

Shekter Smith, Liane (DEQ)

From: Crooks, Jennifer <crooks.jennifer@epa.gov>
Sent: Monday, August 31, 2015 2:35 PM
To: Shekter Smith, Liane (DEQ); Benzie, Richard (DEQ); Busch, Stephen (DEQ)
Subject: FW: links to update flint water news

Importance: High

Today's updates on Marc Edwards' site. His staff is phone calling and emailing results to citizens. Talk at 2.

From: Porter, Andrea
Sent: Monday, August 31, 2015 1:19 PM
To: Poy, Thomas
Cc: Deltoral, Miguel; Crooks, Jennifer; Shoven, Heather
Subject: links to update flint water news

Hi All,

Today, activists delivered a petition (with ~27,000 signatures) asking Flint to immediately switch back to Detroit water:
<http://www.abc12.com/news/headlines/Crowd-gathers-outside-Flint-City-Hall-demands-switch-to-Detroit-water--323442421.html>

And, in case you haven't checked the Marc Edwards Flint site today, there are more Pb results posted:
<https://flintwaterstudyupdates.wordpress.com/>

"Analysis of water samples from an additional 72 Flint homes are concerning
 August 31, 2015 flintwaterstudy Articles

Over the weekend, we analyzed another 72 lead samples collected by Flint residents and mailed to Virginia Tech. For the 120 samples analyzed to date, forty two percent were over 5 ppb, which suggests a serious lead in water problem according to our experience and criteria.

Twenty-three (20% of the 120 samples collected to date) also exceeded the 15 ppb lead action limit. The highest lead sampled in first draw so far was 158 ppb, and the highest sample after 45 second flushing is 1,051 ppb. Six of 120 homes sampled (5%), had over 15 ppb lead even after 2 minutes of continuous flushing.

The 90thile lead level in the Flint Water Study is currently 30 ppb, which is double the EPA standard applied to homes with "worst case" lead plumbing, and in a range where water consumption has caused lead poisoning in children and adverse pregnancy outcomes. Needless to say, these data are very worrisome, especially considering that our survey did not target "worst case" lead plumbing systems as is required for EPA sampling.

Look at our summary page here for more details. We just heard that we are approaching the 250 (out of 300) mark of returned kits and we couldn't be more grateful and proud of Flint's citizen scientists. Please continue collecting samples, as larger number of samples helps to draw stronger conclusions. More samples may also help Flint residents understand what regions of the city and the types of plumbing systems that have the most serious lead problems. We are also contacting homes with high lead levels via phone and email and all sampled residents will receive their results via regular mail."

There's also this part about how residents with high results in the first round were called:
"Informing Flint Residents about lead in their water"

All Flint residents who returned their lead kits will receive their results via regular mail. You will also receive this document on how to interpret your lead results. For the first 48 lead kits analyzed so far, we have finished calling residents who had considerably high lead in their water. For those we couldn't get through, we left voicemail messages and sent an email."

Thanks,
Andrea Porter

Environmental Engineer
Ground Water & Drinking Water Branch
U.S. EPA, Region 5 (WG-15J)
77 W. Jackson Blvd.
Chicago, IL 60604
Phone: 312-886-4427
Fax: 312-697-2656

Up-to-date information on our collaborative research and citizen science work with the residents of Flint, MI in light of reported water quality issues

Analysis of water samples from an additional 72 Flint homes are concerning

(<https://flintwaterstudyupdates.wordpress.com/2015/08/31/analysis-of-water-samples-from-an-additional-72-flint-homes-are-concerning-as-well/>)

August 31, 2015 August 31, 2015 flintwaterstudy Articles

Over the weekend, we analyzed another 72 lead samples collected by Flint residents and mailed to Virginia Tech. For the 120 samples analyzed to date, **forty two percent were over 5 ppb**, which suggests a serious lead in water problem according to our experience and criteria.

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Look at our summary page here (<https://flintwaterstudyupdates.wordpress.com/information-for-flint-residents/results-for-citizen-testing-for-lead-300-kits/>) for more details. We just heard that we are approaching the 250 (out of 300) mark of returned kits and we couldn't be more grateful and proud of Flint's citizen scientists. **Please continue collecting samples, as larger number of samples helps to draw stronger conclusions.** More samples may also help Flint residents understand what regions of the city and the types of plumbing systems that have the most serious lead problems. We are also contacting homes with high lead levels via phone and email and all sampled residents will receive their results via regular mail.



([https://flintwaterstudyupdates.wordpress.com/2015/08/31/analysis-of-water-samples-](https://flintwaterstudyupdates.wordpress.com/2015/08/31/analysis-of-water-samples-from-an-additional-72-flint-homes-are-concerning-as-well/img_6919/#main)

[from-an-additional-72-flint-homes-are-concerning-as-well/img_6919/#main](https://flintwaterstudyupdates.wordpress.com/2015/08/31/analysis-of-water-samples-from-an-additional-72-flint-homes-are-concerning-as-well/img_6919/#main))



(<https://flintwaterstudyupdates.wordpress.com/2015/08/31/analysis-of-water-samples->

[from-an-additional-72-flint-homes-are-concerning-as-well/img_6930/#main](#))



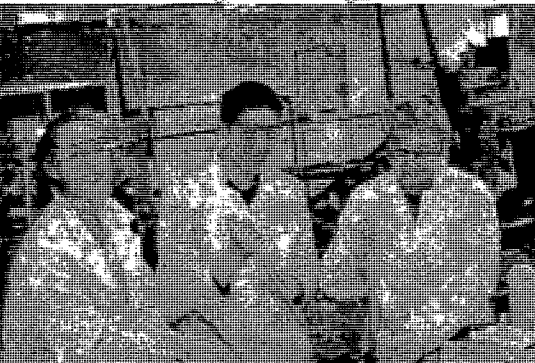
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[homes-are-concerning-as-well/img_6916/#main](#))



