposite direction to which osmosis would normally make it travel (not from a less-concentrated solution to a more-concentrated solution, as in osmosis, but from a more-concentrated solution to a less-concentrated solution). Since you're making the water move against its natural inclination, reverse osmosis involves forcing contaminated water through a membrane under pressure—and that means you need to use energy. In other words, reverse-osmosis filters have to use electrically powered pumps that cost money to run. Like activated charcoal, reverse osmosis is good at removing some pollutants (salt, nitrates, or limescale), but less effective at removing others (bacteria, for example). Another drawback is that reverse osmosis systems produce quite a lot of waste-water—some waste four or five liters of water for every liter of clean water they produce.

Distillation

One of the simplest ways to purify water is to boil it, but although the heat kills off many different bacteria, it doesn't remove chemicals, limescale, and other contaminants. Distillation goes a step further than ordinary boiling: you boil water to make steam, then capture the steam and condense (cool) it back into water in a separate container. Since water boils at a lower temperature than some of the contaminants it contains (such as toxic heavy metals), these remain behind as the steam separates away and boils off. Unfortunately, though, some contaminants (including volatile organic compounds or VOCs) boil at a lower temperature than water and that means they evaporate with the steam and aren't removed by the distillation process.

Michigan Department of Health & Human Services

Michigan Department of Health and Human Services (MDHHS)

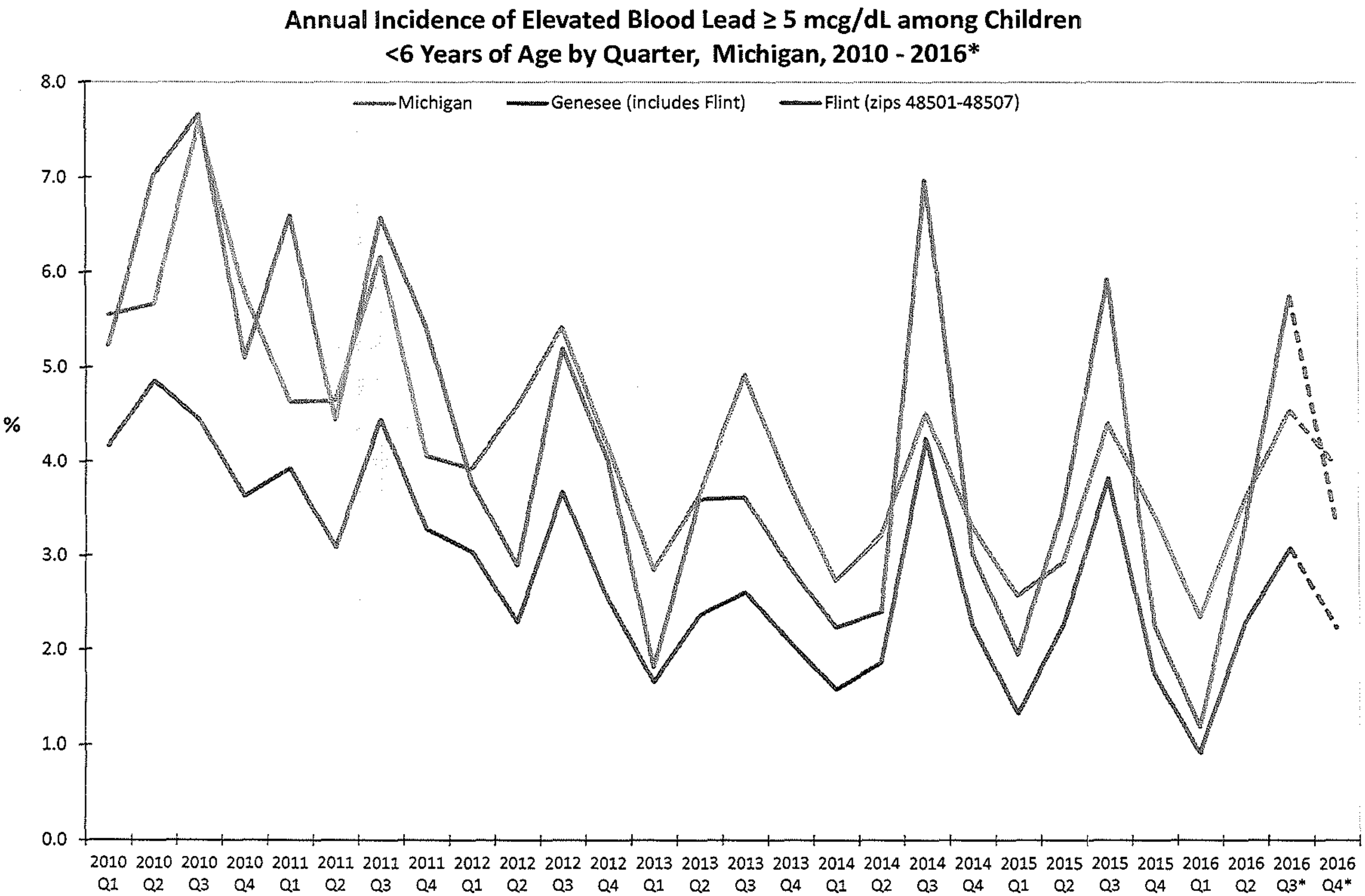
Blood Lead Level Test Results for Selected Flint Zip Codes, Genesee County, and the State of Michigan

