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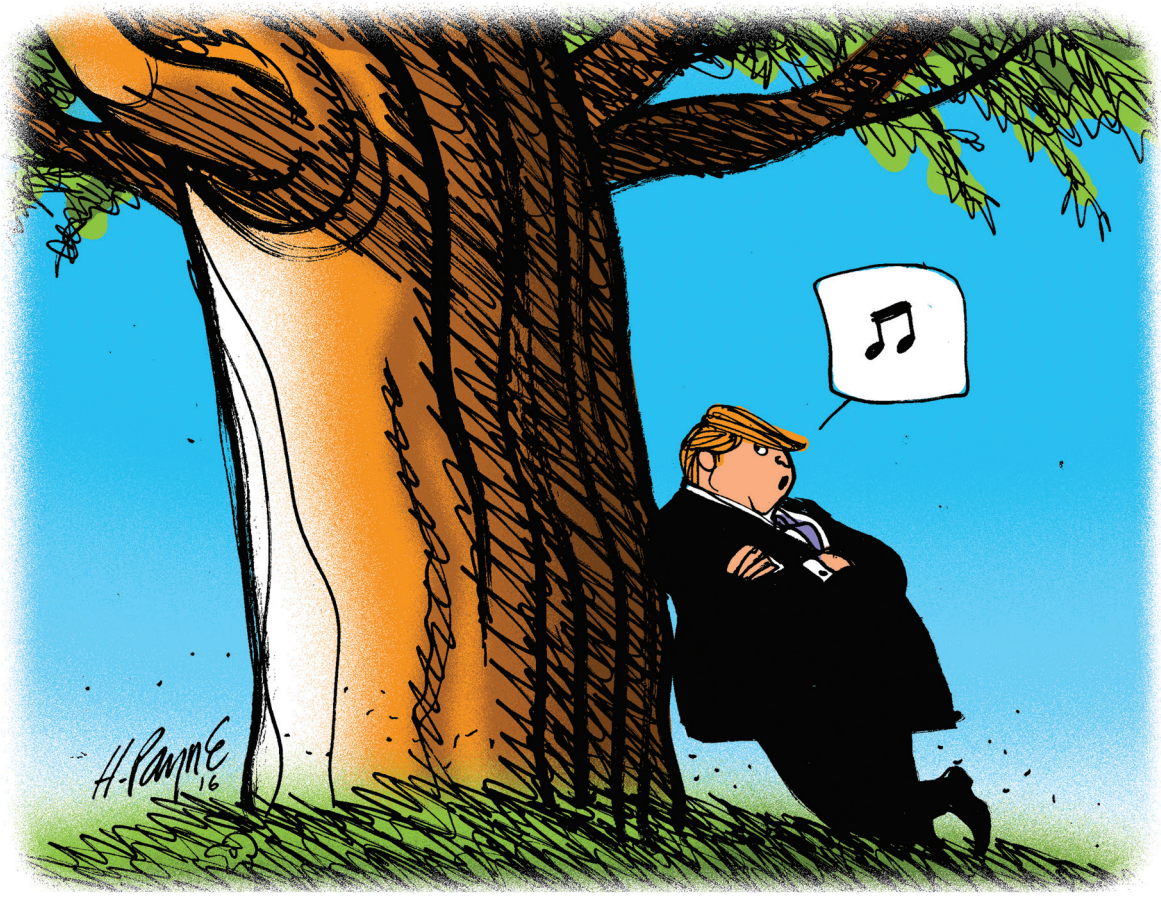