(<https://flintwaterstudyupdates.wordpress.com/2015/08/31/analysis-of-water-samples->

[from-an-additional-72-flint-homes-are-concerning-as-well/img_6905/#main](#))

<https://flintwaterstudyupdates.wordpress.com/>

8/31/2015



([https://flintwaterstudyupdates.wordpress.com/2015/08/31/analysis-of-water-samples-from-an-additional-72-flint-](https://flintwaterstudyupdates.wordpress.com/2015/08/31/analysis-of-water-samples-from-an-additional-72-flint-homes-are-concerning-as-well/img_6900/#main)

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Our team (including Anurag Mantha, not pictured) hard at work towards analyzing the 72 lead kits (216 samples) over the weekend

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Results from Field Sampling in Flint (Aug 17-19 2015) :

Opportunistic Pathogens

(<https://flintwaterstudyupdates.wordpress.com/2015/08/29/results-from-field-sampling-in-flint-aug-17-19-2015-opportunistic-pathogens/>)

[August 29, 2015](#) [August 29, 2015](#) [flintwaterstudy](#) [Articles](#)

Report 3. Opportunistic Pathogens: *Legionella pneumophila* and *Mycobacterium avium*.

During our recent sampling trip to Flint, we found that all of our samples sites were free of fecal indicator bacteria but that many sites lacked a chlorine residual, which is a critical barrier for preventing regrowth of bacteria in pipes

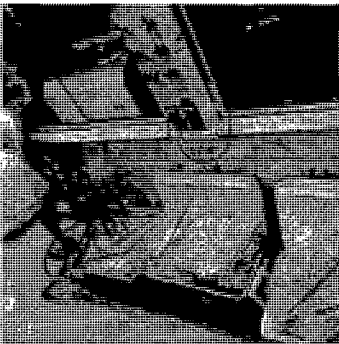
(<https://flintwaterstudyupdates.wordpress.com/2015/08/25/research-results-for-field-sampling-in-flint-august-17-19-2015/>). Our research

team has further observed in previous work that opportunistic pathogens

(<https://flintwaterstudyupdates.wordpress.com/2015/08/23/opportunistic-pathogens/>) tend to grow in distribution system and home plumbing pipes when there is a lack of chlorine residual. Thus, it is worrisome that recent reports in Genesee County indicate a possible increase in cases of Legionnaire's Disease, a respiratory infection caused by an opportunistic pathogen (*Legionella pneumophila*).

(<http://www.detroitnews.com/story/news/nation/2015/08/04/seven-died-legionnaires-disease-new-york/31108771/>)

During our trip, we collected samples from **nine businesses located throughout the city of Flint**, including eight of Flint's designated monitoring sites and a business located in close proximity to the drinking water treatment plant, and **seven homes of Flint water consumers**. For comparison, we also collected water from **four businesses that receive water from Detroit**. At each of these sites we collected *both water samples and swabs of bacteria growing on the surface within the faucet*, known as the **biofilm**.



([https://flintwaterstudyupdates.wordpress.com/2015/08/29/results-from-field-sampling-in-flint-aug-17-19-](https://flintwaterstudyupdates.wordpress.com/2015/08/29/results-from-field-sampling-in-flint-aug-17-19-2015-opportunistic-pathogens/fullsizerender632-2/#main)

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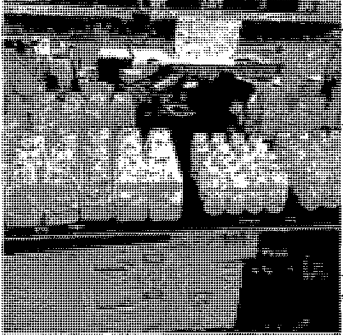
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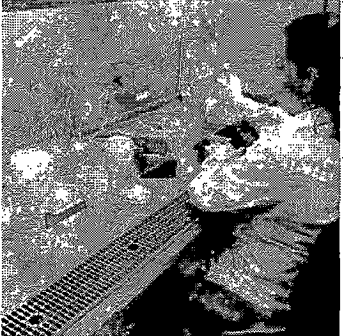
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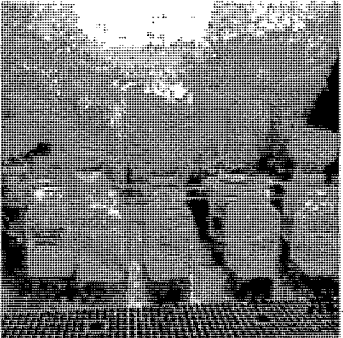
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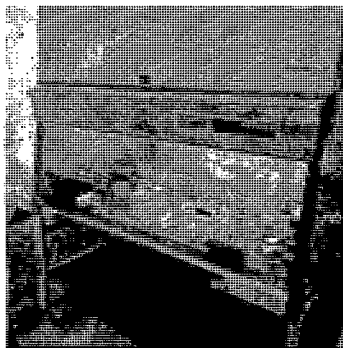
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[2015-opportunistic-pathogens/fullsizerender/#main](https://flintwaterstudyupdates.wordpress.com/2015/08/29/results-from-field-sampling-in-flint-aug-17-19-2015-opportunistic-pathogens/fullsizerender/#main))



