Update: Health studies from the U.S. Centers for Disease Control (CDC) and Virginia Tech published in 2012 and 2014, demonstrated that the incidence of Lead Poisoning in DC children (living in homes with lead service lines) and rates of fetal death, were higher in DC at the time this white paper was written, even though DC was in full compliance with the EPA LCR since 2005.

Gaps in the EPA Lead and Copper Rule That Can Allow For Gaming of Compliance: DC WASA 2003-2009

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The intent of the Lead and Copper Rule (LCR) is to determine the effectiveness of corrosion control measures and assess public safety in a set of "worst case" (for risk of lead leaching) homes, based on normal resident water use patterns. When 10% or more of the sampled sites exceed the Environmental Protection Agency (EPA) action limit of 15 parts per billion (ppb), the LCR requires water utilities to take remedial measures that include corrosion control, lead pipe replacement, and public education to avoid unnecessary exposure to high lead in water.

In Washington DC, DC WASA and its oversight agency, EPA Region III, are supposed to select sites and sampling methods that detect the worst case lead in the system for LCR compliance monitoring. Through Freedom of Information Act (FOIA) requests and other publicly available information, we have documented methods implemented by DC WASA to circumvent the clear intent of EPA regulations by making lead values reported to EPA Region III lower than they otherwise would be through normal resident water usage. Use of these techniques has allowed DC WASA to meet the EPA action limit during 2005-2008, but DC could well have been out of compliance if testing had been properly done. Because public education requirements about risks from high lead in water were not triggered during this time, many DC residents may have been unwittingly exposed to lead-in-water hazards they could have easily avoided. The same would be true in other locales if their local water utilities were to use the same methods.

The boxes in yellow indicate practices that EPA Region III (and, in some cases, EPA Headquarters) are aware of and have recommended, approved, defended, or have taken no steps to stop. Many of these practices are not technically in violation of the LCR, because the LCR does not include language explicitly forbidding them, but they are in clear violation of the *intent* of the LCR, which is to capture worst case lead-in-water levels at high-risk homes under normal water use conditions.

A. Improper practices that have been implemented in DC

Method	How it Works	Actual Practice in DC
	The Design of the LCR Monitoring Program	
Sampling in neighborhoods predicted to have low lead.	GIS computer system, or study of maps of lead pipe and water test data, enables the identification of neighborhood-by-neighborhood trends.	DC WASA used this practice in 2003 to avoid actual replacement of lead service line pipes. The agency refuses to make its sampling pool public, so it is impossible to know if this practice continues today for LCR sampling, although it is clear that parts of the city are not sampled.
Taking samples during times of the year when the outside temperature is low and the pH in the water is high.	Under these conditions, lead leaching tends to be lower.	DC WASA engaged in this practice in 2003. Sample collection in 2005, 2006, and 2007 missed the weeks when lead in DC water is known to peak.
Taking samples during the time of the year when the water is treated with free chlorine, which keeps lead-in-water levels to a minimum.	Under these conditions, lead leaching tends to be lower.	DC WASA engaged in this practice in 2008 (in 2005 and 2006 the Washington Aqueduct did not do a chlorine burn, and we have not been able to obtain the sampling dates for the 2007 monitoring cycle).
	The LCR Sampling Instructions to Homeowners	
Instructing homeowners to flush the lines the night before sampling (also called "pre-flushing").	Pre-flushing cleans out pipes of most lead (esp. lead particles) before overnight stagnation. The longer and faster the flushing the night before, the cleaner the pipe	In 2004, DC WASA implemented a 10-minute pre-flush in their school sampling. In 2005, they incorporated the same pre-flush into their semiannual sampling for LCR