Trump and Environmental Protection

Report
Getting Lead Out of Drinking Water

Brief
Saving Biodiversity During Conflict

Debate
Energizing Private Sector on Climate

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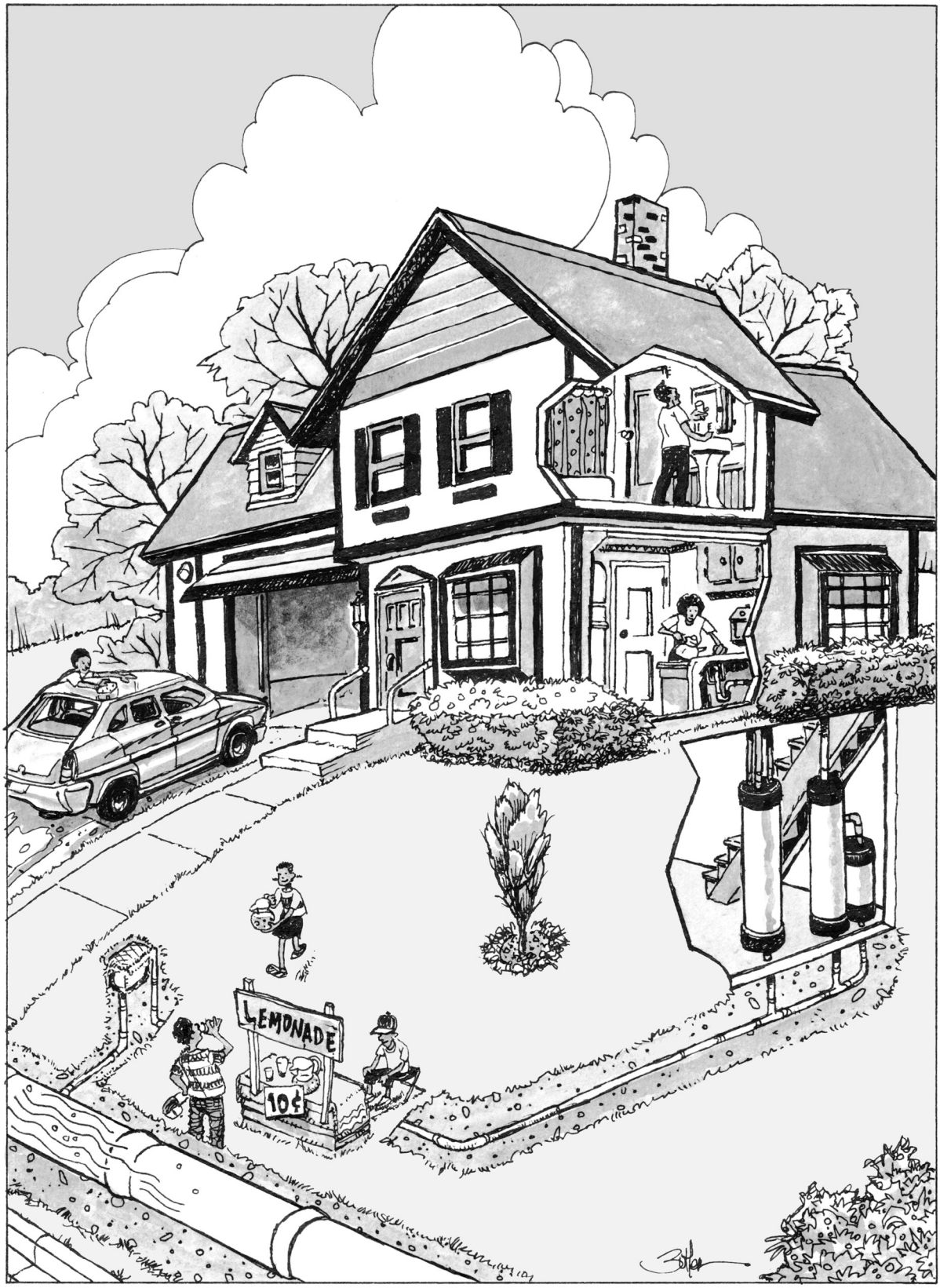

The Path From Flint

The tragedy in this Michigan city demonstrates the need for vigilance in protecting families from lead in drinking water. There will be no better moment to develop workable solutions for getting the heavy metal out, protecting public health, and renewing faith in this basic resource

David B. LaFrance is chief executive officer of the American Water Works Association. AWWA is the world's largest and oldest association of water professionals, with more than 50,000 members worldwide.

It is difficult to imagine what it has been like to live in Flint, Michigan, for the last two years. Confidence in the city's drinking water, a critical resource for one's daily existence, was shattered, and it will likely be years before citizens will fully trust the city, state regulators, or federal policymakers. The discovery of high levels of lead in homes throughout Flint — and the series of decisions that led to it — is a reminder that the first job of every water professional is to protect the families we serve.