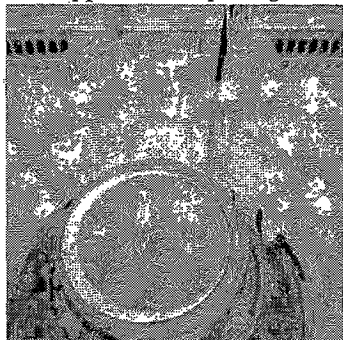
([https://flintwaterstudyupdates.wordpress.com/2015/08/29/results-from-field-sampling-in-flint-aug-17-19-](https://flintwaterstudyupdates.wordpress.com/2015/08/29/results-from-field-sampling-in-flint-aug-17-19-2015-opportunistic-pathogens/fullsizerender3/#main)

[2015-opportunistic-pathogens/fullsizerender3/#main](https://flintwaterstudyupdates.wordpress.com/2015/08/29/results-from-field-sampling-in-flint-aug-17-19-2015-opportunistic-pathogens/fullsizerender3/#main))



(<https://flintwaterstudyupdates.wordpress.com/2015/08/29/results-from-field-sampling-in-flint-aug-17-19->

2015-opportunistic-pathogens/fullsizerender4/#main)



(<https://flintwaterstudyupdates.wordpress.com/2015/08/29/results-from-field-sampling-in-flint-aug-17-19->

2015-opportunistic-pathogens/fullsizerender6/#main)



(<https://flintwaterstudyupdates.wordpress.com/2015/08/29/results-from-field-sampling-in-flint-aug-17-19->

2015-opportunistic-pathogens/fullsizerender77/#main)

From these samples, we investigated the presence of two key opportunistic pathogens which are important to public health: *Legionella pneumophila* and *Mycobacterium avium*. We also measured the presence of a DNA marker (<http://www.thefreedictionary.com/DNA+marker>) specific to all bacteria within the *Legionella* genus. This *Legionella* genus is a category of bacteria which includes several pathogenic (e.g. *Legionella pneumophila*) and several non-pathogenic species:

Results: We did not detect quantifiable levels of *Legionella pneumophila* or *Mycobacterium avium* in water or biofilm samples collected from any of the sixteen sites in Flint or in any of the four sites receiving Detroit water.

We detected bacteria belonging to the *Legionella* genus in water collected from two of the nine businesses/monitoring sites and in five of seven citizen homes. *Legionella* genus was not detected in any of the four samples collected from sites receiving Detroit water.

Conclusion: We found **no evidence** of *Legionella pneumophila* or *Mycobacterium avium* present at the time of sampling at the sites tested. However, we hypothesize that the presence of bacteria belonging to the *Legionella* genus may be indicative of conditions in the distribution system or in the plumbing of tested homes that may be favorable to the growth of the pathogenic species, *Legionella pneumophila*. In particular, the chronically low levels of a chlorine residual in many parts of the distribution system are likely to increase the risk of opportunistic pathogen colonization.

Additional Notes: The method we used to quantify these pathogens is called quantitative polymerase chain reaction (or qPCR). It works by detecting DNA specific to the target microorganisms, making the method very specific, but also very sensitive, as an organism does not necessarily need to be alive or culturable for us to identify that it is present. The minimum threshold of target bacteria, or more accurately the bacteria's DNA that must be present in the 1-liter samples that we collected is 10 DNA copies per mL or 10^4 copies in the entire swabbed biofilm. This is the best available and most sensitive method of *Legionella* detection.

Sample analyses and write-up: Emily Garner

Acknowledgements: Dr. Marc Edwards and Dr. Amy Pruden

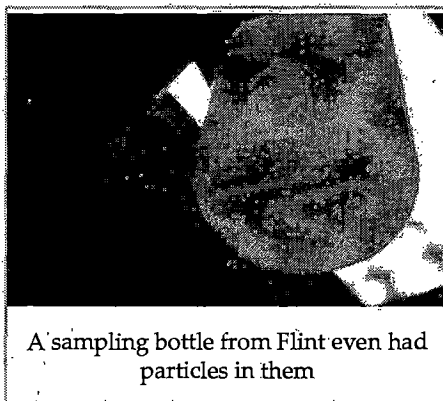
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Analysis of water samples from 48 Flint homes to date for lead are worrisome

(<https://flintwaterstudyupdates.wordpress.com/2015/08/27/analysis-of-water-samples-from-48-flint-homes-to-date-for-lead-are-worrisome/>)

August 27, 2015 flintwaterstudy Articles

Of the first 48 first draw samples collected by Flint residents and analyzed at VT, 52% were over 5 ppb, which suggests a serious lead in water problem according to our experience and criteria. Fourteen samples (30% of those collected) also exceeded 15 ppb lead, suggesting a very serious lead in water problem. That is, the Flint Citizen Science study to date, is finding results worse than the EPA standard which is applied to sampling "worst case" homes. The highest lead sampled in first draw so far was 139 ppb. The 90th percentile lead level is currently 31 ppb, which is double the EPA standard, and in a range where water consumption can cause lead poisoning in children.



A sampling bottle from Flint even had particles in them

Look at our summary page [here \(https://flintwaterstudyupdates.wordpress.com/information-for-flint-residents/results-for-citizen-testing-for-lead-300-kits/\)](https://flintwaterstudyupdates.wordpress.com/information-for-flint-residents/results-for-citizen-testing-for-lead-300-kits/) for more details. We will be relaying our findings to residents in homes with high lead levels in the next few days. We also urge citizens to continue sampling because higher number of samples will allow us to provide even more robust conclusions.