Summary as of January 20, 2017

Executive Summary

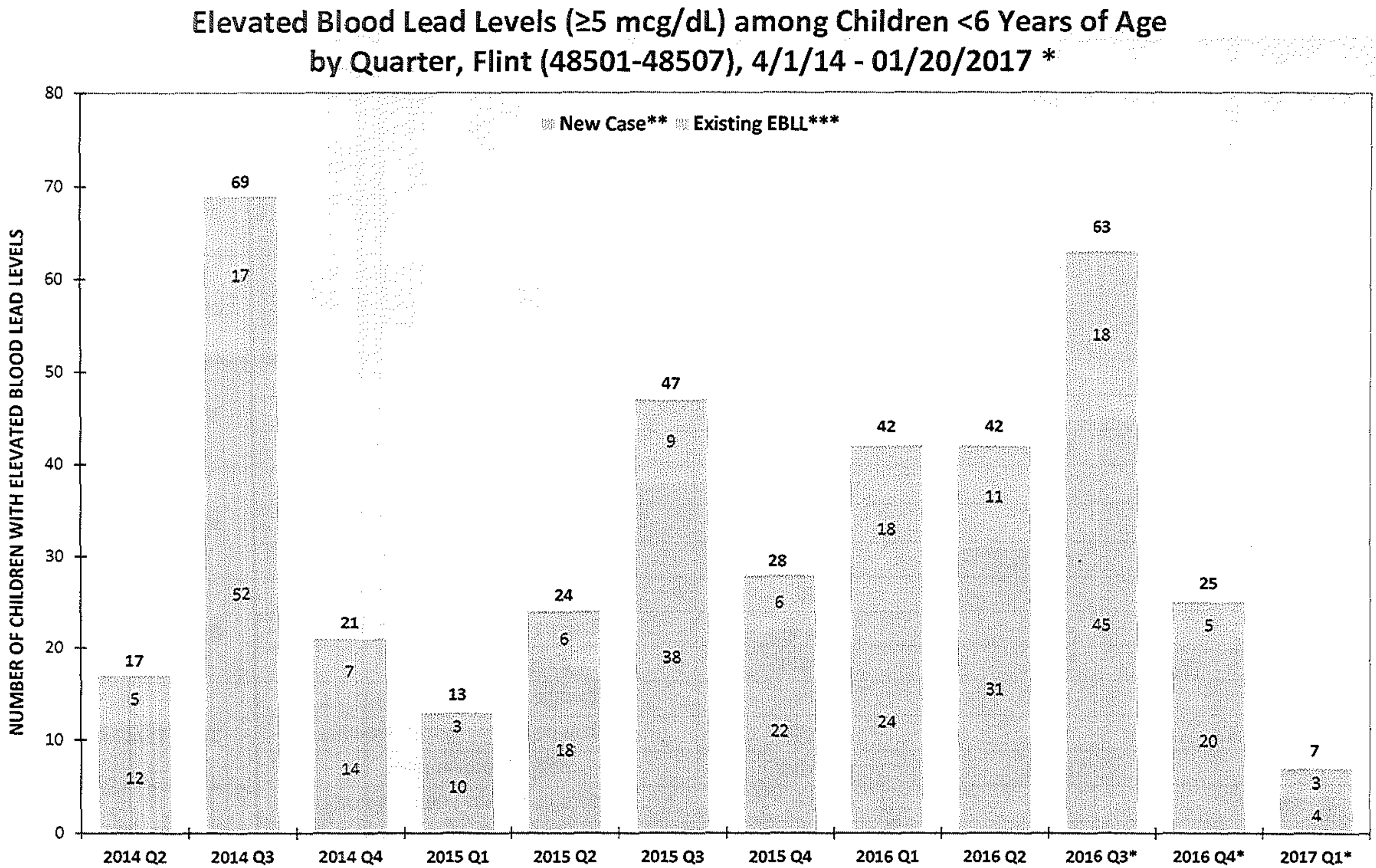
This report is generated by MDHHS to track Blood Lead Level test results in Flint, Michigan.