As the city slowly recovers, there is good news in the broad battle against lead in drinking water. Even before Flint was in national headlines, the Environmental Protection Agency was in the process of revising the national regulation that addresses lead in drinking water. The Lead and Copper Rule, first adopted in 1991, is widely considered one of the most complex regulations under the Safe Drinking Water Act. With a proposed rule revision anticipated in 2017, an advisory council representing a diverse set of stakeholders has provided EPA with recommendations that strengthen consumer protections today while working for a future where sources of lead exposure are removed altogether.

Water professionals recognize lead's health impacts and know that traces of the heavy metal in water, like lead in paint and dust, contribute to a cumulative environmental exposure that can cause severe and long-lasting harm. For decades, more than 50,000 U.S. drinking water systems have worked diligently to protect Americans from lead in the water we drink. By 2014, virtually all systems serving more than 50,000 people were actively adjusting water chemistry to control corrosion and thereby reduce the risk of lead in service lines and home plumbing from dissolving into water and ending up at the tap.

In April 2014, Flint stopped purchasing treated water from the city of Detroit that included corrosion control adjustments. At this point, Flint turned to the Flint River as its supply and cleaned that water in its own treatment plant, constructed in 1952. The city's change in water source without adequate consideration of potential changes in source-water chemistry — and without continuing corrosion control at the Flint water treatment plant — resulted in elevated lead levels at customers' taps. In December 2015, Flint declared a state of emergency. By January 2016, lead contamination in Flint dominated national headlines, sparking a demand for action to secure high-quality drinking water for all Americans.

Residential lead service lines represent a large source of lead that comes into contact with drinking water. Service lines are the pipes that connect individual homes to the water mains in the street. In the late 1800s and early to mid-1900s, lead was often used for service lines two inches in diameter or smaller. The practice fell out of favor in some communities in the early 20th century but continued in other locales until 1986, when lead pipe was banned nationally. Currently, an estimated 6.1 million lead service lines remain across the United States, serving approximately 7 percent of the population. Of the 56,000 homes and businesses in Flint, 8,000 may have lead service lines.

In most communities across America, ownership of water service lines is split between the water system and the customer. Utilities own the public portion from the street to approximately the property line, and the customer owns the remaining private portion that connects to the home or business. Removing these lines in full can therefore pose challenges to both the water system (e.g., costs and gaining access and buy-in from customers to replace the private portion of the lines) and to customers (e.g., affordability and recognition of health benefits from lead service line replacement).

It is also important to note that, in addition to lead service lines, plumbing inside a home or business can contain lead solder and brass components. These, too, can contribute to lead at the tap, particularly in the absence of appropriate corrosion control.

The Lead and Copper Rule is the federal regulation intended to protect customers from lead in drinking water. After promulgating the LCR, EPA revised it in 2000, 2004, and 2007. For most drinking water regulations, EPA identifies a Maximum Contaminant Level. The MCL represents a specific, not-to-exceed concentration of a contaminant in water. However, because lead exposure comes from service lines and home plumbing — not from water leaving the treatment plant — EPA took a different approach. The agency developed what is called a "treatment technique" instead of an MCL.

Under the Safe Drinking Water Act, a treatment technique specifies a set of practices for the water utility designed to control exposure to a contaminant of concern. The LCR treatment technique includes four elements: ongoing monitoring for all regulated systems, a requirement for corrosion control treatment at a subset of systems, public education measures when monitoring indicates lead levels are elevated, and lead service line replacement when corrosion control is not being reliably achieved.

Under the LCR, water is sampled at customer taps. To make the requirement more protective of public health, sampling occurs at locations within the utility's service area that are likely to have higher levels of lead. Using this monitoring data, utilities must determine if they have exceeded the rule's "action level." To make this determination, the water samples are placed in a progression from highest to lowest based on their lead concentrations. When the sample at the 90th percentile in the progression is above 15 parts per billion, the system has "exceeded" the action level and must take additional steps to address the issue, including public education, evaluation of corrosion control, and in some cases, replacing lead service lines.

