Public Comments to the NDWAC

December 4-5, 2019 Public Meeting

Delivered during the public comment period at the meeting:

- Mr. Jeff Tanner, President and Chief Technical Officer, Flow-Liner Systems, Ltd, Zanesville, Ohio
- Mr. Carl Reeverts, Environmental Protection Network
- Mr. Steve Via, American Water Works Association

Delivered in writing only:

- Joseph A. Cotruvo, Joseph Cotruvo & Associates LLC

Remarks by
Mr. Jeff Tanner
President and Chief Technical Officer
Flow-Liner Systems, Ltd., Zanesville, Ohio
before the
Environmental Protection Agency National Drinking Water Advisory Council
December 4, 2019

About the Speaker:

Jeff Tanner is President and Chief Technical Officer for Flow-Liner Systems, Ltd., in Zanesville, Ohio (www.flow-liner.com). Mr. Tanner's experience and background include; Engineering designs for plumbing rehabilitation products & systems, Product development for potable, non-potable and process piping systems, Product design calculations, testing and research, Product innovations, Multiple patents and patent applications, Product submittals, Product general specifications & guidelines, Product presentations and demonstrations. He is a multi-year, active member of the following professional organizations:

- ICC International Code Council
- American Society for Testing and Materials (ASTM) International Committee
- American Water Works Association
- International Association of Plumbing and Mechanical Officials
- American Society of Mechanical Engineers

Mr. Tanner holds licenses including Master Plumber, Backflow Installation & Testing, Fire Protection Contractor and HVAC Contractor.

Mr. Tanner also participated in providing samples and information about PET Linings for the 2017 WRF report "Evaluation of Lead Service Line Lining and Coating Technologies". He worked closely for three years with the University of Kansas, which was contracted by the EPA to produce the report.

Thank you for the opportunity to address members of the National Drinking Water Advisory Council. I appreciate your willingness to serve on this important Federal Advisory Panel that provides EPA with advice and recommendations related to the national drinking water program.

My name is Jeff Tanner and I am President and Chief Technical Officer for Flow-Liner Systems, Ltd., in Zanesville, Ohio. We trace our beginnings to 1976 as a plumbing service and drain cleaning franchise located in Zanesville, Ohio. In 1987, our company expanded into pipe excavation and replacement. Due to many issues with excavation equipment, trench shoring and worker safety we decided there was a better way.

A new company was formed in 2001 as an alternative to excavation and pipe replacement. That company is now, Flow-Liner® Systems, Ltd. specializing in trenchless non-invasive products and systems. Today we employee 25 employees at our main office in Zanesville, Ohio. The installers we certify and train in our trenchless systems spread across the nation, located in 25 states, serving coast to coast and everywhere in between. Flow-Liner and its expert installers have been privileged to have used our technology in esteemed locations like the White House, Federal Bureau of Investigation, the Pentagon and Dulles Airport.

Earlier this year Sanexen Water, Inc. and Flow-Liner Ltd., teamed up to offer innovative and cost-efficient lining technologies to reduce lead and copper contaminants in the public water supply. Flow-Liner has a pipe lining technology for lining potable water service pipes and Sanexen Water, Inc., has a structural lining technology for lining potable water service mains. Our partnership gives us the ability to line both potable water service pipes and water mains to deliver cost-efficiencies to water authorities and ratepayers.

Across the nation professionals in our industry continue to deal with elevated lead levels in their drinking water. Just a few week ago EPA published much-needed revisions to the LCR and many of us are actively working on providing substantive comments on the proposed rule.

Amidst all this I wanted to speak with you today about some of the things EPA proposes in the LCR that we are very encouraged about and ask members of the NDWAC to support in your advisory capacity with EPA.

1.) First. I believe that our industry spends a lot of time and attention focusing on one section of the Safe Drinking Water Act (42 U.S.C. §300f et seq. (1974)). It is the Section (1459B (a)(2)(i)) related to lead service line replacement (LSLR). But, there is another section just underneath the Section on LSLR , Section 1459B (a)(2)(ii) that grants the EPA Administrator authority to determine testing, planning or **other relevant activities** that identify and address conditions that increase concentrations of lead in water for human consumption. The goal of the Safe Drinking Water Act is to reduce the concentration of lead in water for human consumption. But, over the past three decades our industry has allowed the focus of the statute to shift more solely on replacement of LSLs. Thankfully over this same period there have been technological advancements that scientists and engineers all around the world agree can reduce the concentration of lead in water for human consumption. These technologies that are now certified safe for drinking water should be embraced, promoted and continually researched jointly by EPA and industry.

2) We are very encouraged and support EPA proposing revisions in the LCR to strengthen “consumer awareness” and “public education”. When EPA strengthens “consumer awareness” that means informing consumers, ratepayers and homeowners

about ALL technologies, including lining that are available to consumers to reduce lead contaminants in their drinking water. Our companies want homeowners and water authorities to know about trenchless technology options and have these technologies included in the proposed LCR revisions and all related EPA Handbooks (i.e. Drinking Water State Revolving Fund Eligibility Handbook). An overwhelming majority of people are not aware that there are safe, efficient, cost effective and non-invasive technologies available to reduce lead in drinking water. Technologies like these can cost 30-60% less when compared to replacement of lead service lines. Aside from the benefit of being trenchless, meaning minimal-to-no excavation or demolition to streets, sidewalks, driveways and inside of homes, we wanted to touch on some of the other notable benefits.

3) EPA is correct in acknowledging that “Water systems cannot unilaterally implement the actions needed to reduce lead levels in drinking water. Homeowners must be engaged” because in most communities they own portions of the LSL. It is our experience that many water authorities are running into liability issues due to the need of demolition inside of homes during replacement programs. By using trenchless technologies like ours, you remove that risk because all we need is access to the pipe inside the home at the water meter. No digging, no demolition, no excavation, thus we reduce much of the risk and liability issues. With our system you can also install testing ports at the water meter for liner integrity inspections. This allows the water authority or homeowner to inspect the liner at any time.

4) We agree with EPA in proposing water systems develop an inventory of LSLs and preparing and submitting a LSL replacement (LSLR) plan. We would ask you to consider one of the most important of the many benefits to trenchless technologies, is the speed in which the contamination can be stopped and therefore the speed in which the health hazard is removed from public exposure. Treatment control is now the only resolution suggested to immediately reduce lead levels. Rather than rely on tricky chemical control the water system could offer to use lining technologies to immediately reduce lead levels. Consider, our technology takes just a couple of hours to line a lead service line and is recognized as an immediate return to service under the NSF 61 listing. The proposed LCR is allowing up to 35 years for replacing all of the lead service lines in the United States. How long is too long to have the general public exposed to contaminated water? What if your house is years away from having the lead service line replaced in a lead service line replacement plan (LSLRP)? Why not take advantage of trenchless technologies and remove the problem immediately, or at the least, include technologies like ours in a LSLRP until the lead service line can be replaced.