- Blood lead level testing is an important part of our efforts to identify people who have been harmed by drinking water that contained lead. However, MDHHS recognizes that the full community of Flint must be the focus of the public health response.
- People who have had multiple tests are counted only once per year for the annual counts. People counted in 2015 who were tested again after 1/1/2016 are counted in both years.
- Counts on this report include both capillary and venous blood tests.
- As of 5/2/2016, this report will no longer include test results for "Additional Impacted Locations" (48509, 48519, 48529, and 48532) because it has been demonstrated by CDC geographers that almost none of the addresses in these areas were serviced by water from the Flint River.
- Between 10/1/2015 and 1/20/2017, 31,838 people were tested in Flint zip codes 48501-48507.
- Continued testing efforts by Genesee County Health Department, MDHHS, and local medical personnel have identified 235 children under age 18 in Flint zip codes 48501-48507 with blood lead levels greater than or equal to 5 mcg/dL (micrograms lead per deciliter of blood) since 10/1/2015.
- Of children younger than 6 years old tested between 10/1/2015 and 1/20/2017, 2.6% from Flint zip codes 48501-48507 had blood lead levels greater than or equal to 5 mcg/dL.
- Five of the 25 (20.0%) children younger than 6 years old from Flint zip codes 48501-48507 with an elevated blood lead level (tested between 10/1/2016 and 12/31/2016) in Quarter 4 of 2016 had a previous test result greater than or equal to 5 mcg/dL.



*Data for Quarters 3 and 4 of 2016 are incomplete and subject to change. Data for 2017 will be reported starting in March 2017.

People who have had multiple tests are counted only once per year for annual counts. People counted in 2015 who were tested again after 1/1/2016 are counted in both years.
Counts on this report include both capillary and venous blood tests.



* Data for Quarters 3 and 4 of 2016, and Quarter 1 of 2017 are incomplete and subject to change.
** Child has never had a previous elevated blood lead level
*** Child has a pre-existing elevated blood lead level that has not yet been brought down to <5 mcg/dL

People who have had multiple tests are counted only once per year for annual counts. People counted in 2015 who were tested again after 1/1/2016 are counted in both years.
Counts on this report include both capillary and venous blood tests.

Table 1. Incidence of elevated blood lead levels (≥ 5 mcg/dL) among children less than 6 years of age, 2010 – 2017

		Michigan	Genesee County	Flint 48501-48507
1/1/2010 to 12/31/2010	Total tested for lead	156,015	7,053	3,630
	Number of test results ≥5 mcg/dL	9,754	306	230
	Percent of test results ≥5 mcg/dL	6.3%	4.3%	6.3%
1/1/2011 to 12/31/2011	Total tested for lead	152,334	6,760	3,145
	Number of test results ≥5 mcg/dL	7,571	252	182
	Percent of test results ≥5 mcg/dL	5.0%	3.7%	5.8%
1/1/2012 to 12/31/2012	Total tested for lead	149,061	7,152	3,198
	Number of test results ≥5 mcg/dL	6,834	210	130
	Percent of test results ≥5 mcg/dL	4.6%	2.9%	4.1%
1/1/2013 to 12/31/2013	Total tested for lead	148,684	7,133	3,143
	Number of test results ≥5 mcg/dL	5,747	158	96
	Percent of test results ≥5 mcg/dL	3.9%	2.2%	3.1%
1/1/2014 to 12/31/2014	Total tested for lead	143,987	6,820	3,102
	Number of test results ≥5 mcg/dL	5,063	178	122
	Percent of test results ≥5 mcg/dL	3.5%	2.6%	3.9%
1/1/2015 to 12/31/2015	Total tested for lead*	140,919	6,983	3,388
	Number of test results ≥5 mcg/dL	4,793	160	112
	Percent of test results ≥5 mcg/dL	3.4%	2.3%	3.3%
10/1/2015 to 01/20/2017	Total tested for lead*	186,112	13,333	7,482
	Number of test results ≥5 mcg/dL	6,647	239	191
	Percent of test results ≥5 mcg/dL	3.6%	1.8%	2.6%
4/1/2014 to 01/20/2017	Total tested for lead*	332,797	18,783	9,288
	Number of test results ≥5 mcg/dL	12,331	411	294
	Percent of test results ≥5 mcg/dL	3.7%	2.2%	3.2%
1/1/2016 to 01/20/2017	Total tested for lead*	157,175	11,708	6,637
	Number of test results ≥5 mcg/dL	5,722	212	172
	Percent of test results ≥5 mcg/dL	3.6%	1.8%	2.6%