When EPA last revised the LCR, a decade ago, the agency enhanced the implementation and public education aspects of the rule. Further enhancements that address health and policy issues related to lead in water have been, and continue to be, a focus for researchers and policymakers. The data collection, research, analysis, and other work done on these issues focus on reducing exposure to lead and will shape future revision of the LCR.

While not always the case, the term "partial lead service line replacement" generally refers to when a utility replaces only the public portion of the line. In 2011, a new evaluation by EPA's Science Advisory Board found that partial replacements might cause more harm than benefit, especially in the short term. Specifically, the study found that partial lead service line replacements "have not been shown to reliably reduce drinking water lead levels in the short term, ranging from days to months, and potentially even longer" and that they are also "associated with short-term elevated drinking water lead levels for some period of time after replacement."

The SAB finding creates a Catch-22 for EPA and for utilities needing to comply with the LCR. On the one hand, the rule requires lead service line replacement when corrosion control is not effective. In these cases, if the utility cannot gain access to the portion of the service line owned by the property owner, partial lead service line replacements are an allowable way to comply with the rule. On the other hand, the SAB found that a partial replacement can actually increase the short-term risk of higher levels of lead at the customer's tap. The utility quandary then becomes how — when a customer is unwilling to participate in the removal of the private portion of the lead service line — to comply with the LCR and at the same time protect the customer's health.

The SAB's finding also raises programmatic issues for utilities related to their ongoing routine construction and maintenance programs. For example, utilities regularly perform important maintenance and replacements of water mains buried under the street, and in the course of their work they may come across lead service lines. In light of the SAB findings, and in order to continue efficient programmatic practices, a utility must proactively develop a new series of standard operational protocols that address the discovery of a lead service line in the course of routine work. Should the utility not perform the work? Or should it replace only the portion of the lead service line in the street? Or should it add replacing the privately owned portion of the lead service line to the routine project?

In early 2012 another key issue came into focus. The Centers for Disease Control put forth a new metric for community-level intervention to prevent el-

Continued on page 28

Not Through More Stringent Regulation Alone

The tragedy in Flint, Michigan, is a poignant reminder that drinking water can still be an important source of lead exposure in communities. Flint also demonstrated that without effective implementation and oversight of regulatory mandates, communities have no assurance that they are being protected from exposure to lead or other drinking water contaminants. The absence of timely, open, and honest communication also resulted in a missed opportunity to protect Flint residents through effective risk messaging. That along with the heightened anxiety that turned to outrage eroded the community's trust in its elected officials and the regulatory system.

The people of Flint were betrayed by those whose primary job is to protect the health of the public. We don't know how many more Flints there are in which government oversight and support is underfunded or just indifferent. Flint also raises important environmental justice concerns by virtue of the fact that this happened in a predominantly low-income, nonwhite, and economically depressed community. This crisis will hopefully serve as a wake-up call to other communities to reassess whether they are truly responsive to the needs of the citizens they serve. At the least, it will surely take extraordinary steps for the agencies and elected officials that failed the people of Flint to regain the respect and trust of the people.

Other communities have demonstrated that existing laws and rules can be effectively implemented, with the proper oversight, to ensure the protection that those mandates promise. Better planning, monitoring, oversight, and communications under the current Lead and Copper Rule would have afforded Flint a much-higher level of protection from extreme concentrations of lead than was provided. The National Drinking Water Advisory Council has made a clear case that there is a need for a more robust LCR. However, a repeat of the Flint situation will not be avoided through more stringent regulations alone.

I believe it is also important not to view Flint as representative of all cities, their water utilities, and oversight agencies across the country. Utilities are well aware of the hazards of lead and most are in full compliance with the LCR. Many are also actively working to reduce lead concentrations by optimizing water treatment and by implementing lead service line replacement strategies. Nonetheless, there is a need to revise the LCR to create a long-term plan that addresses lead service line replacement as the priority goal.

Chris J. Wiant

Prior to the public disclosure of the situation in Flint, the NDWAC recognized that there is a need to address the deficiencies of the current LCR in order to achieve a higher level of public protection. Recommendations were developed through a consensus process by its Lead and Copper Rule Working Group in 2015. With its full support, NDWAC forwarded those recommendations to EPA. While the recommendation from the working group is for the LCR to remain a treatment technique rule, there are also important enhancements.

