Kettering University
1700 University Avenue • Flint, Michigan 48504-6214

Monday, January 18, 2016

To: The Kettering Community of Parents of our Students and our Alumni

Subject: Kettering Campus Water Update

I know that you value the excellence of the education we provide, but I expect as alumni or parents of students currently enrolled at our great University that you are concerned about the barrage of news about Flint's water supply. I am a proud parent of a Kettering student, and my family and I reside in Flint, so I understand deeply and very personally how you might be feeling about the situation as reported in the media.

Last week, I sent a detailed Kettering Water Update letter to our campus and to our students. Because I know (from direct experience!) that students may not always communicate promptly with their parents on even important issues, I thought I would take a moment to update you and our alumni directly on this issue, because I know it is a subject of concern.

Unfortunately, as is often the case in public crises, a great deal of misinformation about the water supply in Flint is being reported as fact. Just as distressingly, though, a great deal of important information that we do have about the situation is also *not* being reported.

Kettering campus water is safe, and our faculty, staff, students, and campus residents are **not** being exposed to contaminated water on campus. We are, and have been even before the current crisis emerged, committed to ongoing testing of our water to ensure the safety of the campus water supply. Moreover, the entire water supply of Flint has not been contaminated with lead; although some sections of the city have experienced problems, some severe, other sections have not.

All of us deplore that any single person has been exposed to unsafe levels of lead in the water; however, many, many people living in Flint have not been exposed to water containing elevated levels of lead in their residences or places of business. To date:

- Roughly 2% of all individuals tested in Flint have shown elevated blood lead levels.[1]
- Twenty-three (23) children younger than age six tested in Flint show elevated blood levels of lead.[2]
    - Children under the age of 5-6 are the most vulnerable population with respect to the long-term health effects of lead; in the U.S., 535,000 children under the age of 5 have elevated blood lead levels high enough to damage their health.[3]
- A total of 43 of 2182 of people tested in Flint show elevated blood levels of lead.[4]

I also want to clarify that *the water from the Flint River that was used as the city's water source from April 2014 through October 2015 was not contaminated with lead.* The contamination, where it occurred, was due primarily to interactions between treated river water and lead supply

[1] http://www.michigan.gov/documents/deq/Flint_Blood_Testing_Report_December_23_509464_7.pdf
[2] http://www.mlive.com/lansing-news/index.ssf/2016/01/43_flint_residents_identified.html
[3] http://www.cdc.gov/nceh/lead/infographic.htm
[4] ibid.

lines in the distribution system, particularly in lead lines connecting individual houses to local water mains. This is not a global problem with the water, but a problem with how that water - after treatment - interacted with some pipes and other elements of the city's distribution system. This interaction was often (considerably) different - even house-by-house on a single block.

In this letter I want to outline for you what we know about the nature of the contamination of the Flint system, how the university has responded to it, what we have done and are doing on an ongoing basis to ensure the integrity and safety of drinking water on the campus, and how we are working to ensure that those in the campus community who live off-campus in private housing have access to appropriate information, tests, and filters to ensure and monitor the safety of their private supplies.

Because I want to document what I write, I am also including footnotes that will lead you, if you are interested, to the sources of my information, something I learned to do as a faculty member and still highly value. We are committed to deploying every resource at our disposal to continue to ensure the safety of our entire campus community and our visitors. We value your input, and I hope that as members of the Kettering Community and of this great University that the information presented in this letter is helpful to you. If you have questions, comments, or thoughts on this issue we welcome you to send them to us at water@kettering.edu.

Introduction

Inflated lead levels have been detected in the water supply in a number of areas in the city of Flint, and these have received significant medical, political, and media attention over the last three months. The State of Michigan officially declared a state of emergency in Flint on January 6, 2016,[5] and the Federal Government followed on January 16, 2016.[6] Federal, state and local officials have now engaged and are taking more aggressive corrective action to address this situation and the public health crisis that has resulted from it. Proudly, many in the Kettering Community have taken a very active role in helping those families and children in Flint impacted by this health crisis since its beginning last year.