Table 2. Incidence of elevated blood lead levels (≥ 5 mcg/dL) among children 6 to 17 years of age, 2010 – 2017

		Michigan	Genesee County	Flint 48501-48507
1/1/2010 to 12/31/2010	Total tested for lead	14,730	760	400
	Number of test results ≥5 mcg/dL	665	17	12
	Percent of test results ≥5 mcg/dL	4.5%	2.2%	3.0%
1/1/2011 to 12/31/2011	Total tested for lead	12,959	959	499
	Number of test results ≥5 mcg/dL	474	19	13
	Percent of test results ≥5 mcg/dL	3.7%	2.0%	2.6%
1/1/2012 to 12/31/2012	Total tested for lead	12,711	1,259	561
	Number of test results ≥5 mcg/dL	351	13	9
	Percent of test results ≥5 mcg/dL	2.8%	1.0%	1.6%
1/1/2013 to 12/31/2013	Total tested for lead	11,449	1,109	505
	Number of test results ≥5 mcg/dL	271	7	3
	Percent of test results ≥5 mcg/dL	2.4%	0.6%	0.6%
1/1/2014 to 12/31/2014	Total tested for lead	10,563	788	372
	Number of test results ≥5 mcg/dL	285	6	5
	Percent of test results ≥5 mcg/dL	2.7%	0.8%	1.3%
1/1/2015 to 12/31/2015	Total tested for lead*	10,416	1,570	1,084
	Number of test results ≥5 mcg/dL	254	10	8
	Percent of test results ≥5 mcg/dL	2.4%	0.6%	0.7%
10/1/2015 to 01/20/2017	Total tested for lead*	27,419	10,483	7,934
	Number of test results ≥5 mcg/dL	481	58	44
	Percent of test results ≥5 mcg/dL	1.8%	0.6%	0.6%
4/1/2014 to 01/20/2017	Total tested for lead*	40,088	11,228	8,224
	Number of test results ≥5 mcg/dL	724	61	46
	Percent of test results ≥5 mcg/dL	1.8%	0.5%	0.6%
1/1/2016 to 01/20/2017	Total tested for lead*	24,302	9,668	7,308
	Number of test results ≥5 mcg/dL	420	55	39
	Percent of test results ≥5 mcg/dL	1.7%	0.6%	0.5%

Table 3. Incidence of elevated blood lead levels (≥ 5 mcg/dL) among adults at least 18 years of age, 2010 – 2017

		Michigan	Genesee County	Flint 48501-48507
1/1/2010 to 12/31/2010	Total tested for lead	13,681	588	188
	Number of test results ≥5 mcg/dL	1,459	42	18
	Percent of test results ≥5 mcg/dL	10.7%	7.1%	9.6%
1/1/2011 to 12/31/2011	Total tested for lead	13,112	528	132
	Number of test results ≥5 mcg/dL	1,367	43	16
	Percent of test results ≥5 mcg/dL	10.4%	8.1%	12.1%
1/1/2012 to 12/31/2012	Total tested for lead	12,912	539	148
	Number of test results ≥5 mcg/dL	1,413	33	11
	Percent of test results ≥5 mcg/dL	10.9%	6.1%	7.4%
1/1/2013 to 12/31/2013	Total tested for lead	12,081	484	132
	Number of test results ≥5 mcg/dL	1,499	54	16
	Percent of test results ≥5 mcg/dL	12.4%	11.2%	12.1%
1/1/2014 to 12/31/2014	Total tested for lead	12,576	436	111
	Number of test results ≥5 mcg/dL	1,419	44	12
	Percent of test results ≥5 mcg/dL	11.3%	10.1%	10.8%
1/1/2015 to 12/31/2015	Total tested for lead*	13,684	1,250	811
	Number of test results ≥5 mcg/dL	1,368	48	21
	Percent of test results ≥5 mcg/dL	10.0%	3.8%	2.6%
10/1/2015 to 01/20/2017	Total tested for lead*	40,441	21,026	16,422
	Number of test results ≥5 mcg/dL	1,916	330	259
	Percent of test results ≥5 mcg/dL	4.7%	1.6%	1.6%
4/1/2014 to 01/20/2017	Total tested for lead*	56,111	21,609	16,575
	Number of test results ≥5 mcg/dL	3,348	372	269
	Percent of test results ≥5 mcg/dL	6.0%	1.7%	1.6%
1/1/2016 to 01/20/2017	Total tested for lead*	36,697	20,109	15,753
	Number of test results ≥5 mcg/dL	1,640	316	250
	Percent of test results ≥5 mcg/dL	4.5%	1.6%	1.6%