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Research Results for Field Sampling in Flint – August 17-19 2015 (<https://flintwaterstudyupdates.wordpress.com/2015/08/25/research-results-for-field-sampling-in-flint-august-17-19-2015/>)

August 25, 2015 August 25, 2015 flintwaterstudy Articles

Last week, our team visited Flint to conduct extensive field sampling (Aug 17-19, 2015) and evaluate several water quality parameters at different sites within and outside the city (on Detroit water, for comparison). We will post a separate article on trip specifics and our experiences, but here are some preliminary results on what we know so far.

Report 1. Good News. Fecal Indicator Bacteria in Flint.

The most important goal of drinking water treatment is to make sure that fecal bacteria and viruses are removed or destroyed at the water treatment plant. We tested 18 samples collected from around the City of Flint, including 6 from consumer's homes. We had the samples analyzed by the City. Importantly, we also submitted a POSITIVE CONTROL SAMPLE with high levels of fecal bacteria, labeled like every other sample we submitted. This sample let us know if the city's testing could correctly tell us that a badly contaminated sample, was in fact, contaminated. This is a common approach used by researchers, to be sure that a test is working as expected, and that results are trustworthy.

Results: The River had detectable levels of fecal bacteria as is expected, but none of the samples collected from the Flint distribution system had any detection. The city also correctly reported that the POSITIVE CONTROL SAMPLE had high levels of fecal bacteria.

Conclusions: It appears that the treatment plant is achieving their most important goal, and that the city tests are accurate.

Report 2. Bad News. Chlorine measurements in Flint.

<https://flintwaterstudyupdates.wordpress.com/>

8/31/2015

To keep the water safe as it is transported to consumer's homes, it is necessary to maintain a Cl_2 level of 0.2 mg/L or higher throughout the distribution system. In Flint, the *Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, 2012 Edition, Recommended Standards for Waterworks (Ten States Standards)* says that:

- Minimum free chlorine residual in a water distribution system should be 0.2 mg/L.
- Higher residuals may be required depending on pH, temperature and other characteristics of the water.

Results: While we were in Flint, we sampled a total of 17 locations for free chlorine in flushed cold water. Of those 17 samples, 7 samples (41%) did not have any detectable chlorine at all. At one location, Dr. Edwards flushed the tap for 8 hours and never obtained any detectable chlorine. This confirms our concern, that it might not be possible to treat the water to meet existing Federal standards given the high corrosivity of Flint water. In other words, no matter how good the people at the Flint treatment plant are at their jobs, it is possible that Flint residents cannot receive the minimum quality of water mandated by Federal regulations. We will be posting more on this problem in the future.

For comparison, we also took samples of water from a nearby city still using Detroit water, and 4 out of 4 had chlorine levels of 0.2 mg/L or higher. Significantly, these were also collected from hot water samples, which tend to have much lower chlorine than cold water.

Conclusions: It seems very hard to believe that standards for free chlorine residual were being met in the Flint distribution system from August 17-19, 2015.

Primary Author: Dr. Marc Edwards

[1 Comment](#)

Why is it possible that Flint River water cannot be treated to meet Federal Standards?

(<https://flintwaterstudyupdates.wordpress.com/2015/08/24/why-is-it-possible-that-flint-river-water-cannot-be-treated-to-meet-federal-standards/>)

[August 24, 2015](#) [August 25, 2015](#) [flintwaterstudy](#) [Articles, Research Updates](#) [comparison tests, detroit water, drinking water, flint water, iron corrosion](#)

The key problem is that water from the Flint River is highly corrosive to iron and lead, and, unfortunately, these pipe materials are widely used throughout Flint. Herein, we discuss the higher corrosivity of Flint River water to iron, and the associated problem maintaining chlorine disinfectant in the system.

Why is Flint River water more corrosive compared to Detroit water? Flint River water has about 8 times more chloride (Cl^-) in it than Detroit water. Chloride is generally considered to be very corrosive to iron. For instance, chloride present in road salts applied in the winter causes iron in cars and bridges to rust. Detroit also adds a corrosion inhibitor chemical (orthophosphate) to their water that helps to reduce corrosion of metals such as iron and lead. So, current Flint water is not only more corrosive, but there is also no corrosion inhibitor present.

Iron corrosion can cause a serious problem for meeting Federal standards using Flint River Water, because iron corrosion consumes chlorine. Chlorine is added to the water to prevent growth of microorganisms that cause disease, and maintaining a chlorine residual is the best way to protect public health against human pathogens.

To illustrate how iron corrosion is problematic for maintaining a chlorine residual, we collected a sample of Flint water. We put some of that sample into a clean glass container, and some more of it into an identical container with a piece of iron to simulate the effect of water on iron pipes in Flint. We then measured the decay of chlorine over time (Figure 1). The initial level of chlorine was 1.15 milligrams per liter (mg/L), and it stayed pretty high when it was in a glass container. It only dropped to 0.95 mg/L over 12 hours (blue line). Thus, if Flint had a glass (or plastic or concrete) pipe system, chlorine would stay high as it was transported to homes. But when we did the same test with iron present, the chlorine dropped faster due to the corrosion, and was all gone after only 12 hours (red line). After 6 days of doing the test, the chlorine dropped even faster, and was below the minimum required chlorine residual of 0.2 mg/L in just about 1 hour in our test system (green line). **The key point is that Flint River water is corroding iron pipes, and that will cause the chlorine to disappear very quickly.**