5) The LCR is for both lead and copper. There are also high copper exposure concerns – replacing lead pipes with copper pipes is choosing the lesser of two evils, when there

are other safe and cost-effective technologies available. As copper pipes corrode, they release high levels of copper into the drinking water. More and more copper is being put into the ground in current replacement programs. The use of trenchless technologies like ours will also need to be available as these levels will increase over the years and may become a health hazard to the public.

6. (For reference: on Page 61697) We appreciate EPA creating the document "Strategies for Achieving Full LSLR" (docket EPA–HQ–OW–2017–0300). Documents like this that are timely updated with the latest technologies available and best practices to improve efficiencies during full LSLR are sorely needed throughout the U.S. to help clarify to water systems what technologies are certified and cost-effective for use to reduce lead in drinking water. In the LCRR EPA refers to this document in context of identified financial assistance for customer-owned LSLs. To strengthen public education and consumer awareness we recommend EPA propose to include Strategies for Achieving Full Lead Service Line Replacement as an integral resource in the LCR for water systems when developing their proposed LSLR plans.

7. We have submitted post-WRF Report 2017 ("Evaluation of Lead Service Line Lining and Coating Technologies") information for the EPA's review and consideration. This information consisted of a "Case Histories report from Europe" providing information on PET Linings long term effectiveness and cost savings. We have also discovered a few clarifications needed in the WRF Report 2017. The report mentions PET as recycled PET on page 45; we want to make it clear that our PET Lining is made from Virgin PET not recycled PET. This is why it passes the stringent NSF-61 Standard. The report does mention Virgin PET on page 140, but we feel a clarification is needed so not to confuse the reader. The report also mentions the PET used is Amorphous PET. The Grade of PET used in our expandable pressure pipe PET liner is a specific crystalline PET, not Amorphous PET. All installations made with our liner have PET in a condition with a suitable degree of crystallinity. Our PET lining has been tested for hydrostatic strength in the same way as a regular 'standalone' pressure pipe. Under cold water conditions the results indicate a 50-year design life even when tested without the benefit of a supporting host pipe.

Again, thank you for the opportunity to address the NDWAC about these important issues.

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EPN Statement to National Drinking Water Advisory Council (NDWAC)
at December 4-5, 2019, Meeting
November 22, 2019

The Environmental Protection Network (EPN) appreciates the opportunity to provide a statement on our comments on the U.S. Environmental Protection Agency's (EPA) proposed new drinking water standard for perchlorate and our initial thoughts on the EPA's proposed revisions to the lead and copper rule (LCR). We will provide comments on the LCR to EPA by the comment deadline on January 13, but wanted to solicit views of others, including NDWAC members, before we settle on the specific comments we will submit.

EPN is an organization comprised of over 450 EPA alumni volunteering their time to protect the integrity of EPA, human health and the environment. We harness the expertise of former EPA career staff and confirmation-level appointees to provide in-depth analyses and insights into regulations and policies proposed by the current administration that have a serious impact on public health and environmental protections.

Perchlorate
On August 26, 2019, EPN submitted comments to EPA raising serious concerns about its proposed new drinking water standard for perchlorate. EPA is proposing a drinking water regulation for perchlorate and a health-based Maximum Contaminant Level Goal (MCLG).

In its comments, EPN raised significant concerns about the proposed action, including that it:

- Lacks robust epidemiology studies making it very difficult to estimate the likelihood and magnitude of the effects on neurodevelopment in fetuses and infants exposed to perchlorate through cord blood, breast milk and formula;
- Sets the proposed perchlorate standard on a reference dose (RfD) that does not provide an adequate margin of safety. An RfD is an estimate, with uncertainty spanning some order of magnitude, of a daily oral dose to people, including sensitive subgroups, that is likely not to cause appreciable risks of negative health effects during a lifetime.
- Uses a novel approach to derive a Relative Source Contribution (RSC) for perchlorate that must be peer reviewed by external experts before it can be used. A RSC is the proportion of the total daily exposure to a chemical that is attributed to tap water in calculating acceptable levels; and
- Presents serious implementation issues, including the extent and cost of the initial perchlorate monitoring required by states and water systems, the adequacy of EPA's cost-benefit analysis of the proposed regulation, and the inclusion of an option to withdraw from the 2011 regulatory determination that EPA would regulate perchlorate in drinking water.

Due to serious questions about the scientific defensibility of the EPA perchlorate regulation and the validity of the monitoring and cost-benefit analysis, EPN strongly recommends that EPA: (1) submit a new proposal that does not include an option to withdraw from the 2011 regulatory determination; (2) recalculate the MCLG and MCL with an appropriately sensitive endpoint, an adequate margin of safety, and a peer-reviewed RSC; and (3) develop cost-effective monitoring recommendations and a cost-benefit analysis that accounts for co-benefits.

Lead and Copper

EPA's proposal to modify the lead and copper rule was long awaited. Some of the proposed language addresses long-standing issues around the implementation of the existing 1991 regulation. We strongly support these areas, such as the new trigger level of 10 ppb (parts per billion), elimination of partial pipe replacements, the tightening of some of the 'gaming' outlets, requiring 24 hour public notification of exceedances, and several others.

However, the overall rule changes make it considerably more complicated than it is now and add provisions that roll back public health protections. The proposal clarifies and strengthens the health protection under the LCR, but imposes a significant new burden on the States to oversee and enforce the modified LCR. The requirements are more difficult to understand, implement, and enforce. In addition, adding a new trigger level to the existing action level adds another step in determining what the water system needs to do to comply. Also, reducing the required lead service line replacement from 7% to 3% significantly reduces health protection. Currently, overall compliance with the current LCR is not adequate. Simplifying the requirements will improve compliance. EPA needs to take steps to simplify what water systems have to do, not make it more difficult.

EPN is working to more fully develop its comments to EPA and welcomes any opportunities to discuss its comments with NDWAC and others before the January 13 deadline.