Table 4. Total incidence of elevated blood lead levels (≥ 5 mcg/dL), 2010 – 2017

		Michigan	Genesee County	Flint 48501-48507
1/1/2010 to 12/31/2010	Total tested for lead	184,426	8,401	4,218
	Number of test results ≥5 mcg/dL	11,878	365	260
	Percent of test results ≥5 mcg/dL	6.4%	4.3%	6.2%
1/1/2011 to 12/31/2011	Total tested for lead	178,405	8,247	3,776
	Number of test results ≥5 mcg/dL	9,412	314	211
	Percent of test results ≥5 mcg/dL	5.3%	3.8%	5.6%
1/1/2012 to 12/31/2012	Total tested for lead	174,684	8,950	3,907
	Number of test results ≥5 mcg/dL	8,598	256	150
	Percent of test results ≥5 mcg/dL	4.9%	2.9%	3.8%
1/1/2013 to 12/31/2013	Total tested for lead	172,214	8,726	3,780
	Number of test results ≥5 mcg/dL	7,517	219	115
	Percent of test results ≥5 mcg/dL	4.4%	2.5%	3.0%
1/1/2014 to 12/31/2014	Total tested for lead	167,126	8,044	3,585
	Number of test results ≥5 mcg/dL	6,767	228	139
	Percent of test results ≥5 mcg/dL	4.0%	2.8%	3.9%
1/1/2015 to 12/31/2015	Total tested for lead*	165,019	9,803	5,283
	Number of test results ≥5 mcg/dL	6,415	218	141
	Percent of test results ≥5 mcg/dL	3.9%	2.2%	2.7%
10/1/2015 to 01/20/2017	Total tested for lead*	253,972	44,842	31,838
	Number of test results ≥5 mcg/dL	9,044	627	494
	Percent of test results ≥5 mcg/dL	3.6%	1.4%	1.6%
4/1/2014 to 01/20/2017	Total tested for lead*	428,996	51,620	34,087
	Number of test results ≥5 mcg/dL	16,403	844	609
	Percent of test results ≥5 mcg/dL	3.8%	1.6%	1.8%
1/1/2016 to 01/20/2017	Total tested for lead*	218,174	41,485	29,698
	Number of test results ≥5 mcg/dL	7,782	583	461
	Percent of test results ≥5 mcg/dL	3.6%	1.4%	1.6%

Centers for Disease Control and Prevention National Surveillance Data

Tested and Confirmed Elevated Blood Lead Levels by State, Year, and Blood Lead Level Group for Children <72 months of age

https://www.cdc.gov/nceh/lead/data/national.htm

State	Year	# of Children Tested	# of children at 5-9 µg/dL	% of children at 5-9 µg/dL	# of children at ≥5 µg/dL	% of children at≥5 µg/dL
Alabama	2010	17,088	968	5.66	1090	6.38
	2011	22,349	989	4.43	1,108	4.96
	2012	14,744	547	3.71	656	4.45
	2013	29,671	888	2.99	1,007	3.39
	2014	24,408	653	2.68	780	3.20
	2015	21,798	523	2.40	624	2.86
Arizona	2010	68,734	810	1.18	965	1.40
	2011	62,292	487	0.78	566	0.91
	2012	61,463	649	1.06	750	1.22
	2013	61,959	556	0.90	636	1.03
	2014	52,094	494	0.95	563	1.08
	2015	47,339	433	0.91	525	1.11
California	2010	627,649	20,385	3.25	21,676	3.45
	2011	565,397	15,485	2.74	16,641	2.94
	2012	N/A	N/A	N/A	N/A	N/A
	2013	N/A	N/A	N/A	N/A	N/A
	2014	146,192	3,195	2.19	3,557	2.43
	2015	152,112	2,598	1.71	2,991	1.97
Colorado	2010	N/A	N/A	N/A	N/A	N/A
	2011	N/A	N/A	N/A	N/A	N/A
	2012	N/A	N/A	N/A	N/A	N/A
	2013	N/A	N/A	N/A	N/A	N/A
	2014	16,555	N/A	N/A	373	2.25
	2015	N/A	N/A	N/A	N/A	N/A
Connecticut	2010	82,388	5,481	6.65	6,266	7.61
	2011	67,891	3,958	5.83	4,588	6.76
	2012	75,232	3,996	5.31	4,534	6.03
	2013	21,842	1,703	7.80	2,097	9.60
	2014	75,333	3,251	4.32	3,773	5.01
	2015	68,799	2,771	4.03	3,331	4.84
Delaware	2010	11,592	371	3.20	434	3.74
	2011	17,440	463	2.65	554	3.18
	2012	10,142	204	2.01	241	2.38
	2013	13,600	333	2.45	380	2.79
	2014	13,935	269	1.93	315	2.26
	2015	12,321	264	2.14	315	2.56
Washington D.C.	2010	N/A	N/A	N/A	N/A	N/A
	2011	N/A	N/A	N/A	N/A	N/A
	2012	N/A	N/A	N/A	N/A	N/A
	2013	N/A	N/A	N/A	N/A	N/A
	2014	16,405	236	1.44	286	1.74
	2015	N/A	N/A	N/A	N/A	N/A
Florida	2010	203,401	7,051	3.47	7,449	3.66
	2011	167,844	4,948	2.95	5,163	3.08

