Comments from Marc Edwards

<u>Reference and Abstract for Cartier Poster</u>

The reference and abstract for Clements' Poster Presentation is below.

This paper will also be presented at ACE in DC., June 2011.

Cartier, C., Shokoufeh, N., Laroche, L., Edwards., M. and M. Prévost.
Effect of flow rate and lead/copper pipe sequence and junction types on galvanic and deposition corrosion of lead pipe. Poster presented at the Canadian Water Network Conference February 28 to March 3, 2011.
http://www.cwn-rce.ca/wp-content/uploads/2010/11/CWR-abstract-booklet.pdf

<u>Background Information on: 1) WASA's 2008 post-partial study sampling protocol, 2) Sandvig protocol information, 3) data from lead pipes in DC showing impacts of flow on particulate lead release from service lines</u>

1) Attached is the protocol used in the 2008 sampling program by DC WASA.

10 minute pre-flush the eve before sampling, and uses a bottle with a small opening.

As an aside, the run the water until the temperature changes instruction, also generally misses the water in the service line.

Our concerns about this protocol were presented to the DC Council in 2008.

We obtained this via FOIA.

2) In relation to data from Sandvig, on page F-3 of their report, it is noted that they **<u>pre-flushed 15 minutes</u>** before the 6 hour stagnation time, and before profiles were collected. Again, this is a procedure that temporarily remediates and lowers release of particulate lead from service lines. I do not see the flow rate listed for collection of their profiles in the report, but they cite Giani et al., who used a very low 1.4 liter per minute flow rate. I seem to recall HDR used a rate of 1 liter every 30 seconds, but I definitely remember the flow rate was low. You might note that even with the 15 minutes pre-flushing and low flow rate to collect profiles, particulate lead release from the service line was still a problem. This author also notes a significant increase in lead from faucets when sampled at higher flow rates in her report, comparing 1 lpm vs. 4 lpm. They did not check flow dependency for lead service lines.

3) We did check flow dependency for lead service lines in DC. We collected data on particulate lead release in a DC home with a lead service line in 2004. We timed the sample collection to obtain water from the service line and repeated the procedure in triplicate at each flow rate. The data below is Figure 5 of a paper we previously submitted to the SAB (*Lead in Tap Water and in Blood: A Critical Review; Triantafyllidou 2011, which is a draft form of a paper accepted for*

publication in Critical Reviews in Environmental Science and Technology). The figure is presented below. As you can see, the particulate lead release from the service line is a very strong function of flow rate. At flow rates below 2 lpm, you are not really detecting the particulate lead release which occurs at normal flow rates. As you increase flow rate, you detect more particulate lead. Each sample had a minimum 8 hour stagnation before collecting the 2nd draw. The figure also shows typical kitchen faucet flow rates for comparison.