The levels of lead found in some areas of Flint are gravely upsetting, but I want again to stress that the problem of lead contamination in public and private drinking water supplies is not present in all of Flint. Unfortunately, this distinction has been absent from much of the reporting on this subject in the media. Reports often imply that the water was tainted at the source (i.e. the Flint River), or that contamination of the water is uniform across the entire distribution system and that every house and business has been equally affected.

I also think it important for us to recognize that this problem is widespread and in fact is not isolated to Flint.[7] For example, I am sad to report, drinking water supply contamination, in some cases at levels far worse than have been found in Flint, has been found in Washington D.C., Seattle, Baltimore, Philadelphia, and Los Angeles among other cities and areas of the country.[8] In Michigan, elevated blood-lead levels have been found in an even higher percentage of children

[5] http://www.freep.com/story/news/local/michigan/2016/01/05/us-attorneys-office-investigating-lead-flint-water/78303960/
[6] http://www.mlive.com/news/flint/index.ssf/2016/01/president_obama_signs_emergenc.html#incart_2box_news_flint
[7] http://www.cdc.gov/nceh/lead/leadinwater/
[8] ibid., http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5312a6.htm, http://www.washingtonpost.com/wp-dyn/content/article/2009/08/03/AR2009080303003.html, and http://www.yaleseas.com/watersymposium/pdfs/EdwardsLeadPaper.pdf

than Flint is experiencing in sections of Jackson, Detroit, Grand Rapids, Saginaw, Holland, and a number of other cities.[9]

The Nature of the Problem

First, the nature and cause of the contamination are reasonably well understood at this point. In brief:

- Historically, the Flint water system used and distributed treated water from Detroit Water Authority. It did so until April 2014, when it switched to treating water from the Flint River in an existing Flint water treatment plant.
- The "raw" river water to which the city switched in April 2014 was not contaminated with lead.
- The water within *some* sections of the distribution network was, however, contaminated *after* the water left the treatment plant by the leaching of metals such as lead, iron, and copper from lead service lines and lines containing lead solder.

After the switch to river water, the City failed to treat the water for corrosivity by managing its chemistry,[10] which lead to the erosion (and release) of lead-bearing pipe scale in supply lines[11] and lead/copper galvanic corrosion of lead solder and lead copper joints in the distribution system.[12] Because raw water quality varies across the US, federal law requires all municipal water systems to have a corrosion control plan to address this possibility; this regulation is known as the Lead and Copper Rule.[13] Flint unfortunately did not have such a plan in place when it switched the water source to the River.

Here I want to stress that the lack of corrosion control did not, in and of itself, make the water unsafe. What it did do, however, is increase the potential for the water to react chemically with certain types of plumbing systems, and in doing so leach lead and other metals (if they were present) from those systems.

And if this isn't enough complexity, the City (out of what I'm sure were benign motives) used a relatively high level of chlorine to treat the river water to prevent bacterial growth in the supply. The unanticipated consequence of this choice, combined with a lack of activated charcoal filtration in the treatment process, led to the subsequent production of elevated levels of trihalomethanes (which are disinfection by-products of water chlorination) in the water, but these were present primarily in areas of the system where the water pooled or moved through the system slowly.

In October of last year, Flint switched its water source back to Detroit Water Authority. It took approximately 3-4 weeks for the Detroit source water to replace fully all of the water in the distribution system. In December, Flint also began introducing additional corrosion control

[9] http://www.crainsdetroit.com/article/20151210/NEWS/151219980/interactive-map-places-with-higher-lead-rates-than-flint

[10] Specifically the chloride-to-sulfate mass ratio in the treated water, which can be influenced by salt entering the source river from runoff or changes in the way that organics are removed in the treatment process. This is typically adjusted by adding lime or orthophosphates in the treatment process, see http://www.waterrf.org/publicreportlibrary/4088.pdf

[11] http://pubs.acs.org/doi/pdfplus/10.1021/es101328u?src=recsys&

[12] http://www.awwa.org/publications/journal-awwa/abstract/articleid/26682.aspx

[13] http://www.epa.gov/dwreginfo/lead-and-copper-rule and http://www.ecfr.gov/cgi-bin/text-idx?SID=531617f923c3de2cbf5d12ae4663f56d&mc=true&node=sp40.23.141.i&rgn=div6

additives to the water supply.[14] It did this expecting that the addition of these additives will, over time, help to rebuild the protective scale on the inside of the parts of the distribution system where it has been damaged.