The goal of the recommended revisions is the removal of lead service lines. The NDWAC also recognized that a shared responsibility exists among federal, state, and local governments, utilities, and customers. In recognizing the time and financial resources required to achieve the goal of lead service line removal, it is essential to have a robust effort of consumer education and engagement that enhances the protection that is currently provided through monitoring and water treatment.

The recommendation includes other important features, such as the establishment of a Household Action Level that, when exceeded, requires notification of the consumer and the applicable health agency for follow-up; additional study to address corrosion control, sampling methodologies, and monitoring; engagement of federal partners such as Housing and Urban Development and the Centers for Disease Control and Prevention; and development of the appropriate metrics that demonstrate progress with lead service line replacement.

Flint was a tragedy for the entire community. It was also a reminder for others that the problem of exposure to lead in community water supplies is real and the risk, especially to children, is not trivial. Hopefully the lessons learned from Flint will prevent a recurrence in another city. Meanwhile, the NDWAC recommendations to EPA offer a well-conceived path forward to provide enhanced protection to the public through effective implementation of a revised Lead and Copper Rule.

Chris J. Wiant, M.P.H., Ph.D., is the president and CEO of the Caring for Colorado Foundation, a health grantmaker. He has more than 40 years of experience in public health and environmental policy and programs at the state, local, and national level and with the foundation. He also served on the Colorado Water Quality Control Commission and is currently a member of the National Drinking Water Advisory Council. He was a member of the Lead and Copper Working Group.

evated blood lead levels in children. It recommended replacing the level of concern of 100 parts per billion in blood with a reference level for lead. This reference level was set at 50 ppb, which represents a blood lead level that 97.5 percent of children ages 1 to 5 fall below. CDC subsequently adopted this recommendation and urged that EPA consider it.

A 2013 study by EPA staff raised questions about how to take water samples and manage risk for homes with lead service lines. The authors collected a sequential series of samples from homes with lead service lines within a water system that was compliant with the LCR. The sequential samples were used to develop a profile of the lead levels at the tap, in the home plumbing, and in the service line. The study found higher levels of lead in samples representing water from the lead service line.

At least two possible alternative, but related, policy and operational considerations arise from these findings. One is to modify the LCR sampling process in order to target the lead concentration in water residing in the service line and to use this measurement as the indicator of the corrosion control's effectiveness. The other is community-wide planning to remove all lead service lines in their entirety and thereby eliminate this potential contribution.

In January 2014, the Reduction of Lead in Drinking Water Act took effect. This law dramatically reduced the allowable level of lead in new pipes, fittings, and fixtures installed in potable water systems, thereby further reducing the amount of lead in contact with drinking water. While the act cannot address lead in existing home plumbing and piping, it does set a very stringent standard for lead content in all plumbing materials used in current and future construction and repairs.

Against this backdrop, in February 2014 EPA asked for input from the National Drinking Water Advisory Council, a diverse group of stakeholders that includes utilities, consumer advocates, and health professionals. Twenty-three months later, the NDWAC forwarded its recommendations. The proposed work group process was to have focused on improving individual elements of the current LCR (e.g., the compliance monitoring sample pool, the compliance sampling protocol, etc.). However, as the NDWAC work group drafted its recommendations, the group took a different tack. While responding to individual LCR considerations, members also looked for the next significant opportunity for risk reduction and described a path toward that goal. They recommended that each community implement a strategy with the goal of removing all lead service lines in their entirety, engage in more proactive public education, and expand corrosion control and monitoring. They also recommended the development of a national household action level and an approach that supports customer-requested water samples.

Existing legislation significantly reduces lead in new plumbing materials, and corrosion controls address the release of lead already in contact with water. Therefore, the work group determined that the greatest remaining opportunity to further reduce lead risk in water is to remove lead-bearing materials that come into contact with water — particularly, lead service lines. When made of lead, the service line can represent as much as 75 percent of the observed lead concentration in tap water. The NDWAC recommended that every water system with lead lines in its service area develop a proactive replacement program, with a milestone of 2050 for complete removal.