	2012	177,754	3,334	1.88	3,640	2.05
	2013	N/A	N/A	N/A	N/A	N/A
	2014	N/A	N/A	N/A	N/A	N/A
	2015	N/A	N/A	N/A	N/A	N/A
Georgia	2010	126,982	6,121	4.82	6,368	5.01
	2011	118,782	4,731	3.98	5,006	4.21
	2012	115,423	4,132	3.58	4,366	3.78
	2013	104,158	2,738	2.63	2,943	2.83
	2014	105,246	2,427	2.31	2,584	2.46
	2015	94,380	1,726	1.83	1,837	1.95
Illinois	2010	163,119	13,443	8.24	15,804	9.69
	2011	172,045	12,705	7.38	14,735	8.56
	2012	170,714	13,149	7.7	15,353	8.99
	2013	161,459	8,434	5.22	10,177	6.30
	2014	155,305	7,290	4.69	8,954	5.77
	2015	132,747	5,962	4.49	7,481	5.64
Indiana	2010	63,296	3,889	6.14	4,363	6.89
	2011	57,534	3,400	5.91	3,789	6.59
	2012	54,458	2,794	5.13	3,151	5.79
	2013	50,345	2,222	4.41	2,513	4.99
	2014	38,140	1,553	4.07	1,758	4.61
	2015	21,452	1,071	4.99	1,253	5.84
Iowa	2010	80,401	33,917	42.18	34,468	42.87
	2011	76,278	30,363	39.81	30,863	40.46
	2012	45,964	14,576	31.71	14,896	32.41
	2013	N/A	N/A	N/A	N/A	N/A
	2014	N/A	N/A	N/A	N/A	N/A
	2015	N/A	N/A	N/A	N/A	N/A
Kansas	2010	34,140	1,657	4.85	1,864	5.46
	2011	34,648	1,597	4.61	1,834	5.29
	2012	24,228	1,323	5.46	1,474	6.08
	2013	N/A	N/A	N/A	N/A	N/A
	2014	N/A	N/A	N/A	N/A	N/A
	2015	N/A	N/A	N/A	N/A	N/A
Kentucky	2010	20,194	883	4.37	1,008	4.99
	2011	22,185	1,083	4.88	1,180	5.32
	2012	13,534	563	4.16	679	5.02
	2013	14,635	502	3.43	578	3.95
	2014	13,877	414	2.98	465	3.35
	2015	11,908	343	2.88	387	3.25
Louisiana	2010	56,698	3,409	6.01	3,550	6.26
	2011	1,865	139	7.45	259	13.89
	2012	1,488	166	11.16	322	21.64
	2013	10,086	737	7.31	923	9.15
	2014	19,014	815	4.29	944	4.96
	2015	16,469	737	4.48	869	5.28
Maine	2010	13,396	N/A	N/A	N/A	N/A
	2011	13,961	N/A	N/A	N/A	N/A
	2012	N/A	N/A	N/A	N/A	N/A
	2013	N/A	N/A	N/A	N/A	N/A
	2014	N/A	N/A	N/A	N/A	N/A
	2015	N/A	N/A	N/A	N/A	N/A
Maryland	2010	115,328	3,657	3.17	4,171	3.62
	2011	110,169	2,893	2.63	3,329	3.02
	2012	111,101	2,562	2.31	2,907	2.62