Oral Comments to the
National Drinking Water Advisory Council
Submitted on behalf of the
American Water Works Association
December 4, 2019

National Primary Drinking Water Regulations: Proposed Perchlorate Rule

The American Water Works Association urges NDWAC to continue to emphasize the importance of science-based regulations in ensuring the nation has safe and reliable drinking water. For regulations to be effective, they must be scientifically sound and represent a meaningful opportunity for public health protection.

In 2008, the U.S. Environmental Protection Agency issued a preliminary regulatory determination to not regulate perchlorate. That decision was reversed in 2011. EPA's current effort to finalize a perchlorate MCLG and MCL follows a lawsuit over the Agency's missing a deadline after the positive determination.

Based on EPA's current analysis, none of the proposed MCLs (18, 56, 90 µg/L) would provide health risk reduction benefits that justify the costs of a federal perchlorate regulation. AWWA has recommended that EPA withdraw its positive regulatory determination while reviewing and finalizing the interim health advisory level (15 µg/L) through a process that provides appropriate public engagement. We hope that the Agency will act as quickly as possible on this recommendation.

National Primary Drinking Water Regulations: Proposed Lead and Copper Rule Revisions

AWWA greatly appreciates NDWAC's December 2015 recommendations for revising the current Lead and Copper Rule. In reviewing the proposed rule revisions, it is apparent that while EPA considered the Council's recommendations, the Agency did not incorporate all of them.

AWWA and our members are still preparing comments on the LCR proposal. Given the breadth and complexity of the proposed rule, the comment period is very short, and our review is not complete. However, we can recognize today that several NDWAC recommendations are reflected in the proposed rule:

1. Identification and complete replacement of lead service lines
2. Improved consumer education and outreach, particularly with respect to lead service lines
3. Retention of the current lead action level and in-home sampling protocol
4. Additional emphasis on corrosion control

The Agency's proposal reflects a core principle in the NDWAC recommendations, that lead risk reduction is a shared responsibility with respect to lead service line replacement.

EPA did diverge from NDWAC's advice in key respects. Most notably, important requirements for water systems to take action on lead are tied to a new trigger level, the lead action level, or to specific instruction from the state. This linkage is particularly true of lead service line replacement and required improvements to corrosion control practice.

EPA also included mandatory testing in schools and childcare facilities, which the NDWAC working group considered and did not recommend.

The proposed rule focuses heavily on what water systems must do, but does not describe what EPA, states, or other parties will do to assist in this shared endeavor. Neither the proposed rule nor the existing National Lead Action Plan describe federal actions that will support the proposed rule framework. EPA and state primacy agencies should allocate time and effort to the revision of housing regulations, setting of public health codes for childcare and school facilities, supporting rate commission filings, engaging AWWA's members and other technical experts in the regular updating of corrosion control guidance, revising the EPA lead website, and many other activities. The NDWAC recommendations noted that the success of rule revisions requires complementary federal and state actions to help communities undertake the actions envisioned in the proposal.

If NDWAC chooses to make additional recommendations to EPA, AWWA would urge the Council to:

1. Continue to hold to the principles of its earlier recommendations.
2. Encourage EPA to promulgate a final rule that is implementable. The ability to implement a revised rule was a recurring concern during the NDWAC Work Group discussions. Both systems and states must be able to accomplish required tasks for a rule to be effective and maintain public confidence. Effective rules include reasonable expectations for:
   a. Actions that are achievable in practice by the regulated entities,
   b. Implementation timeframes that are in keeping with the challenge being addressed, and
   c. Documentation and reporting that will indeed be used for meaningful state and federal oversight.

With EPA intending to finalize this rule next year, systems and states will need to move forward aggressively as soon as the comment period is over to meet initial rule deadlines. NDWAC may want to return to this rule as a discussion topic next year to hear how states and systems are taking on implementation.

Who is AWWA

The American Water Works Association is an international, nonprofit, scientific and educational society dedicated to providing total water solutions assuring the effective management of water. Founded in 1881, the Association is the largest organization of water supply professionals in the world. Our membership includes more than 4,000 utilities that supply roughly 80 percent of the nation's drinking water and treat almost half of the nation's wastewater. Our 50,000-plus total membership represents the full spectrum of the water community: public water and wastewater systems, environmental advocates, scientists, academicians, and others who hold a genuine interest in water, our most important resource. AWWA unites the diverse water community to advance public health, safety, the economy, and the environment.

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December 2019.

To: The National Drinking Water Advisory Council

From: Joseph A. Cotruvo, Washington, DC

I had planned to attend the NDWAC meeting but was overtaken by commitments to the major wastewater to drinking water recycling project in Los Angeles.

The NDWAC serves an essential function to assist and guide EPA OGWDW to make appropriate decisions within the directives of the Safe Drinking Water Act, with regard to protecting and maintaining drinking water quality. EPA's decisions require appropriate and sometimes difficult judgments that must be supported by clear and objective analyses of all of the essential decision factors for protection from drinking water contaminants. They include: national occurrence, total human exposure and drinking water's contribution, toxicity and dose response and credible risk assessments, analytical methods and monitoring feasibility, treatment technology, economic impacts to the range of water suppliers, and practicality regarding the essential roles of the water provider. The NDWAC is well positioned to address the real world impacts of any of the decisions to be made and their appropriateness.

I have broad experience and a broad perspective in drinking water and health issues over about 45 years and continue to engage actively on issues of drinking water quality and safety, risk assessment, regulatory aspects, and potable water reuse. I was director of the Drinking Water Standards Division after passage of the Safe Drinking Water Act, and so have engaged in all of those elements with respect to many/most of the existing drinking water MCLs and treatment requirements and policies, as well as the Health Advisory Program. I was also director of the Risk Assessment Division in the Office of Toxic Substances. After EPA, I was a member of the Board of Directors of DCWater, and continue to serve on the World Health Organization's committee producing the WHO's Guidelines for Drinking Water Quality, and consult internationally on a variety of topics including desalination and recycling of wastewater to drinking water. My doctorate is in Physical Organic Chemistry and I am board certified by the American Academy of Environmental Engineers and Scientists.

These comments address five topics: Lead and Copper Rule proposal, Perchlorate, PFAS, Legionella and water's nexus to legionellosis, and Distribution Systems. The latter two, legionella and distribution systems provide the greatest public health risks associated with drinking water and warrant the highest priorities for management, investments, and health and safety improvements.