Each water system will need to develop a complete inventory of lead service lines — something that many systems do not have because the private portions of service lines are not part of their system assets. Achieving full lead service line replacement (e.g., from the main to the home plumbing) will require actively engaging the customer. Replacement will take time, but it can be accelerated by local, state, and federal policies that promote lead service line replacement (e.g., replacement as a condition of property transfer, inclusion of removal in Housing and Urban Development lead-safe housing requirements, etc.). And removing lead service lines is best accomplished through an ongoing program rather than one that is sporadically initiated and stopped, as is often the case under the current LCR rule structure.

The cost of replacing the lines is substantial. Assuming the replacement of each line costs approximately $5,000, a mid-range estimate, full replacement of the estimated 6.1 million lead service lines nationally would cost roughly $30 billion. And as noted, in many, if not most communities, ownership of service lines is shared, meaning there will potentially be significant financial realities for both individual households with lead service lines and utilities.

Public education is already an element of the LCR, but the requirements for communicating about lead in drinking water apply largely after an Action Level exceedance. The NDWAC proposal makes public education on lead an ongoing activity for all water systems. It encourages EPA, CDC, HUD, and others to coordinate their lead educational materials to address the many routes of environmental exposure (e.g., paint, dust, soil, water). The proposed changes would include direct outreach to consumers with lead service lines and would speak to the potential hazards posed by lead pipes. This elevated, ongoing, and co-

Continued on page 30

Sidebar

Unsafe Lead Service Lines Must Be Removed

A consensus has emerged among drinking water and public health professionals that we must replace the estimated six to ten million lead service lines still in use. LSLs deliver water from the main under the street to our homes and cannot be safely managed in place.

Corrosion control — treating the water to create a protective coating inside these pipes as well as leaded plumbing inside the house — has been our primary tool to reduce lead in drinking water. While it is important, corrosion control is not up to the task of protecting children from the unpredictable spikes of lead particulate released into drinking water when the LSLs are disturbed. Children's developing brains are vulnerable to long-term harm from even these short-term spikes. After all, there is no safe level of lead exposure.

Instead of being the last resort — as it is under the Environmental Protection Agency's Lead and Copper Rule — LSL replacement should be an essential and integral part of a revised rule. Full replacement across the nation may take decades of sustained effort to accomplish, but it needs to be done.

Three years ago, my recommendation would have been quite different. Like many who work on lead-poisoning prevention, I focused on paint and thought water was well-controlled. I routinely used the 15 parts per billion Lead Action Level in the LCR as the benchmark for safety. I had heard about the crises in Washington, D.C., in the 2000s but thought it was primarily a problem with the discredited technique of replacing only part of the lead service line. I taught classes explaining that the protective coating on the inside of lead pipes and leaded plumbing formed an effective barrier.

In 2014, my eyes were opened. EPA asked me to serve on a workgroup of its National Drinking Water Advisory Council to develop recommendations to revise the LCR. I soon realized that LSLs could release significant amounts of lead particulate into the water we drink without warning or notice. The monitoring program was not designed to detect spikes. Its purpose is to improve system-wide corrosion control, not to identify health risks.

A year later, the workgroup released a report recommending replacement of all LSLs as part of a rule overhaul and development of a health-based Household Action Level to alert public health officials and help families make decisions to protect formula-fed infants, the most vulnerable population. The report was essentially complete before Flint made the national news.

Tom Neltner

In 2015, the full advisory council recommended EPA fix the rule by implementing the workgroup's recommendations. It also suggested additional items based on the lessons from Flint and points made in a workgroup dissenting opinion. EPA committed to issuing a proposed rule revision in 2017. Its latest thinking was captured in a white paper the agency issued last October.

The path ahead will be difficult. EPA rulemaking is a slow and tedious process, especially when private homeowners are affected, costs run into the billions, and civil rights and environmental justice implications must be considered with every option. Optimistically, the rule will be finalized in 2018 and compliance would begin in 2021. Even then, the rule alone is unlikely to accomplish the goal without support from Congress and other federal agencies and programs.

Fortunately, under the leadership of the American Water Works Association, the industry has stepped up and committed to full LSL replacement. The Environmental Defense Fund has joined a broad coalition of more than 20 national utility, public health, and consumer protection groups to launch the LSL Replacement Collaborative, designed to help communities voluntarily accelerate their efforts to design and implement local programs. The collaborative will be releasing tools in early 2017 that include a roadmap for communities, best practices to replace the LSLs, and opportunities for federal, state, and private groups to support these communities.