	2013	110,410	2,502	2.27	2,859	2.59
	2014	109,089	2,269	2.08	2,596	2.38
	2015	108,813	2,083	1.91	2,442	2.24
Massachusetts	2010	226,267	11,722	5.18	12,726	5.62
	2011	217,235	9,044	4.16	9,809	4.52
	2012	212,154	8,675	4.09	9,435	4.45
	2013	210,789	6,887	3.27	7,571	3.59
	2014	212,014	6,429	3.03	7,214	3.40
	2015	208,595	5,889	2.82	6,584	3.16
Michigan	2010	296,425	15,939	5.38	18,289	6.17
	2011	295,214	12,869	4.36	14,737	4.99
	2012	279,036	11,148	4.00	12,622	4.52
	2013	114,462	3,383	2.96	3,827	3.34
	2014	138,898	4,365	3.14	5,000	3.60
	2015	128,689	3,996	3.11	4,623	3.59
Minnesota	2010	94,015	3,296	3.51	3,591	3.82
	2011	91,747	2,724	2.97	2,986	3.25
	2012	92,093	2,437	2.65	2,699	2.93
	2013	89,505	1,834	2.05	2,025	2.26
	2014	89,081	1,509	1.69	1,729	1.94
	2015	87,830	1,455	1.66	1,671	1.90
Mississippi	2010	47,785	N/A	N/A	N/A	N/A
	2011	41,556	3,905	9.40	N/A	N/A
	2012	42,626	3,533	8.29	N/A	N/A
	2013	43,396	3,135	7.22	N/A	N/A
	2014	46,084	3,080	6.68	N/A	N/A
	2015	41,934	1,988	4.74	N/A	N/A
Missouri	2010	101,409	6,302	6.21	7,157	7.06
	2011	94,011	5,116	5.44	5,610	5.97
	2012	89,638	4,581	5.11	5,211	5.81
	2013	N/A	N/A	N/A	N/A	N/A
	2014	N/A	N/A	N/A	N/A	N/A
	2015	83,158	2,989	3.59	3,413	4.10
Nevada	2010	13,597	184	1.35	209	1.54
	2011	N/A	N/A	N/A	N/A	N/A
	2012	N/A	N/A	N/A	N/A	N/A
	2013	N/A	N/A	N/A	N/A	N/A
	2014	N/A	N/A	N/A	N/A	N/A
	2015	N/A	N/A	N/A	N/A	N/A
New Hampshire	2010	14,817	2,499	16.87	2,669	18.01
	2011	14,215	2,116	14.89	2,261	15.91
	2012	13,529	1,486	10.98	1,604	11.86
	2013	14,080	907	6.44	1,014	7.20
	2014	13,708	763	5.57	854	6.23
	2015	13,464	669	4.97	756	5.61
New Jersey	2010	184,867	NA	NA	NA	NA
	2011	181,051	6,816	3.76	8,063	4.45
	2012	181,603	5,639	3.11	6,604	3.64
	2013	179,147	5,656	3.16	6,500	3.63
	2014	172,846	4,778	2.76	5,566	3.22
	2015	176,306	4,638	2.63	5,484	3.11
New Mexico	2010	47	3	6.38	3	6.38
	2011	76	1	1.32	2	2.63
	2012	157	3	1.91	4	2.55
	2013	8,380	N/A	N/A	N/A	N/A

	2014	12,031	N/A	N/A	N/A	N/A
	2015	11,895	N/A	N/A	N/A	N/A
New York (no city)	2010	222,742	13,091	5.88	15,621	7.01
	2011	222,805	11,649	5.23	13,786	6.19
	2012	55,803	2,721	4.88	3,383	6.06
	2013	N/A	N/A	N/A	N/A	N/A
	2014	37,432	1,951	5.21	2,497	6.67
	2015	123,811	4,892	3.95	6,023	4.86
New York City	2010	326,884	12,895	3.94	14,400	4.41
	2011	334,892	10,733	3.20	12,007	3.59
	2012	330,619	7,672	2.32	8,688	2.63
	2013	324,477	6,826	2.10	7,702	2.37
	2014	316,958	6,074	1.92	6,993	2.21
	2015	308,380	4,731	1.53	5,610	1.82
North Carolina	2010	162,828	7,230	4.44	7,475	4.59
	2011	156,454	5,598	3.58	5,797	3.71
	2012	149,821	4,268	2.85	4,461	2.98
	2013	147,148	2,751	1.87	2,917	1.98
	2014	142,649	2,419	1.70	2,618	1.84
	2015	108,988	1,924	1.77	2,121	1.95
Ohio	2010	142,290	11,310	7.95	12,624	8.87
	2011	149,886	9,836	6.56	11,477	7.66
	2012	154,556	9,658	6.25	11,399	7.38
	2013	156,966	8,602	5.48	10,064	6.41
	2014	151,713	7,604	5.01	9,048	5.96
	2015	133,441	6,346	4.76	7,615	5.71
Oklahoma	2010	40,597	1,639	4.04	1,786	4.40
	2011	40,108	1,700	4.24	1,860	4.64
	2012	39,856	1,402	3.52	1,583	3.97
	2013	41,356	1,134	2.74	1,324	3.20
	2014	42,086	978	2.32	1,189	2.83
	2015	40,646	1,049	2.58	1,213	2.98
Oregon	2010	14,921	391	2.62	439	2.94
	2011	13,782	315	2.29	352	2.55
	2012	13,671	348	2.55	379	2.77
	2013	12,357	344	2.78	359	2.91
	2014	12,041	299	2.48	313	2.60
	2015	12,162	267	2.20	282	2.32
Pennsylvania	2010	158,487	17,804	11.23	20,955	13.22
	2011	157,642	14,548	9.23	17,440	11.06
	2012	154,623	12,270	7.94	14,772	9.55
	2013	146,930	11,330	7.71	13,361	9.09
	2014	140,241	10,175	7.26	11,983	8.54
	2015	19,763	1,450	7.34	1,766	8.94
Rhode Island	2010	28,282	2,347	8.30	2,720	9.62
	2011	28,239	1,792	6.35	2,083	7.38
	2012	28,325	1,582	5.59	1,834	6.47
	2013	27,643	1,270	4.59	1,499	5.42
	2014	26,854	1,157	4.31	1,374	5.12
	2015	26,345	1,122	4.26	1,354	5.14
Tennessee	2010	72,646	3,271	4.50	3,411	4.70
	2011	69,901	2,504	3.58	2,636	3.77
	2012	71,569	2,602	3.64	2,735	3.82
	2013	84,839	1,758	2.07	1,874	2.21
	2014	84,223	1,456	1.73	1,570	1.86