Lead and Copper Rule (LCR) Proposal

The original LCR was promulgated in 1991. It differed from all previous regulations. An MCL was not feasible because of the unique origin of lead in drinking water at the tap, which is from the corrosive effect on metal surfaces that water contacted on the way to the tap, and thus the variability of conditions and effects in virtually each dwelling and building. Lead service lines, old galvanized iron pipe in old residences, leaded brass faucets, and perhaps old (pre 1986) lead solders are the sources. The LCR was geared to determine whether the water being served by the supplier was excessively aggressive to those features to warrant corrective actions to reduce corrosion and lead releases. That determination is to be made using a virtual worst case collection of a 1 liter first draw sample after sufficient stagnation. Monitoring sites were required to be weighted toward likely worst case locations, such as likely presence of lead service lines. Compliance was specified to begin with corrosion control, which, if inadequate, would require a lead service line replacement schedule. The later would be only a partial resolution, because lead service lines are not the only source of lead contamination, old galvanized pipe in old housing is another important source. A study of high lead detections in Washington, DC showed a very high correlation with high iron, and that was consistent with old galvanized plumbing in the home. Trace water lead accumulates on the iron oxide coatings that develop. Thus, emphasis on adequate corrosion control is essential so as not to suspend the internal iron oxide deposits. Washington and others have successfully utilized phosphate addition as a very effective way to significantly reduce lead releases.

That regulation has been successful where it was implemented and enforced. Unfortunately, that has not always been the case in some states and water systems. Flint is a prime example where the LCR was not enforced, and further, the state regulator allowed the water supplier to make significant changes of water source and treatment without the routine measures to evaluate the consequences of the choices prior to implementation. Fortunately, although water lead increased in some homes, only a small temporary increase in blood lead occurred in a small percentage of children. That was likely because consumption was greatly limited when the water became so obviously contaminated by discoloration and taste from suspension of sediments. However, the most likely adverse health outcome was many cases of legionellosis and at least 12 deaths due to inhalation of the microbe contaminated water aerosols probably during showering.

Figure 1 shows the downward trend of child blood leads in Flint over about 10 years (2006-2016). Note the 2014-2016 period when the water problem occurred, and also 2008 and 2011.

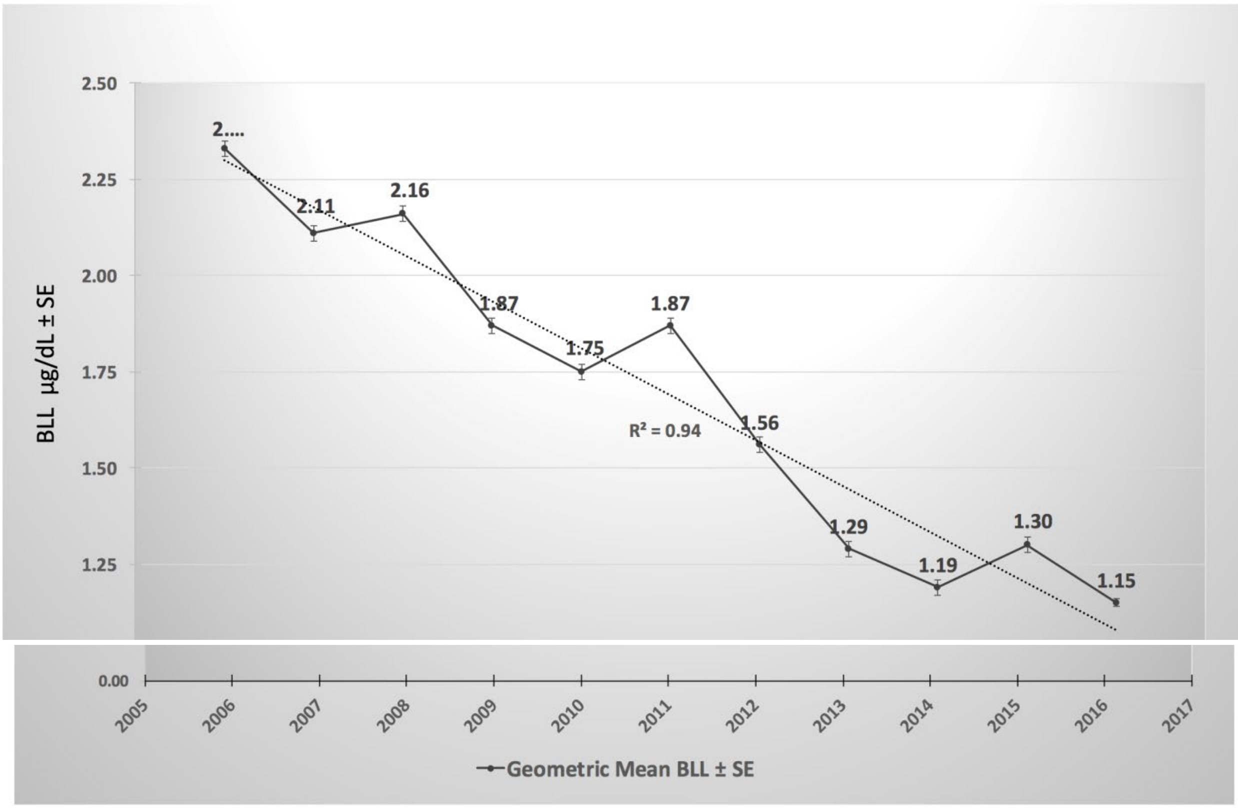


Figure 1. From Gomez et al.
https://www.ncbi.nlm.nih.gov/pubmed/?term=Blood+Lead+Levels+of+Children+in+Flint%2C+Michigan%3A+2006-2016

There would not have been a lead problem in Flint if they had been in compliance with the LCR. So, the critical issue to be resolved is the best way to require the states to enforce and achieve universal compliance with the LCR, rather than establishing additional potentially more confusing regulatory requirements. The proposed new LCR is so complex that it probably raises more barriers to universal compliance as well as providing burdens that many, especially smaller, water suppliers would have serious difficulties understanding it, let alone complying with it.

Overall there has been more than 95% reduction (from about 16 ug/dL to much less than 1 ug/dL) of average US child blood lead since the 1976-1980 NHANES study prior to elimination of leaded gasoline. Old lead paint seems to be the cause of remaining high values. The attachment: Lead Reduction is a National Success Story, (Cotruvo, JA (2019). JAWWA April, 111:4, 73-75, 2019) describes several recommendations aimed at simplifying the existing LCR while facilitating the monitoring requirements, which are difficult to implement in their current form. Perhaps a good approach to facilitate removal of lead service lines would be legislation to include lead service and galvanized pipe mitigation as part of real estate transactions, like radon and lead paint mitigation that is often required. The cost would be buried in the sale price and effectively shared between the buyer and seller.