Not All Areas of Flint were Impacted Equally

The specific mechanisms that gave rise to the contamination of the system mean that **not all areas of the system were equally impacted**. Portions of the system that do not contain lead service lines or lead solder were not as greatly impacted as those that do. Older parts of the system, especially sections built in the 1940's through the 1960's[15] that have not been upgraded since their construction are disproportionately vulnerable.[16] Other areas are far less so.

As a consequence, **the presence of lead contamination in the water supply was not uniform across the entire municipal water system, and not all areas of the city or all resident supplies were equally affected by it**. [17]

- The amount of lead that leached into a given part of the system depended upon a variety of factors, including the age of the system in the area, the specifics of its construction (e.g. are lead service lines present), and the time that water typically spends in that part of the system between treatment and use.
    - The levels of lead contamination measured in the water drawn from a particular source point depends upon the characteristics of the infrastructure through which the water passed, and how long it took to do so. **This is why water drawn in some houses on a single block might show measurable lead contamination, while others did not.**[18]
- For the same reason, as I noted earlier, only a percentage of Flint residents have been exposed to water containing elevated levels of lead in their residences or places of business.[19]

Kettering's Campus Water Supply and Our Approach to Ensuring its Safety

The municipal water infrastructure that supplies Kettering is relatively modern, the flow-rates of water through the system are high, and we do not have lead-copper transitions in the main supply lines, as do many residences in some areas of the city. All of these factors reduce the chance of contamination in our supply. Even so, the University has taken a number of proactive steps to ensure that the campus drinking and cooking water supplies are free from contamination, a number of which have been described in previous communications to the campus on this issue. These include:

[14] https://www.cityofflint.com/2016/01/10/flint-city-leaders-county-state-officials-announce-relief-effort-expansion/
[15] In the early part of the last century, many municipal codes *required* the use of lead pipes when connecting homes and businesses to municipal water mains but most codes banned the use of lead pipes by the early 1970's. Chicago, for example, continued to require them as recently as 1986, see: *EPA warns modernizing water system may boost levels of lead*, Chicago Tribune, September 25, 2013. Some major U.S. cities still have 100% piping bringing water from the utilities to homes and businesses, see: https://www.safeplumbing.org/health-safety/lead-in-plumbing.
[16] http://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=20001R4V.txt
[17] For an example see: http://www.michigan.gov/documents/deq/Copy_of_deq-fw-Flint-Home-Owner-Data-Sept-3-thru_Nov-5-15_505529_7_505579_7.pdf
[18] ibid.
[19] ibid.

- Since early 2015 (after the switch to river water but before lead contamination was suspected), the University has been engaged in recurring testing of all drinking and food service water distribution points on campus using an independent, certified laboratory (Brighton Analytical, LLC). We will continue to test all drinking and food service water distribution points (and there are almost 100 of these) indefinitely.
- We also similarly test incoming water from our (six) Flint Municipal Water system input supply lines.
- All food service water source lines are flushed for a minimum of five minutes prior to use each morning, and only cold water is used, consistent with EPA guidelines.[20]
- We use NSF/ANSI 53 certified filters on all drinking water supplies on campus; these filters are certified to remove lead and trihalomethanes in addition to a wide variety of other contaminants and suspended solids. You may find details on the NSF/ANSI 53 certification standard at nsf.org and on the websites of manufacturers that produce filters conforming to this standard. There are 31 specific performance criteria that fall under Standard 53.
- All of our filters are maintained and replaced at the intervals recommended by their respective manufacturers.
- To be conservative, we shut off all water fountains on campus where the filters for that fountain were located at a significant physical distance from the fountain itself (usually because of space restrictions in the fountain cabinet).