	and the lower the lead levels that will be detected the next day.	compliance. In 2007, they instructed DC public schools to pre-flush every building for 45 minutes, and every tap for another 5-15 minutes. They maintained the 10-minute pre-flush instruction for LCR compliance sampling until the fall of 2008, when DC residents exposed it with the help of the Washington Post. On September 12, 2008, EPA Headquarters determined that pre-flushing goes against the intent of the LCR, and on September 16, 2008, EPA Region III instructed DC WASA to abandon the practice. But after lobbying from DC WASA (e-mails and letters obtained via FOIA are available upon request), on September 25, 2008, EPA Headquarters and Region III granted DC WASA permission to continue to pre-flush, albeit for 2 minutes instead of 10. A 2004 experiment by Virginia Tech showed that a pre-flush of 2 minutes temporarily eliminates almost as much lead as a 10-minute pre-flush.
Instructing homeowners to try and limit stagnation time to a maximum of 8 hours (e.g., DC WASA's 2005-2008 protocol said, "Do not use any water in the house for 6 to 8 hours;" Chicago's Department of Water Management says, "It is important to collect the sample as soon as possible after six (6) hours.")	EPA's LCR states that stagnation time prior to sample collection must last for a minimum of 6 hours. EPA's guidance specifies clearly that there is *no upper limit* to stagnation time for LCR sampling. DC WASA's instruction appears to place an arbitrary cap on stagnation that is not consistent with normal resident use, and may have resulted in the exclusion of samples with higher-than-average concentrations of lead.	At least from 2005 to the fall of 2008.

Instructing homeowners to collect 1st and 2nd draw samples by opening the tap *gently* and ***slowly***, and/or providing bottles with narrow openings.	Sampling at low flow rates prevents lead particles from getting swept out of the pipe and into samples.	DC WASA has used this practice since at least 2002. E-mails indicate that they fully understood that low flow rates would reduce lead particles in samples.
Instructing homeowners to remove aerators when sampling.	Aerators contain lead sediment, and removing them decreases lead leaching into water. In 2006, EPA issued an instruction disallowing aerator removal for LCR compliance monitoring, but in October 2008, EPA raised the issue again as a potential topic for renewed consideration.	This practice was suggested by EPA Region III to DC WASA in 2002. It was used in DC WASA's school and apartment sampling instructions in 2004. It was effectively banned by EPA in 2006 because it was implicated in a case of childhood lead poisoning from water in Durham, NC.
	The Management of LCR Samples Prior to Analysis	
Counting samples from homes that, according to homeowner records, do not have a lead pipe, as if they did have a lead pipe.	DC WASA database showed lead pipe, but the customer provided unequivocal evidence to DC WASA that there was no lead pipe.	This occurred in the spring of 2005. EPA Region III claimed the sample was valid because DC WASA *thought* the customer had a lead pipe.
Discarding properly collected samples if the stagnation time exceeds 18 hours.	EPA's LCR guidance states clearly that there is *no upper limit* to stagnation time for LCR sampling. By discarding samples that stagnated for more than 18 hours, DC WASA places an arbitrary cap on stagnation, and invalidates properly collected samples that may contain high lead. DC WASA argues that their practice is more conservative than California, which by state law discards samples after a 12-hour stagnation.	Presently in use by DC WASA. We don't know how far back this practice goes.

	The Lab Analysis of LCR Samples	
Having at least two labs analyzing LCR samples: one that is selected as the "official" lab for water samples expected to be low, and one that is selected as the "unofficial" lab for water samples expected to be high.	Sending customer samples that are expected to have higher lead to the lab that does not "count," and excluding those test results from the monitoring data reported to EPA Region III.	In 2005, DC WASA would have failed to meet the action level if samples sent to the lab at Washington Suburban Sanitary Commission (WSSC) had been counted for LCR compliance. According to written EPA guidance these samples should have counted.
Using weak acid in sample preparation.	Lead particles in water tend to sink to the bottom of the bottle and they often do not get measured. The net result is that the reported lead-in-water values can be 80% lower than what is actually present in consumers' drinking water.	This is not a problem specific to DC WASA, but it is a potential national problem because EPA allows water utilities to specify weak acid sample preparation.
	The Validation and Invalidation of Analyzed LCR Samples	
Revalidate previously invalidated samples with low lead.	For water samples that were invalidated by EPA Region III because they came from homes with no record of lead pipe, select those with low lead levels and dig test pits to determine the pipe material. If lead pipe is identified, ask EPA Region III to revalidate the samples. Do not repeat the same process on invalidated samples with high lead levels.	DC WASA and EPA Region III engaged in this practice in spring 2005.
Select homes for LCR sampling that tested low even during the lead-in-water crisis of 2004.	DC WASA sampled tens of thousands of homes across in the city in 2004. On the basis of prior results, the agency can include in their LCR testing	In a winter 2008 meeting that discussed an independent assessment of lead in DC tap water, DC WASA stated that if homes that tested high for

	homes known to have lower lead in water even during highly corrosive conditions.	lead in 2004 were sampled today, DC WASA would fail to meet the LCR.