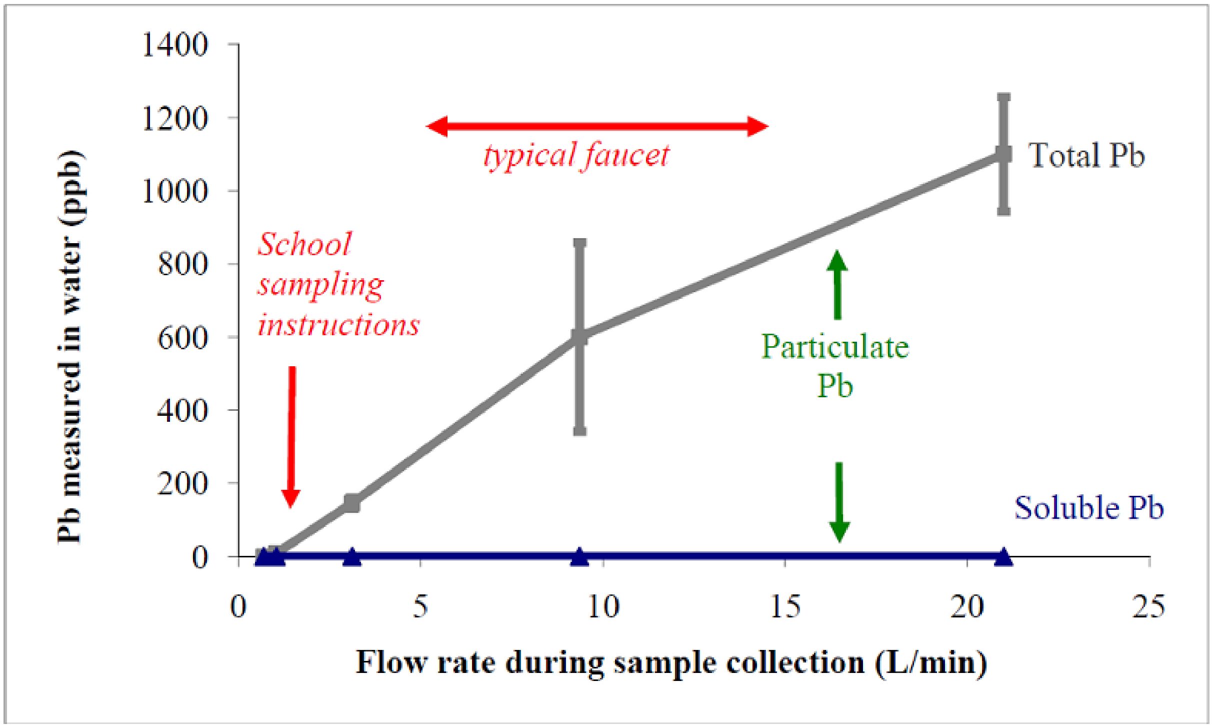


FIGURE 5: Lead measurement in flushed tap water samples versus flow rate in a home with lead pipe. Error bars represent 95% confidence intervals over triplicate samples collected on subsequent days at each indicated flow rate. Sample collection at the kitchen tap was timed to collect water derived from the lead pipe. (Edwards, 2005)

Seasonal Effect and Large Potential Impacts on Providence Data; Sampling Protocol

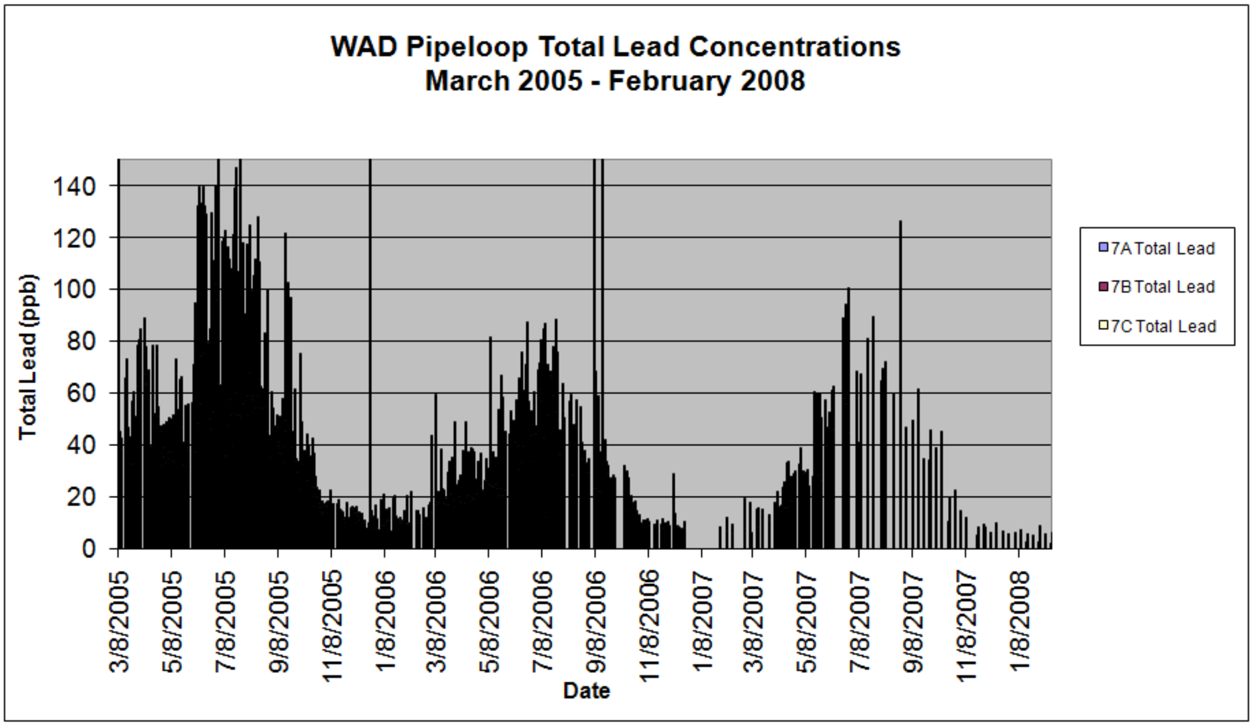
While I applaud the newly produced Providence report, it is worth noting two significant limitations.

Specifically, release of lead from service lines shows a very strong seasonal dependency. An example is illustrated on page 26 of the supplemental information available on the internet, associated with the following peer reviewed article:

Edwards, M., Triantafyllidou, S., and D. Best. Elevated Blood Lead in Washington D.C. Children from Lead Contaminated Drinking Water: 2001-2004. Environmental Science and Technology. 43, 5 1618-1623 (2009).