Perchlorate

Perchlorate can be present in water from some past industrial discharge and fertilizer and percolation activities, and some perchlorate can be generated on the surface by solar UV oxidation of chloride. Trace amounts can be present in aged hypochlorite disinfectant. Perchlorate binds with the sodium iodide symporter (NIS) that transports iodide to the thyroid, so excessive perchlorate can alter thyroid function in people who are not consuming sufficient dietary iodide. Poor thyroid performance can have adverse effects on neurological development of infants. Perchlorate had been used therapeutically in treatment of Graves Disease. EPA has an existing Health Advisory of 15 ppb, derived from a review of the perchlorate literature by an early National Academy of Sciences expert panel. Some states have decided to use even lower concentrationtargets. The more recent World Health Organization 2017 Guideline for perchlorate is 70 ppb. The OGWDW proposal's 3 options, including not to regulate, are reasonable for consideration and comment. The proposed middle option (56 ppb) is in the same ballpark and slightly lower than the 2017 WHO Guideline, so it can be considered to be reasonable for consideration of a possible regulation, if that course is decided. Few water supplies approach that concentration; however, a regulation also imposes monitoring costs.

Whether a national drinking water regulation for perchlorate would meet the Safe Drinking Water Act criteria for national regulation is open for debate. Some studies have concluded that regulation of perchlorate in drinking water at some low level would not meet a risk cost benefit test. EPA's Inspector General issued a report in 2010, suggesting that rather than a drinking water regulation, the most beneficial public health approach would be to assure that all pregnant women received prenatal care that included iodine supplementation.

PFAS

Numerous perfluoro compounds have been produced and commercialized over the last 60 years, and they and many byproducts and residues have entered the environment. Perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) have received particular attention. These perfluoro compounds have numerous commercial uses because of their unusual chemical properties, such as in firefighting foams, and in Scotch Guard and related products as water repellant coatings. They are being detected at low concentrations in a small percent of particularly groundwater supplies at parts per trillion levels, and especially associated with past uses of firefighting foams at airports and airbases, and some industrial point sources. The problem is that they are persistent and not subject to significant chemical or bio degradation in the environment, so once present they will not disappear for many years. PFOS and PFOA have been phased out in the US as of 2006. Blood detections in the population have declined significantly from virtually 100% incidence since then, but existing groundwater contamination is persistent.

The challenge is to determine a rational toxicological basis for acceptable levels in drinking water, as well as for exposures from the other sources. There is considerable controversy on those acceptable levels. EPA has published Health Advisories of 70 ppt for combined PFOS and PFOA. The Canadian Guidelines are 600 ppt for PFOS and 200 ppt for PFOA. The Australian expert committee reviewing several high exposure occupational epidemiological studies concluded: "There is mostly limited or no evidence for any link with human disease from these observed (*exposure*) differences". Several states have adopted guidance or standard values in the ppt teens or as low as 5 ppt (1 ppt is 1 millionth of a ppm). Prior to any drinking water regulatory action, there is need for a mainstream scientific consensus on the appropriate "safe" levels for perfluorocompounds in water, as well as for other exposures, and the relative source contributions. I suggest that prior to further action EPA should initiate an international process, perhaps with WHO, to provide credible consensus recommendations. That would overcome the multiplicity of values being applied, which confuses the public, and undermines the credibility of risk assessment processes and water quality targets.

https://news.bloombergenvironment.com/environment-and-energy/insight-we-need-scientifically-credible-health-benchmarks-for-pfas (The Michigan value should be 0.1% not 0.001%.)

Legionella

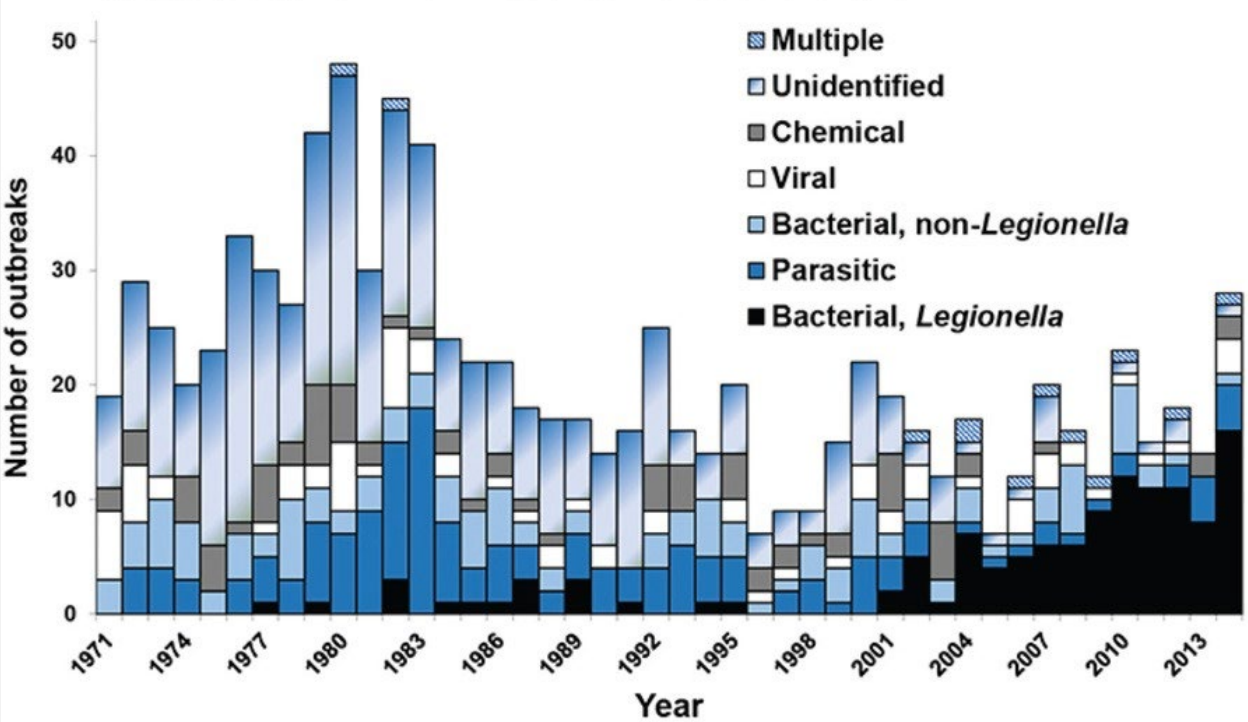
Legionellosis is now the most significant waterborne disease in the US, and it causes deaths. It is caused by inhalation of water aerosols, not by ingestion. Legionellosis and Pontiac Fever are caused by inhaling a sufficient dose of the bacteria usually *Legionella pneumophila* or *Legionella longbeachea,* respectively. Figure 2 illustrates the increasing trend of legionellosis outbreaks and the reduced trend of traditional waterborne disease outbreaks since 1980. CDC now estimates about 70,000 annual cases of legionellosis and about 10% are fatal; most have a water nexus in some form.