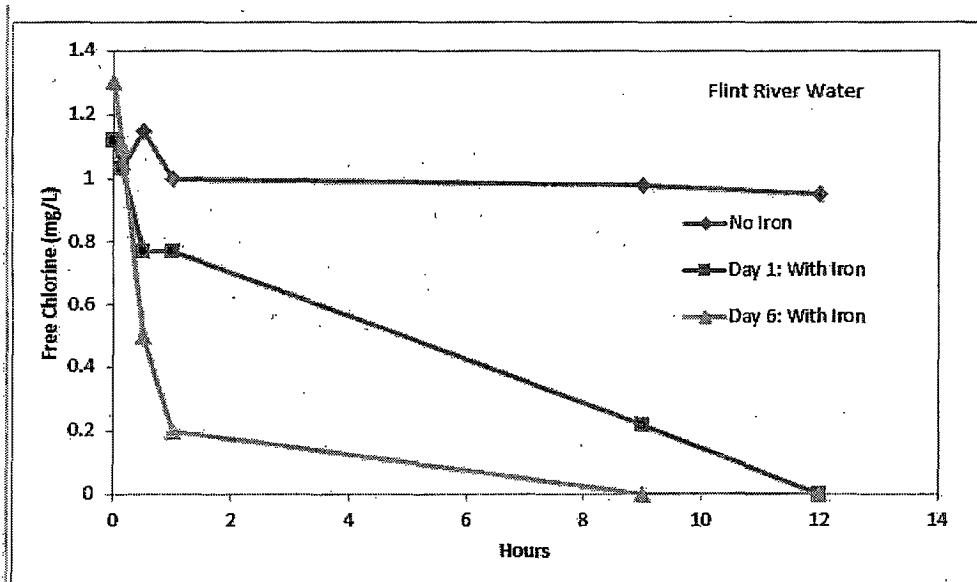


Figure 1: Decaying of free chlorine in Flint River water with and without iron

When we did the exact same test using water from Detroit (collected on the outskirts of Flint), the chlorine in the container without the iron stayed high at about 0.6 mg/L over a 12 hour test (blue line below). When iron was present, chlorine dropped, but much slower than in the Flint River water (red line and green line). Ironically, Detroit water started with only about 60% of the chlorine initially present in Flint water, but ended up with much more chlorine after 12 hours because there was less iron corrosion. What is more, comparing Day 1 to Day 6, Flint water ate up more chlorine the longer the test was run, whereas Detroit water ate up less chlorine the longer the test was run.