  We did this as a precautionary measure, since it is possible for lead (if, for example lead solder was used in its supply line) to be produced through the interaction of water with plumbing in the supply line *after* it has been filtered *if* that water is allowed to sit undisturbed for a protracted time in the supply line (such as when a water fountain is used very rarely).

We do not test the water used in toilets, bathroom vanities, or showers, **but we do test the sources from which they draw water** (i.e. the input supply lines to campus). **Human skin does not absorb lead in water**, so bathing, washing, or showering is safe even using water containing lead over the EPA's action level.[21] [22] Adults may safely use unfiltered water for brushing their teeth.[23]

In addition, we continue to make improvements to our local system to improve convenience and ensure safety. One of the most visible of these is the replacement of many of our water fountains across campus with hydration stations; this project in fact began a number of years ago. All of our hydration stations are monitored and contain integral NSF/ANSI 53 water filtration systems.

How are Lead Levels in Water Specified and Interpreted?

The concentration of a metal, like lead, in water is often measured in parts per billion, usually denoted **ppb**. A concentration in water of 1 ppb represents one gram, or three one-hundredths of an ounce (3/100 ounce), of a substance in 260,000 *gallons* of water. One ppb is also three seconds

[20] EPA 810-F-93-001
[21] http://www.cdc.gov/nceh/lead/tips/water.htm
[22] http://www.michigan.gov/deq/0,4561,7-135-3313_3675_73946-372051--,00.html
[23] http://www.michigan.gov/documents/deq/2015-10-21_-_Lead_-_Flint_Water_FINAL_504265_7.pdf

out of 100 years. **Ten parts per billion (10 ppb) is the equivalent of approximately one teaspoon of water in an Olympic-sized swimming pool.**

The EPA has set an action level for lead in drinking water supplies at 15 ppb. In other words, if drinking water contains lead below this level, EPA regulations state that no action is required.[24]

For reference, the EPA permits faucets to be sold in the U.S. that leach 10 ppb or less of lead into water during a 19-day test.[25] Studies conducted by the EPA have found that the geometric mean of lead levels in drinking water systems in the US is 2.8 ppb.[26]

Results of Our Ongoing Testing

- As of the date of our last test series and over the past many months, we have tested the water drawn from the six input lines to campus a total of 15 times and all tests have resulted in a measured level of "ND" (for "None Detected"), with only three, single-test exceptions. In these three exceptions:
    - One detection was at 1 ppb, one was at 5 ppb, and the other was at 7 ppb. All of these are significantly lower than the EPA's allowable limit for lead of 15 ppb.[27]
    - These were single point-in-time detections; **later repeat testing of the same distribution points detected no lead**.
- **No lead has ever been detected in any water source used for food preparation.**
- As of the date of our last test series and over the past many months, all drinking water distribution points (e.g. water fountains) on campus have consistently tested "ND" (for "None Detected") for lead, with only six, single-test exceptions in well over one-hundred tests conducted. In these six exceptions:
    - All detections were at levels of less than 5 ppb (1,4,5,2,3 and 2 ppb respectively); all are significantly under the EPA's allowable action limit for lead of 15 ppb.[28]
    - These were single point-in-time detections; **later repeat testing of the same distribution points detected no lead**.

Access to Test Data

We make all results of these tests public. You may always find our latest test results along with other information related to the state of water in Flint at http://www.kettering.edu/water. We will continue to update the test reports on this site as we receive them.

[24] http://www.cdc.gov/nceh/lead/tips/water.htm
[25] https://www.safeplumbing.org/health-safety/lead-in-plumbing
[26] Levin R, Schock MR, Marcus AH. Exposure to lead in U.S. drinking water. In: *Proceedings of the 23rd Annual Conference on Trace Substances in Environmental Health.* Cincinnati, OH, US Environmental Protection Agency, 1989.
[27] http://www.cdc.gov/nceh/lead/tips/water.htm
[28] ibid.

On this same webpage, you will also find a link to PDF copies of the certified assay reports provided to us by our independent laboratory.