Legionellosis is underreported because many pneumonia cases are not typed to identify the specific microorganism cause. Pontiac Fever has flu like symptoms and is generally self-limiting and not fatal, so it is often not diagnosed or treated by a physician. Legionella bacteria grow primarily in warm water environments such as building plumbing systems, cooling towers, spas and hot tubs and ornamental fountains, and wastewater oxidation and aeration basins. Cases generally increase in summer months. The optimal growth temperatures are in the range of +/- ~25 to 50 degrees centigrade (~77 to 122 F), but they will grow outside of that range. They multiply in biofilms and in some amoebas that provide protein nutrients and also protect them from disinfectants.

The public at highest risk due to individual susceptibilities are elderly, smokers, and immune compromised including cancer patients. Many cases have occurred in hospital intensive care units, long term care facilities, hotels, spas and from building plumbing, and downwind from cooling towers and wastewater treatment facilities. However, cases have occurred in all age groups. The growing immunosuppressed population is at particular risk.

Any mitigation process for *Legionella* and legionellosis risk should be associated with the development, application, and periodic revision of a comprehensive water safety or management plan that incorporates a Hazard Assessment Critical Control Point (HAACP)-type management system for maintaining improved changes in building water system conditions. These can include: (1) temperature management in hot water systems, (2) disinfection treatment especially of warm and hot waters, but also cold water (3) continuous presence of residual disinfectants to the water tap/outlet, (4) periodic surveillance and monitoring to detect changing *Legionella* presence, and (5) verification and regular iterations of effective practices.

Figure 2. Etiology of drinking water associated outbreaks (n=928), by year, US, 1971-2014. Source: Benedict *et al.*, 2017



The CDC MMWR (CDC, 2015) for 2013 to 2014 demonstrates that water related Legionnaires' disease is now the most significant waterborne disease in the United States, and probably in other developed nations. Twenty-four of the 42 reported U.S. drinking water-associated outbreaks were caused by *Legionella* resulting in 130 cases and 13 deaths; notably, it was the only cause of deaths among the reported waterborne outbreaks. The CDC MMWR reports over about the last 10 years consistently indicate that about 60% of waterborne disease outbreaks and all deaths are due to legionellosis. Unpublished data from 2015 to 2017 in CDC's National Outbreak Reporting System (NORS), indicated 89 drinking water related legionellosis outbreaks with 572 cases and 58 deaths.

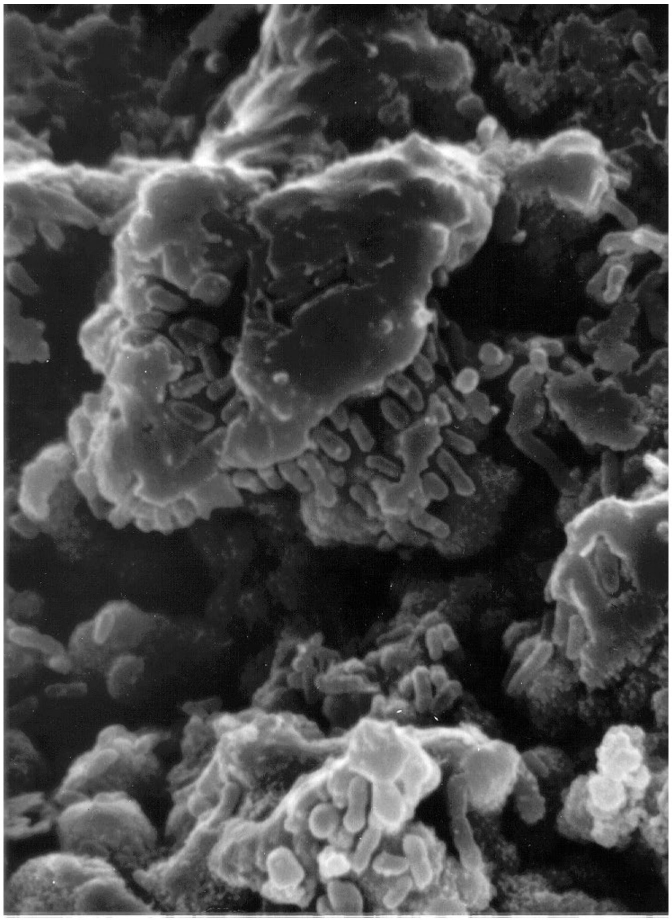
Existing EPA drinking water regulation interpretations actually act as an impediment for hospitals to install supplemental disinfection to reduce risks to patients. They require that if any facility having more than 25 users adds treatment to the public water entering the facility, it becomes a public water system. Thus, a facility (e.g., building or hospital) that adds water treatment to water from a public water system would become a consecutive water system. That designation adds unfamiliar additional responsibilities and could adversely impact decisions on adding supplemental disinfection in their plumbing systems. Other countries like Canada, UK and Australia, do not have similar requirements. The positive benefit risk balance for a more appropriate interpretation is obvious. A different interpretation by EPA would facilitate actions that would immediately reduce legionellosis risks in those facilities. This could be done by variance and exemption guidance and would not require a regulatory change.

See: Cotruvo, JA. Facilitating Supplemental Disinfection for *Legionella* Control in Plumbing Systems. JAWWA. 106:8, 74-83, August 2014.

Distribution System Degradation

Distribution systems are almost uniformly in various states of disrepair. Good quality treated water leaving the water plant passes through aging distribution pipes often coated with tuberculation and biofilms resulting in opportunities for reduced water quality. It has been estimated that about 500,000 water main breaks occur each year in the US. Not only do these require emergency repairs, and unbilled water loss, but they allow recontamination and seeding of distributed water by the likes of Legionella and other pathogenic microorganisms. The photomicrograph below illustrates the not unusual interior condition of many distribution pipes, including encrustations and even rod shaped bacteria.