The supporting information is available at: http://pubs.acs.org/doi/suppl/10.1021/es802789w

Another version of this same data from FOIA is produced below.



The above samples from a 3 replicate DC lead pipes at the Washington Aqueduct (collected after > 6 hours stagnation) illustrate the very strong effects of temperature on lead release. In August the lead release from the pipe was stable at about 70 ppb. 4 months later, the lead leaching was stable at 12 ppb from the exact same pipe. In other words, due to the lower temperature, there was an 83% reduction in lead release. This temperature effect is well established in the literature. The vast majority of the lead above is particulate.

My key point is that the magnitude of the reduction observed in Providence over the same time period (comparing August to November) is of comparable magnitude. It is premature to suggest that that Providence data taken over these 4 four months shows that, eventually, benefits of partial replacements are observed.

I also note that we know nothing about the sampling protocol used in Providence. Pre-flushing, flow rates...all of these factors need to be determined and reported. As I mentioned previously, "spikes" from particulate lead can be missed at low flow rates and with pre-flushing.

Point-Of-Use Devices

The paper below shows that while NSF only tests filters to 150 ppb, they are still remarkably effective at higher levels, under the new NSF certification program. Under the old NSF certification program, they were not tested with particulates. As a result of our work, some of the NSF certified devices that did not remove particulates, lost their certification. Any device currently certified to remove lead has to have been proven effective with lead particulates.

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Lead removal from tap water using POU devices
Elise Deshommes, Yan Zhang, Karine Gendron, Sébastien Sauvé, Marc Edwards, Shokoufeh Nour, Michèle Prévost

Particulate lead is inadequately considered in lead certification procedures. In 2007, modification of the NSF-53 testing protocol for lead reduction, consisting of the addition of particulate lead in the NSF challenge water, resulted in cancellation of the certification of pour-through point-of-use devices. The results of this study showed that tap-mounted and under-the-sink domestic filtration devices were efficient in removing total lead (both dissolved and particulate) under the NSF reference level of 10 μg/L. However, pour-through domestic filtration devices poorly removed particulate lead, and, as a result, high lead levels remained in effluent water. This lack of efficiency is attributed to the type of filter used in pour-through devices and justifies cancellation of the NSF-53 certification for lead reduction for such devices in 2007. The results of this research also show the importance of selecting appropriate devices for lead reduction, because particulate lead can be released sporadically from lead service lines, premise plumbing, and faucets.

http://www.awwa.org/publications/AWWAJournalArticle.cfm?itemnumber=55326

3/2008 DC WASA sampling protocol - study of homes with 2006 partial pipe replacement

D.C. WATER AND SEWER AUTHORITY

Instructions for Water Sampling

Please read the instructions carefully before sampling your water.

Part 1. Water Stagnation (*The process for preventing water from flowing*):

1. Run the cold water tap from your kitchen faucet for 10 minutes before starting stagnation.
2. Close the cold water tap.
3. Write the date and time that you closed the tap on the attached chain-of-custody form.
4. **Do Not** use any water in the household for a minimum of 6 hours.
5. Make sure your humidifier, icemaker, or sprinkler system is either turned off or not using water.
   Do not forget to shut off the ice-maker inside your refrigerator/freezer.

Part 2. Water Sampling (*Please do not remove aerator from faucet*):

← bottle

1. Use the kitchen cold-water faucet for all sampling. If you have a water treatment unit or filter attached to your plumbing system or faucet, please bypass the unit or remove the filter before sampling.
2. (1st) Gently open the cold water faucet and immediately fill the first bottle to the top.
   Close the faucet and tightly cap the sample bottle once the bottle is full.

3. On the bottle label, fill out **Collect Date**, **Collect Time**, **Collector** (your name), **Address,** and Circle **1st Draw**. Leave **Sample** # blank.
4. (2nd) Open the cold-water faucet and run the water, keeping a hand/finger under the flowing water until the water changes temperature. Fill the second bottle to the top and tightly cap the bottle.

5. On the bottle label, fill out **Collect Date**, **Collect Time**, **Collector** (your name), **Address,** and circle **2nd Draw**. Leave **Sample** # blank.
6. Open the cold-water faucet and run the water for 2 additional minutes. Fill the third bottle to the top and tightly cap the bottle.
7. On the bottle label, fill out **Collect Date**, **Collect Time**, **Collector** (your name), **Address,** and write **3rd Draw** in the space between 1st and 2nd draw. Leave **Sample** # blank.

Part 3. Fill out the Chain-of-Custody Form and Leave for DCWASA Pick-up:

1. Note the Date and Time of sampling for all bottles on the attached chain-of-custody form. Please make sure that you answer all the questions and sign the form.
2. Leave **samples and completed forms** on the front porch or where the kit was dropped off. DCWASA will pick-up the samples on the morning of Wednesday, March 26th.