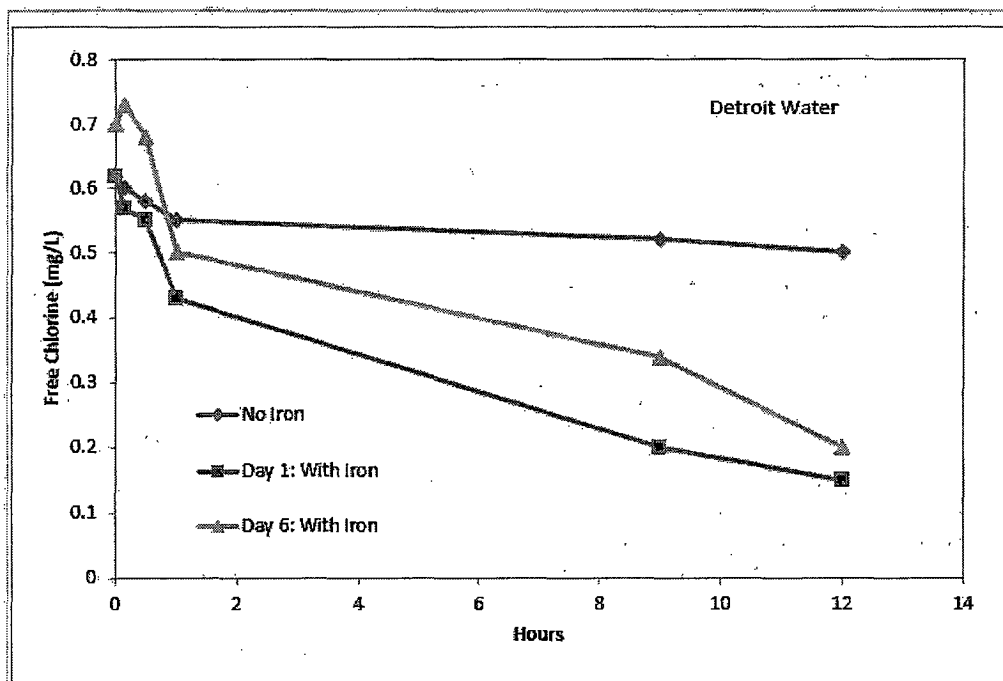
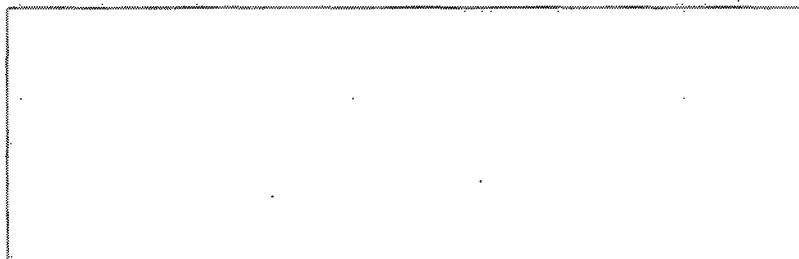
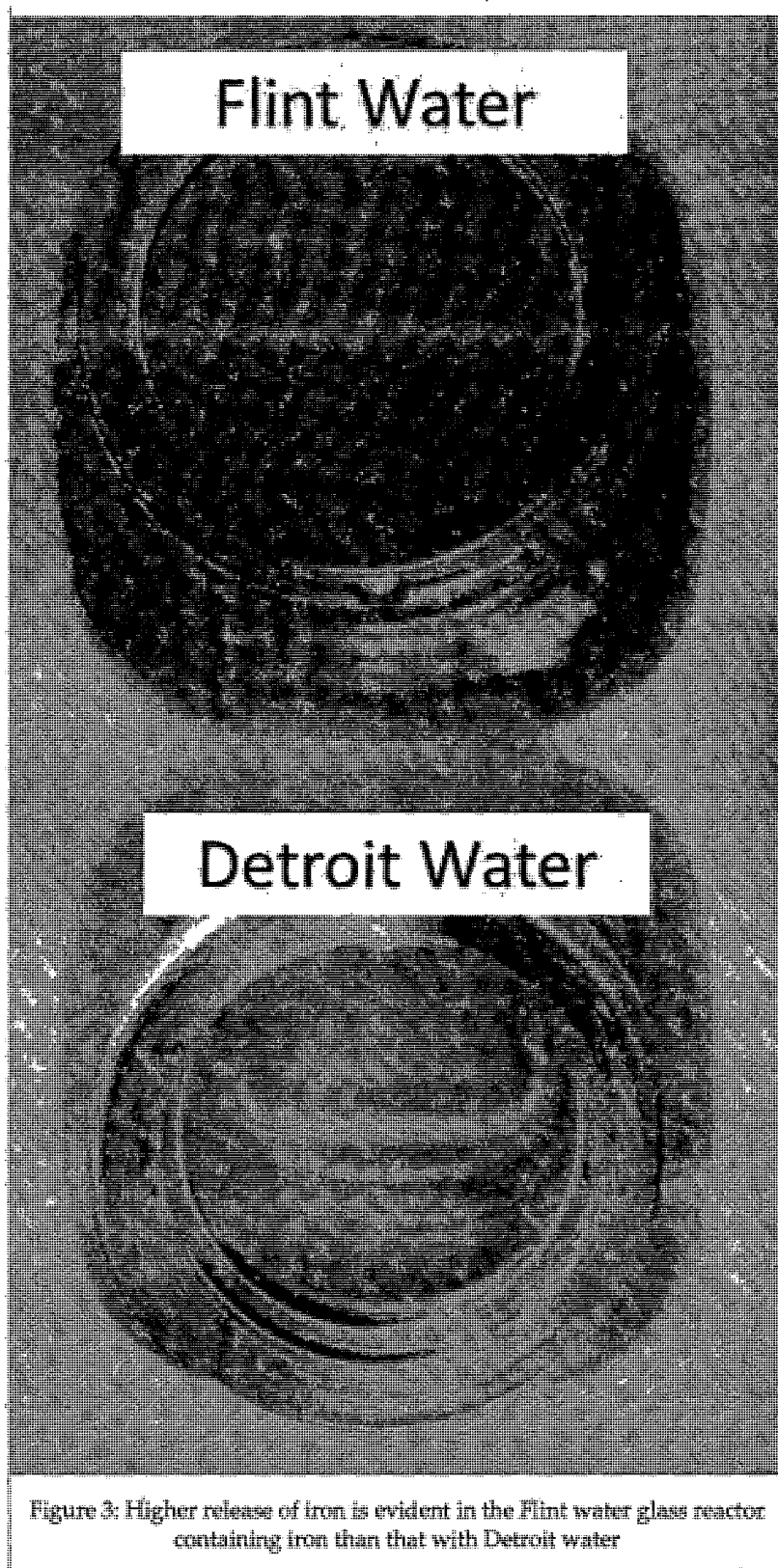


Figure 2: Decaying of free chlorine in Detroit water with and without iron

Figure 3 shows a picture of Flint water and Detroit water after reacting in the glass containers described after the first 5 days of the test. This also illustrates why residents have been complaining of "red" or discolored water after the switch to the Flint River source.





At present, as a rough estimate which we will elaborate on later, it looks like Detroit water is about 5 times less corrosive to iron pipe than Flint River water. This also probably means that the iron pipes in the city of Flint system will fail 5 times faster using the Flint River water rather than the Detroit water. In fact, this is probably already occurring as evidenced by increased rates of water main leaks and breaks (http://www.mlive.com/news/flint/index.ssf/2012/05/flint_officials_water_leakage.html). While an economic analysis cannot yet be done based on our limited data, it is possible (and even likely) that the economic damage to the Flint pipe system due to corrosion is going to cost the city tens of millions of dollars more in pipe repair costs in the coming years compared to what they would have paid if they had stayed on Detroit water.

| Up-to-date information on our collaborative research and citizen science work with the residents ... Page 10 of 13

Conclusion: The high rates of iron corrosion from using Flint River water as a drinking water source are damaging the Flint distribution system (http://www.mlive.com/news/flint/index.ssf/2015/04/flint_dpw_director_says_water.html). The corrosion is also causing chlorine to disappear quickly, which may make it more likely for harmful bacteria to grow in the water. Furthermore, it is possible that with the existing unlined iron pipe system in Flint, and the relatively low water demand (due to declining population, loss of GM – which used a lot of water – as a water customer, and high rates), that it will very difficult to meet Federal standards for minimum chlorine levels no matter what is done to treat the water.