	2015	83,397	1,122	1.35	1,220	1.46
Texas	2010	363,338	9,834	2.71	10,779	2.97
	2011	213,534	5,143	2.41	5,693	2.67
	2012	N/A	N/A	N/A	N/A	N/A
	2013	N/A	N/A	N/A	N/A	N/A
	2014	N/A	N/A	N/A	N/A	N/A
	2015	N/A	N/A	N/A	N/A	N/A
Vermont	2010	10,004	987	9.87	1,053	10.53
	2011	10,085	987	9.79	1,056	10.47
	2012	10,141	877	8.65	943	9.30
	2013	7,640	601	7.87	640	8.38
	2014	8,715	543	6.23	595	6.83
	2015	9,859	543	5.51	585	5.93
Virginia	2010	100,489	3,757	3.74	4,095	4.08
	2011	98,474	3,138	3.19	3,417	3.47
	2012	N/A	N/A	N/A	N/A	N/A
	2013	N/A	N/A	N/A	N/A	N/A
	2014	N/A	N/A	N/A	N/A	N/A
	2015	N/A	N/A	N/A	N/A	N/A
Washington	2010	N/A	505	N/A	547	N/A
	2011	N/A	369	N/A	394	N/A
	2012	N/A	443	N/A	461	N/A
	2013	N/A	N/A	N/A	N/A	N/A
	2014	N/A	N/A	N/A	N/A	N/A
	2015	NA	N/A	N/A	N/A	N/A
West Virginia	2010	10,963	734	6.70	812	7.41
	2011	11,710	586	5.00	654	5.58
	2012	11,428	535	4.68	596	5.22
	2013	11,901	459	3.86	503	4.23
	2014	1,430	62	4.34	76	5.31
	2015	9.784	318	3.25	386	3.95
Wisconsin	2010	95,048	8,190	8.62	9,172	9.65
	2011	89,703	6,801	7.58	7,692	8.57
	2012	98,628	6,121	6.21	7,029	7.13
	2013	94,573	5,288	5.59	6,053	6.50
	2014	89,148	4,255	4.77	4,938	5.54
	2015	84,539	3,962	4.69	4,610	5.45
U.S. Total	2010	4,375,356	256,819	5.99	282,434	6.59
	2011	4,286,833	202,666	4.98	224,820	5.52
	2012	4,070,635	154,156	4.66	154,156	5.25
	2013	2,938,161	101,383	3.67	101,383	4.19
	2014	2,675,145	100,775	3.27	100,775	3.77
	2015	2,415,604	79,957	2.83	79,957	3.31
Flint,	2010	3,630	N/A	N/A	230	6.38
Michigan	2011	3,145	NA	N/A	182	5.79
	2012	3,198	N/A	N/A	130	4.07
Includes	2013	3,143	N/A	N/A	96	3.05
results for	2014	3,102	N/A	N/A	122	3.93
kids under 6	2015	3,388	N/A	N/A	112	3.31