For environmental professionals, there are important lessons to consider. First, Flint reminds us of the crucial role states play in protecting us and the implications when they fail. Second, EPA must regularly update its rules and policies to reflect the latest science. The drinking water program requires periodic reassessments, but those were insufficient. Third, the best strategy is to prevent putting a toxic compound like lead into commerce and avoid the enormous costs to clean up the legacy later.

We can fix this problem. The science is certain, the solution is clear, and stakeholders agree it needs to be done. Despite political uncertainty ahead, Americans should agree that children and their parents deserve safe drinking water.

Tom Neltner is a chemical engineer and attorney who serves as the Environmental Defense Fund's chemicals policy director.

ordinated communication program would provide the basis for public awareness needed to encourage service line replacement and bring greater attention to lead as a health concern.

While removing lead service lines reduces a major source of the metal in water, it is important to remember that there are other sources in household plumbing. Therefore, corrosion control remains a critical element in managing lead risks even after removing problematic service lines. The current LCR requires community water systems and non-transient non-community water systems serving more than 50,000 persons to maintain optimized corrosion control. Smaller systems that exceed the lead Action Level must also optimize corrosion control. The NDWAC recommendations would make optimized corrosion control a requirement for community and non-transient non-community water systems of all sizes, even smaller systems that have to-date stayed under the Action Level for lead.

The NDWAC also noted that systems already employing corrosion control should measure water quality control parameters (e.g., alkalinity, phosphate concentration, etc.) more actively and at more monitoring locations in their distribution systems. Water quality parameters are not a surrogate for observing lead concentrations, but they are variables that the water system can monitor and manage to determine the effectiveness of the utility's corrosion control program.

The NDWAC also asked EPA to propose a health-based Household Action Level for lead in water. The council recognized that even in a community where the LCR Action Level for lead in water has not been exceeded, some individual homes could have high levels at the tap. Therefore, the NDWAC recommendation was that if a water sample from a home is above a certain Household Action Level threshold, the sample results and contact information for the sample site would be provided to the local health department. This would trigger poison prevention experts from the health department to engage the household and provide the family with assistance. Additionally, having this Household Action Level would facilitate clear risk communication by helping water systems speak directly to homeowners about lead risks.

A final important public outreach element in the NDWAC's recommendations relates to challenges posed by homeowner-requested sampling. To comply with the current LCR, utility personnel must sample homes in areas that are at high-risk for lead exposure, including some homes known to have lead service lines. To obtain these samples, they must engage homeowners or tenants as willing participants to collect reliable samples using the prescribed sampling protocols.

The current sampling structure and guidance may discourage water systems from supporting customer-requested sampling. That is because under the LCR, all samples collected, whether as part of the LCR or at the request of a customer, could be used by state regulators to determine if a system is exceeding the Action Level. For example, a utility that took three samples at a home to help a customer diagnose where lead was entering the water (e.g., at the tap, indoor plumbing, or service line) could be required to include these three high values in its compliance dataset, despite the fact that the samples were taken for other reasons than LCR compliance.

The NDWAC observed that a better approach — one that would not dissuade utilities from responding to customer-requested samples — is to encourage the exchange of information between the water system and customer about actual lead levels in order to help consumers evaluate their risks, take steps to protect themselves, and understand the benefits of full lead service line replacement. To address this observation, the NDWAC recommended that water systems that are reliably compliant with the lead Action Level employ data from customer-requested sampling to inform corrosion control practices. The NDWAC feels this would encourage more dialogue with customers. With more active consumer engagement, the NDWAC anticipated there would be additional benefits, including development of a more geographically diverse and continuous dataset.

The situation in Flint has clearly demonstrated the need for vigilance in protecting families from lead in drinking water. It has also presented an opportunity. There will be no better moment to develop workable solutions for getting lead out of our water, protecting public health, and renewing consumers' faith in drinking water. The revisions to the LCR proposed by the NDWAC serve as a starting point for the newest phase of this effort, not just for Flint but for all of communities.