Primary Author: Dr. Marc A. Edwards

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300 Lead Testing Kits Dispatched to Flint from Virginia Tech (<https://flintwaterstudyupdates.wordpress.com/2015/08/24/300-lead-testing-kits-dispatched-to-flint-from-virginia-tech/>)

[August 24, 2015](#) [August 24, 2015](#) [flintwaterstudy](#) [Articles, Research Updates](#)

Students and scientists (see [About Us](https://flintwaterstudyupdates.wordpress.com/about-us/) (<https://flintwaterstudyupdates.wordpress.com/about-us/>)) at Virginia Tech assembled and shipped 300 kits for Flint residents to sample their water and get it analyzed for lead. The kits comprise of three bottles (1L, 500 mL and 250 mL ones) and an [instruction sheet](https://goo.gl/Zyp0YY) (<https://goo.gl/Zyp0YY>) for sampling tap water. All 300 kits were sent out August 14th (Friday) and reached Flint on August 19th (Wednesday). Here are some pictures of our team assembling the kits.



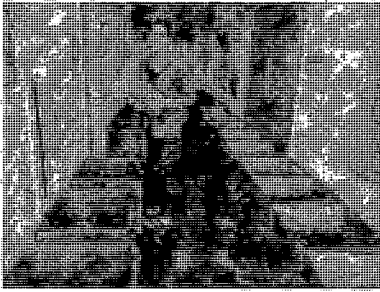
(<https://flintwaterstudyupdates.wordpress.com/2015/08/24/300-lead-testing-kits-dispatched-to-flint-from-virginia-tech/p1060132/#main>)



(<https://flintwaterstudyupdates.wordpress.com/2015/08/24/300-lead-testing-kits-dispatched-to-flint-from-virginia-tech/p1060141/#main>)

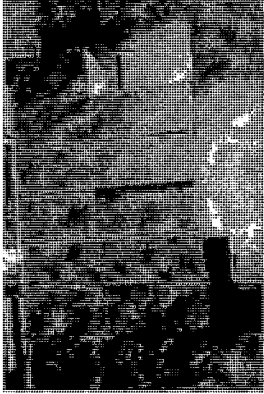


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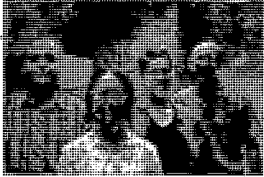
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[from-virginia-tech/p1060151/#main](https://flintwaterstudyupdates.wordpress.com/2015/08/24/300-lead-testing-kits-dispatched-to-flint-from-virginia-tech/p1060151/#main))



([https://flintwaterstudyupdates.wordpress.com/2015/08/24/300-lead-testing-kits-dispatched-to-flint-from-virginia-](https://flintwaterstudyupdates.wordpress.com/2015/08/24/300-lead-testing-kits-dispatched-to-flint-from-virginia-tech/img_6870/#main)

[tech/img_6870/#main](https://flintwaterstudyupdates.wordpress.com/2015/08/24/300-lead-testing-kits-dispatched-to-flint-from-virginia-tech/img_6870/#main))



([https://flintwaterstudyupdates.wordpress.com/2015/08/24/300-lead-testing-kits-dispatched-to-flint-from-virginia-](https://flintwaterstudyupdates.wordpress.com/2015/08/24/300-lead-testing-kits-dispatched-to-flint-from-virginia-tech/img_6866/#main)

[tech/img_6866/#main](https://flintwaterstudyupdates.wordpress.com/2015/08/24/300-lead-testing-kits-dispatched-to-flint-from-virginia-tech/img_6866/#main))

The VT group also made an instructional video for water sampling on YouTube to complement the instruction sheet:

Flint's non-profit group Water You Fighting For?

([https://www.facebook.com/WaterYouFightingFor/photos/a.808792962547356.1073741832.792641617495824/874347885991863/?](https://www.facebook.com/WaterYouFightingFor/photos/a.808792962547356.1073741832.792641617495824/874347885991863/?_rd=1&p=10&type=1)

[_rd=1&p=10&type=1](https://www.facebook.com/WaterYouFightingFor/photos/a.808792962547356.1073741832.792641617495824/874347885991863/?_rd=1&p=10&type=1)) is helping coordinate distribution of these kits to volunteering homes and we are expecting the first batch of 25 kits back in the next couple of days. We are grateful to Water You Fighting For? (Melissa Mays and LeeAnne Walters), Laura Sullivan, ACLU of Michigan (Curt Guyette), Democracy Defense League (Claire McClinton and Nayyirah Shariff), Concerned Pastors for Social Action (Alfred Harris Sr.) and all Flint residents for their dedication and drive towards a well-organized sampling effort to maximize identification of potential lead problems in households.

Erin Brockovich's voice of support:

| Up-to-date information on our collaborative research and citizen science work with the residents ... Page 12 of 13
If you don't see a tweet above, go [here](https://twitter.com/ErinBrockovich/status/631979253123317760) (<https://twitter.com/ErinBrockovich/status/631979253123317760>).