Distribution systems probably constitute the major financial investment in water systems, and the greatest vulnerability for degradation of post treatment water quality. Figure 2 shows the increase in distribution related disease outbreaks versus source related outbreaks that are well managed by filtration and disinfection. Many systems with pipe well over 100 years old are currently in use and many water suppliers do not have aggressive programs for leak detection and reasonably rapid upgrades, because of costs. Water suppliers need to allocate dedicated funds to manage and restore their distribution systems to reduce the probability of breaks.



See: Drinking Water and Public Health in an Era of Aging Distribution Infrastructure. Martin J. Allen, Neil Grigg, Robert Clark, Joseph Cotruvo. Public Works Management and Policy. October, 2018. DOI: 10.1177/1087724x18788368 journals.sagepub.com/home/PWM

Conclusion

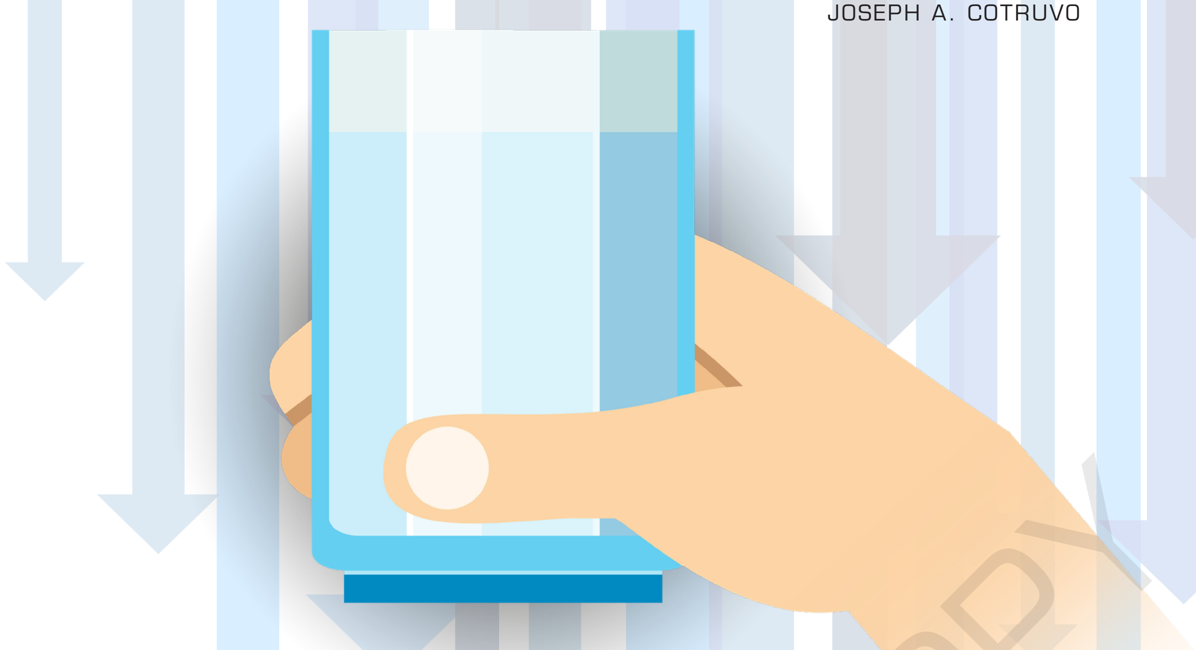
This information summary provides a lot of factual information and suggestions regarding five topics of current interest in drinking water management. Legionella contamination and related distribution system replacement and repair constitute the greatest challenges to maintaining safe drinking water in the US. Addressing those problems should be the highest priority for continued health protection by water suppliers and state and federal drinking water programs.

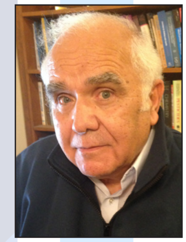
I appreciate the opportunity to provide these brief comments on those complex issues to contribute to your deliberative process. I am available for further elaboration, including more supportive citations, if desired.

Sincerely,

Joseph A Cotruvo

JOSEPH A. COTRUVO





Cotruvo

Lead Reduction Is a National Success Story

David Cornwell's October 2018 *Journal AWWA* article "How Have We Done in Reducing Lead in Water Since the LCR?" as well as earlier writings demonstrate that, when enforced, the Lead and Copper Rule (LCR) has been effective in improving corrosion control, reducing the number of lead service lines, and contributing to further reductions of child blood lead levels (BLLs). The October 2018 special issue of *Journal AWWA,* which was focused on Distribution Systems and Corrosion Control, provided a body of information describing how water professionals are addressing lead and corrosion issues.

LEAD REDUCTION EFFORTS

The spike in lead levels in Flint, Mich., circa 2014 and the issues that plagued the city afterward wouldn't have occurred if standard treatment practices had been applied and the state effectively enforced existing regulations. Although lead in water will remain a concern as long as lead-containing pipes and fittings and galvanized pipes are still in service, the average and peak BLLs in US children have drastically declined in the past 40 years, primarily as a result of eliminating lead in automobile gasoline, paint, food-can and water pipe solders, and millions of service lines, as well as reducing lead in brass water fixtures.

Between 1976 and 1980, average BLLs in US children aged 6 months to 5 years were about 16 µg/dL (µg per 100 cc of blood), according to the National Health and Nutrition Examination Survey (NHANES II). Further, the survey noted that 63.3% of BLLs were in the 10–19 µg/dL range and 0.1% were in the 50–59 µg/dL range. The national mean values were down to 2.7 µg/dL by 1991 and to 1.9 µg/dL by 2002. The mean in 2014 was 0.84 µg/dL, according to a study by Hernán Gómez and colleagues that appeared in the June 2018 issue of *Pediatrics*. Given this trend, it's probably even lower today.

As of 2012, the CDC "reference" level for BLLs is 5 µg/dL, reduced from the prior 10 µg/dL "concern" level. The reference level is based on the 97.5th percentile of national BLLs in children being less than 5 µg/dL, at which point follow-up action is recommended to determine and eliminate the cause of any exceedance. Subtle, but potentially reversible, IQ losses are suspected to potentially occur at levels about 5–10 µg/dL or perhaps lower, as discussed in a Mar. 22, 2016, PBS.org article by Ellen Ruppel Shell (https://to.pbs.org/2R946o8). CDC recommends that chelation therapy for lead poisoning be considered if BLLs exceed 45 µg/dL. Developmental mental deficits can occur at considerably lower concentrations.