B. Practices that have been implemented, but were subsequently banned

Method	How it Works	Actual Practice in DC
Invalidating results with high lead-in-water concentrations.	If a sample tests high, finding a way to claim it is not a legitimate sample. Invalidating even a few high results can completely skew sampling.	DC WASA used this practice in 2001. Presently, EPA forbids sample invalidation after analysis. But DC WASA can invalidate any sample before "official" analysis for any reason (including, for example, seeing lead particles in the sample).
Sampling from homes that do not have lead pipe, in violation of agreement with the EPA and intent of LCR.	Homes without lead pipe have a lower chance of lead in water.	2005 sampling round. DC WASA was fined by EPA Region III, and samples were invalidated.

C. Practices that have been considered but we have no evidence they have been implemented

Method	How it Works	Actual Practice in DC
Replacing faucets that cause problems with high lead in water with lead-free faucets, and keep these homes in the LCR monitoring sampling pool.	To the extent the faucet is the problem, replacing it drops lead in the samples collected only for the LCR pool, without reducing the risk for the city as a whole.	Proposed in January 2003 by a DC WASA consultant.
Adding homes to the monitoring program that have already been sampled with low lead.	Sampling a home for lead under another program and, if lead levels are low, trying to recruit the homeowner to the volunteer pool for the LCR	E-mails indicate that DC WASA openly discussed this practice in 2003.

	monitoring program.	
Replacing most of the lead pipe of homes that sampled with high lead, and keeping on sampling the same homes even though they are no longer highest risk sites.	Replacing a home's lead pipe can dramatically decrease the chance of finding high lead in later sampling.	E-mails indicate that DC WASA openly discussed this practice in 2003.
Dropping homes from the LCR monitoring program that had already been sampled with high lead in water.	Maximize the chance for inclusion of low risk homes in the LCR monitoring pool.	DC WASA proposed this plan to EPA Region III in 2002. EPA Region III said it was not appropriate. There is no proof it was ever used. But DC WASA claims that all water test data is confidential, and so there is no way to check on what they are doing.

D. Practices that hide lead in water and that are used legitimately because they are allowed or required by the LCR

Method	How it Works	Actual Practice in DC
Using only the cold water faucet for all LCR sampling.	Hot tap water tends to dispense more lead than cold tap water. By limiting LCR sampling to cold tap water, LCR monitoring misses worst case lead in water that, under normal use conditions, is often ingested.	DC WASA complies with this requirement.
A long period of flushing between 1st and 2nd draw samples until there is a significant change in water temperature.	This subjective instruction results in highly variable flushing times between 1st and 2nd draw samples. DC WASA customers have reported flushing for anywhere between 1 and 10 minutes between draws. In a typical single-family home, a flush of 3 minutes or longer would result in water samples that come directly from the water main and have had practically no	DC WASA complies with this requirement. The problem is that the instruction often "misses" the worst case lead from the water held in the lead service line.

	contact time with the home's lead-bearing plumbing materials.	
Discarding properly collected samples for any reason whatsoever prior to analysis.	EPA presently allows utilities to get rid of samples prior to lab analysis without reporting them to EPA. This means that utilities can eliminate from their sample pool bottles with clear signs of high lead. For example, lead particles are often visible to the naked eye; water with lead rust is often discolored. It is even possible that quick (albeit superficial) tests can be used to check for lead content in a sample, thus allowing for the early identification of excessively contaminated bottles.	We don't know if and to what extent DC WASA engages in this practice.

E. Practices that would be clearly fraudulent

Method	How it Works	Actual Practice in DC
Tampering with samples. For example, sending distilled (or lead-free) water to the lab for analysis instead of the water collected from the homeowner's tap, or sending a home's tap water that is partially discarded and mixed with distilled (or lead-free) water.	Producing lead-in-water measurements that do not correspond to actual lead-in-water levels. Because the water utility obtains samples before they go to the lab, there are no effective safeguards to prevent this.	Several 2004 reports by DC WASA contractors identify non-detectable lead in homes of lead poisoned children, and the reports were written days before the water samples were actually analyzed by the lab. Homeowners reported that no water samples had been collected from their homes. Samples that were collected from other homes sat at DC WASA for weeks before being sent to the Washington Aqueduct for analysis.