[Leave a comment](#)

Hazardous Waste-levels of Lead found in a Flint household's water (<https://flintwaterstudyupdates.wordpress.com/2015/08/24/hazardous-waste-levels-of-lead-found-in-a-flint-households-water/>)

August 24, 2015 August 24, 2015 flintwaterstudy Uncategorized

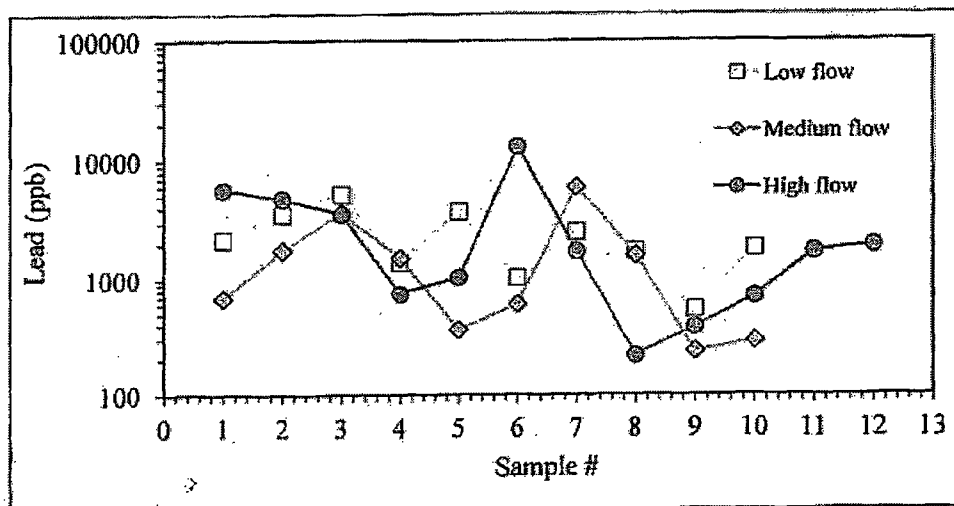
LeeAnne Walters had children with health problems that she was concerned might be linked to the poor water in her home. The water in her home was very brown, even after it was passed through a filtered designed to remove particles. The City of Flint tested her water in March 2015 and found

(<http://www.deadlinedetroit.com/articles/12697/scary-leaded-water-and-one-flint-family-s-toxic-nightmare#.VbLvmvIViko>) 104 parts per billion (ppb), and tested it again and found 397 ppb lead. Even more worrisome is that these high lead levels came after using sampling techniques that tend to make lead levels lower in samples that the city collects. These include use of bottles with very tiny opening and preflushing. Pre-flushing is the act of flushing cold water for 3-4 minutes, prior to beginning the required stagnation period of 6+ hours, after which water samples are taken for lead testing. Pre-flushing essentially "pre-cleans" the lead from the plumbing, and also virtually eliminates the likelihood of detecting lead in water that can come from lead pipe. Likewise, use of bottles with tiny openings, forces consumers to collect water at a very low flow rate, which tends to reduce the amount of lead in water compared to normal use.



Figure 1: LeeAnne Walters shows samples taken from her home on January 21 and January 15 this year to Flint's emergency manager Jerry Ambrose during a January 21 forum (Image courtesy: [The Daily Mail/AP](http://www.dailymail.co.uk/news/article-2978777/Protests-water-taste-smell-city-breaks-tie-Detroit.html) (<http://www.dailymail.co.uk/news/article-2978777/Protests-water-taste-smell-city-breaks-tie-Detroit.html>))

Virginia Tech collaborated with Ms. Walters' on a follow-up sampling event. In this case we used bottles that allowed consumers to use water at a normal flow rate. We also collected 30 bottles from her home at low, medium and high flow rates. The drinking water samples all had extremely high lead levels between 200 ppb to 13,200 ppb (Figure 2). Water containing more than 5,000 ppb of lead, exceeds criteria that classifies water as a hazardous waste. The US EPA action level for lead is 15 ppb and the World Health Organization (WHO) maximum lead level is 10 ppb. Thus, the lead levels in Ms. Walters' water were very alarming by any standard.. It is also important to point out that there is NO safe level for lead in water.



Sample results and graph are provided courtesy of Virginia Tech

Figure-2 Results for lead in sequential sampling (1L water samples taken consecutively) at low, medium and high flows — Results range from 200 to 13,200 ppb

When first viewing the results, Dr. Marc Edwards (who assisted Ms. Walters in the sampling) was in disbelief. "I called Dr. Jeff Parks, who is a senior research scientist who ran the samples, and asked him if this could be an error, because we had never seen such sustained high levels of lead in 25 years of work", he said. The samples were re-tested with extra quality assurance/quality control checks, all of which confirmed the astronomical lead levels in Ms. Walters' water. Figure 3 shows close-up pictures of rust particles found in Ms. Walters' water.

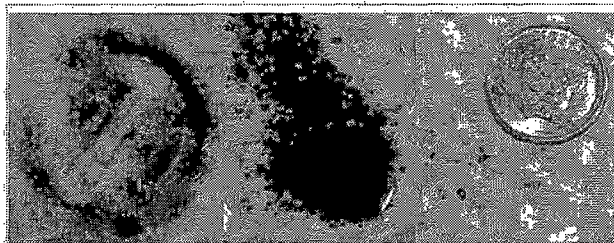


Figure 3: Looking into the bottom of a 1L water sample from Ms. Walters' house (left); close-up of large rust particles (middle and right) — Photograph courtesy Kelsey Pieper and Min Tang

Ms. Walters and her family were not drinking the water, so it was a mystery as to how one of her kids, a four year old, could have been lead poisoned (<http://www.aclumich.org/sites/default/files/file/EPAWaterReport062415.pdf>), as was evident from blood tests done after the city tested the water and found high lead levels. Their home is otherwise lead free. It is possible that in this unusual case, that the level of lead in the water was so high, that her children did not have to drink it to be exposed. Ingesting the lead indirectly, after washing their hands, showering, bathing or even washing dishes, may have caused the high lead in their blood.

We will be examining the hypothesis of the city officials, that problems with lead over the EPA Action Level are isolated to Ms. Walters' home.

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Acknowledgements: Dr. Marc Edwards, Dr. Jeffrey Parks

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