Although high lead concentrations were measured in Flint's water, the water was so obviously tainted that few people drank it, even after public assurances it was safe. In the end, child BLLs weren't significantly affected, as noted by Gomez and Kim Dietrich, who explained in an opinion piece in the *New York Times* on July 22, 2018. In the 2018 *Pediatrics* study, Gómez and colleagues examined the results of almost 16,000 BLLs for children in Flint between 2006 and 2016 and found the number of measured BLLs above 5 µg/dL was 11.8% in 2006 and, in general, continuously declined, with some variations, to 3.7% in 2016. Mean BLLs were 2.33 µg/dL in 2006 and 1.15 µg/dL in 2016.

The half-life of lead in blood is about 30 days. CDC's July 1, 2016, *Morbidity and Mortality Weekly Report* for Flint (http://bit.ly/2UcWsek), from more than 9,000 samples, indicated a temporary increase from 2.5 to 4.2% (from 59 to 71) in the number of children with BLLs between 5 and 9 µg/dL after the switch to Flint River water, then a decline from 3.4 to 1.1% (68 to 37) after the change back to Detroit drinking water. The number of those few with BLLs greater than 10 µg/dL was lowered somewhat, but this may not have been statistically significant. The report notes that 53% of the blood samples were from venous blood and 46% were from capillary (finger stick) blood samples. This complicates the interpretations because skin contamination can cause capillary blood measurements to be higher than venous blood and may be less reliable than venous blood samples. According to "Interpreting and Managing Low Blood Lead Levels," a 2013 guidance for physicians from the Physicians Pediatric Environmental Health Specialty Units, initial capillary blood lead measurements greater than 4 µg/dL should be confirmed by a venous sample. It wasn't clear whether that had occurred for the data set of 9,000 samples used by CDC.

Unfortunately, the greater adverse health outcome in Flint is the likelihood that the corrosive water allowed for the mobilization of *Legionella* bacteria from biofilms and sediments, increasing the risk of legionellosis from aerosol inhalation. Sammy Zahran and colleagues, who published a report on Feb. 20, 2018, in the *Proceedings of the National Academy of Sciences* (https://doi.org/10.1073/pnas.1718679115), found that 87 cases of legionellosis and 12 deaths were reported at one point in 2014–2015 in Genesee County, Mich.

LEAD AND COPPER REGULATION

The US Environmental Protection Agency's LCR regulation was promulgated in 1991 and updated in 2000 and 2007. It requires water suppliers to regularly test for excessive corrosivity in drinking water at the tap in distribution system locations at the highest risk (50% lead service lines). Testing is performed on water that has been stagnant overnight or for at least 6 h. A 1 L first draw sample is collected, and if more than 10% of the samples exceed the lead action level of 15 µg/L or the copper action level of 1.3 mg/L, the system must introduce corrosion-control procedures and public notification. If the corrosion control isn't successful, the system must begin a lead service line replacement program of 7% per year.

The LCR action level isn't a maximum contaminant level, and it doesn't presume typical exposure. It's a benchmark screening value to indicate excessive corrosion potential for the water as tested under extreme and noncontinuous circumstances. The stagnant first draw sample is intended to be a virtual worst case and includes water in contact with the usually leaded brass tap and some length of plumbing and solder joints, which would have high lead solder if installed before 1986 when lead solder was banned by statute.

The World Health Organization's (WHO's) 2017 *Guidelines for Drinking-Water Quality* and the European Union's (EU) drinking water directive are both 10 µg/L for lead in drinking water). Some might misinterpret this level to be more protective than the US action level. However, WHO and the EU don't require stagnant first draw water as the LCR screening test does; WHO and the EU would also allow running water sampling more typical of most daily use rather than first draw. Therefore, it's possible that routine exposure to drinking water at 10 µg/L or more could occur.

REGULATORY SUGGESTIONS

The LCR could be strengthened with minimal effort and limited cost impact by the following:

- Partial lead service line replacements that include only the public portion, but not the private segment, aren't generally recommended. In Washington, D.C., for example, lead levels peaked and then stabilized within a few weeks of public lead service line replacements. In this case, bottled water or filters should be provided to customers in the interim.
- Experience shows that expecting residents to conduct uncontrolled monitoring is difficult to arrange and has opportunities for error. Controlled on-site sampling with advance approval from residents, as by utility or health department personnel, would be more reliable. Even better, perhaps, would be to test local lead line loops in a laboratory to continuously determine the intrinsic corrosivity of the system's water.
- Sampling stagnant first-draw water is good with respect to plumbing lead. The simplest improvement would be adding a second-draw sample when the temperature change indicates that service line water is being accessed. For example, DC Water also conducted second-draw sampling, which consistently showed that phosphate corrosion control was successful. Sampling also showed a strong correlation between high iron levels from premise galvanized pipe and high lead levels.
- In apartment buildings, lead service lines often were not installed because the lead pipe capacity is too small, so first-draw stagnant samples would probably be sufficient for determining the effects on plumbing in these buildings.

However, the current and future LCR must be diligently applied by water utilities and properly enforced by regulators.

ADVICE TO CONSUMERS

Some recommendations for consumers to resolve their lead concerns include the following:

- Check if a lead service connection exists in your home. Find where the outside incoming water line connects to the indoor meter if one is present. Ask the water supplier for a water analysis if there's any doubt.
- Don't drink the first water out of a tap, regardless of plumbing type. It will probably be warm and not taste very good, and it might have leached some material from pipes during stagnation. Let the tap water run for several seconds, preferably until the temperature has changed, indicating that more distant service line water has been reached (assuming there is no lead service line).
- Don't consume anything made from first-draw water or water from the hot water tap, including baby formula, reconstituted juices, rice, pasta, boiled potatoes, and soup.
- If the home or building contains galvanized iron pipe, the water should be sampled for lead and iron. Serious consideration should be given to replace older galvanized pipe with currently approved pipe.
- Read the water supplier's annual Consumer Confidence Report and insist that the water supplier is following the law and managing corrosion.

The successful reduction of lead levels in water is a prime example of comprehensive regulations aimed at a definable problem where success and risk reduction benefits are measurable. The Flint situation raised awareness of lead issues and stimulated concerted efforts to address issues (especially in schools), although fortunately the blood lead data show that many high child exposures didn't occur. With regard to drinking water's relatively small remaining contribution to BLLs of lead, the LCR has been successful, but there are some locations that haven't fully applied the regulation and sufficiently managed corrosion. Those who are lagging behind should realize that there's nothing to be gained and much to be lost by not fully applying the LCR to their water systems.

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