We have encouraged our students to speak with their parents or guardians about this issue, and to share with them all communications they receive from us. Copies of all of our communications to students on this matter may also always be found at http://www.kettering.edu/water.

More Information

If you have further concerns, I encourage you to read the Centers for Disease Control website on lead contamination of water at http://www.cdc.gov/nceh/lead/leadinwater/ and http://www.cdc.gov/nceh/lead/tips/water.htm as well as the citations in this letter. Additional information is also available on our website at http://www.kettering.edu/water.

If you have technical questions about the campus water supply, they may be directed to Nadine Thor, Director of Auxiliary Services, at nthor@kettering.edu. Questions from students or their families of a more general nature should be directed to Dean Betsy Homsher, Dean of Students, at bhomsher@kettering.edu.

We will of course continue to update the campus as this situation evolves.

Members of the Kettering Community that Live off Campus in Impacted Areas

We have encouraged our students, faculty and staff who live off campus within Flint city limits to use bottled water, to test their water (which also supports the city's data collection and analysis efforts), and to use appropriate water filtration in drinking water sources until notified otherwise by civil authorities.[29]

In the interim, **free bottles of water, water filters, replacement cartridges, and home water testing kits are widely available to all Flint residents.**[30] There are multiple distribution points for these around the city, and the University maintains a supply of filters in the Office of Student Life for students otherwise unable to obtain them.

Information on the city's distribution of all of these items to residents may be found at www.michigan.gov/deq. Students residing off campus needing assistance in acquiring water, test kits, and/or faucet filters have been encouraged to contact the Office of Student Life at (810) 762-9871.

A Note on Water Clarity

You may see pictures of bottles of rusty or cloudy water in articles on water safety; the same has been true of the reporting surrounding the water crisis in Flint.

The presence of suspended rust in water can turn it orange, red, brown or yellow. The presence of rust in water is not an indication of the presence of lead or other contaminants in the water, nor does it necessarily indicate that the water is unsafe to drink.[31] In water, lead is colorless, odorless, and tasteless,[32] and the presence of rust in water does not indicate the presence of lead, bacteria, or other substances.

[29] http://www.michigan.gov/deq/0,4561,7-135-3313_3675_73946---,00.html
[30] http://www.michigan.gov/deq/0,4561,7-135-3313_3675_73946-366279--,00.html
[31] http://www.quincyma.gov/CityOfQuincy_Content/documents/RustyWaterFactSheet.pdf
[32] http://extension.psu.edu/natural-resources/water/drinking-water/water-testing/pollutants/lead-in-drinking-water

> *On its own, rust in water is not a sign of harmful bacteria or lead. In fact, the limits set by the Environmental Protection Agency (EPA) for iron in drinking water are based on aesthetics (taste, odor, color), not safety concerns.*[33]

Trapped air (in the form of small bubbles) in the water can also turn it cloudy or milky. Water pipelines are pressurized systems, so any air introduced into the system can remain trapped until the water leaves a faucet. This cloudiness is not indicator of water quality.

The NSF/ANSI 53 water filtration systems we use on campus for all drinking water remove suspended particulates including the iron that can discolor water (known as "turbidity reduction").

Legionella

It has very recently been reported[34] that there were an unusually high number of cases of Legionnaire's Disease seen in Genesee County in 2014-2015.[35] It has also been suggested in the media that this increase related in some way to the switch in the Flint water supply. Roughly half of the cases identified are in individuals who live outside of the city and the Flint municipal water service zone,[36] and a possible causal link between the two has absolutely not been established.

We have no evidence of any member of the University community having contracted Legionnaire's Disease.

Legionnaire's Disease is not contracted by drinking water containing *Legionella* nor is it transmitted between individuals. It is not contagious.

Legionnaire's Disease is a form of pneumonia caused by the bacteria *Legionella pneumophila*, and it is treatable with several classes of antibiotics.[37] It has an incubation period of two to ten days. *Legionella* do not survive in water above 140 °F (60 °C). *Legionella* are normally found in rivers, lakes, and streams,[38] and they are normally present in the water systems of large buildings and even in a percentage of residential water systems.[39]

Legionnaire's Disease is primarily contracted by heavy smokers, immunocompromised individuals, and individuals with chronic lung disease[40] through the aspiration of water or the inhalation of water mist contaminated with the *Legionella* bacteria.[41] Even after exposure to *Legionella* most people do not become sick.

Cooling towers for large buildings are frequently cited as potential breeding ground for *Legionella* bacteria if they are not regularly maintained and disinfected.[42] **The University has for many years routinely monitored and disinfected all cooling towers on campus.**

As part of a proactive effort, though, we have also begun ongoing and recurring testing of our water for the presence of *Legionella.* We will take appropriate action (which we will report) if elevated levels of the bacteria are detected in campus water supplies in the future. We will of

[33] http://www.berkeleywellness.com/healthy-eating/food-safety/article/rusty-water
[34] http://www.freep.com/story/news/local/michigan/2016/01/13/snyder-flint-area-has-seen-spike-legionnaires/78750610/
[35] http://www.mlive.com/news/flint/index.ssf/2016/01/legionnaires_disease_cases_spi.html
[36] http://media.mlive.com/newsnow_impact/other/Legionellosis+Analysis+Report+20150604.pdf
[37] http://legionella.org/about-the-disease/what-is-legionnaires-disease/treatment/
[38] http://legionella.org/about-the-disease/what-is-legionnaires-disease/legionella-bacteria/
[39] http://legionella.org/faqs/general-public/disease-sources/
[40] http://www.cdc.gov/legionella/about/people-risk.html
[41] http://www.cdc.gov/legionella/about/causes-transmission.html
[42] http://www.cdc.gov/healthywater/other/industrial/cooling_towers.html

course publish the results of these tests on http://www.kettering.edu/water when they become available.

Federal Emergency Declaration

On January 16, 2016 and at the request of the state of Michigan, President Obama signed an emergency declaration the purpose of which is to make Federal aid available to the city in support of current filter and water distribution efforts to impacted persons in the city.[43] Substantively, this declaration simply mobilizes the Federal Emergency Management Agency (FEMA) to assist in these efforts and also makes certain federal funds available to the city for the purpose of supporting these activities. As stated in the order, it "is to provide water, water filters, water filter cartridges, water test kits, and other necessary related items for a period of no more than 90 days."[44]

A Kettering Professor (from the Beginning) and Our Students have been and will continue to be Part of the Solution

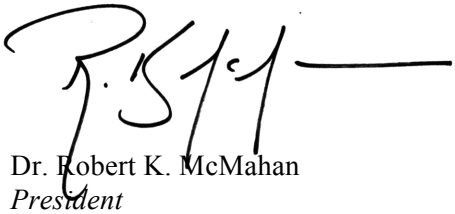
Last year, Kettering's Mechanical Engineering Professor Laura Sullivan was asked to co-chair Flint's Technical Water Advisory Board and was recently appointed by Mayor Karen Weaver to the Karegnondi Water Authority. This is important work, and through it she makes all of us in the greater Kettering family a key part of the solution. I want to take this opportunity to recognize her and to thank her for her service to Flint and the University.

Our students are some of the most creative in the world, and so we have been and are continuing to organize ways for our students, often in teams, to solve some of the challenging and unforeseen problems that have arisen in the distribution and installation of filters in affected areas of Flint. These efforts not only take advantage of the expertise and ingenuity of our students but they are also consistent with Kettering's ongoing commitment to Flint. We will make information on these efforts available on http://www.kettering.edu/water as it becomes available.

Please know that we are deploying every resource at our disposal to ensure the safety of our entire campus community and our visitors, and we will continue to work with federal, state, and local officials to help create long-term solutions to these problems. We value your input, and I hope that as valued members of the Kettering Community and of this great University that this letter has been helpful to you. If you have questions, comments, or thoughts on this issue or the University's response to it please send them to us at water@kettering.edu.

Thank you.

Warmest Regards,



Dr. Robert K. McMahan
President

[43] http://www.mlive.com/news/flint/index.ssf/2016/01/president_obama_signs_emergenc.html
[44] ibid.