The future will likely see water systems being even more attentive to their corrosion control strategies, actively engaging with their customers, and ultimately, working for the complete removal of all lead service lines. While the water utilities play a significant role in fulfilling the NDWAC's vision, they cannot do it alone. It will also take collaboration among consumers, public health officials, government at all levels, philanthropy, and other partners.

The tragic events that took place in Flint have sped us down the path to solving the challenges of lead in drinking water. Addressing these concerns is complicated but also solvable if we all share the responsibility to support, fund, implement, and prioritize the action needed to assure the safety of our drinking water. **TEF**

Now Is the Time to Reduce Lead Exposure

Increased concern about lead in drinking water in the wake of the crisis in Flint, Michigan, offers society the opportunity to reduce lead exposure at the tap. It is time to redouble our efforts to end childhood lead poisoning, and to make drinking water source protection, treatment, and distribution true priorities that impact decisions made by government at every level and by all of us who consume water as part of daily life. Increased oversight, innovation, and investment can reduce lead at the tap and prepare us to meet other drinking water challenges.

We need to ensure that the current Lead and Copper Rule, propounded under the Safe Drinking Water Act, is being implemented properly. Last year, EPA announced increased oversight of state agencies responsible for implementing the LCR and updated protocols in a number of areas, including sampling location and methods, corrosion control treatment, and transparency between utilities and communities. EPA also directed states to work with water systems to update the inventory of lead in their distribution systems. This will result in more attention being paid to lead at the tap and to identifying treatment issues or other problems that are resulting in increased exposure.

Then EPA needs to revise the LCR, an effort in which the agency has been engaged for quite some time and which will result in a proposed revision later this year. EPA should update and provide clear requirements for monitoring programs, including where samples are taken and the protocols for taking them. A revised rule should improve how public education programs are conducted, because unlike as with most other contaminants, action in the home or building is critical to reducing lead exposure.

EPA has also committed to setting a Household Action Level, which would be an amount of lead that, if found in a sample, should prompt not only an investigation to find the source of contamination but also notification of local health officials. EPA should also require water systems to inventory sources of lead in their distribution systems, including lead service lines, and to replace them within a certain amount of time.

The best way to reduce exposure to lead at the tap is to reduce the amount of the metal in contact with water. The largest such source is the lead service line, which carries water from the main under the street to the home or commercial building. There are calls from policymakers, consumers, and others to replace them more quickly than a revised LCR could.

Lynn Thorp

Successful programs require community stakeholders to work together, and there are case studies demonstrating that it can be done. Clean Water Action is working with the Lead Service Line Replacement Collaborative, a diverse group of organizations including water systems, public health and environmental organizations, and others who plan to accelerate this process by providing tools to help communities develop programs for full lead service line replacement.

Lead exposure is most dangerous for children under the age of six, and childhood lead poisoning remains a serious issue in this country. The crisis in Flint should prompt us to ensure that lead hazard prevention programs are well-resourced and that federal, state, and local health programs prioritize childhood lead poisoning prevention while recognizing water as a prominent potential source of exposure.

Preventing future Flints is not just about preventing lead exposure at the tap. The high quality of drinking water in the United States has led Americans to undervalue the complicated tasks of protecting, treating, and distributing drinking water. For example, contaminants that pose health risks in drinking water are often the result of pollution that should be controlled where it occurs, at the groundwater or surface water source. Instead, this burden is too often passed on to treatment plants. The costs of removing contamination are thus being borne by water systems and their consumers. The Clean Water Act and other programs thus need to focus on drinking water protection and public health protection.

An overarching program for preventing lead exposure at the tap and for cleaner drinking water overall should include promoting sustainable water systems supported by a robust research program, an emphasis on innovation, and ample oversight at the federal and state levels to meet the Safe Drinking Water Act goals of reducing public health risk from drinking water. Political uncertainty in light of recent events should not distract us from these goals.

Lynn Thorp is Clean Water Action's national programs director. She served two terms on the National Drinking Water Advisory Council. She has also served on federal advisory committees and other collaborative processes around numerous Safe Drinking Water Act implementation activities, including a recent NDWAC workgroup on revisions to the Lead and Copper Rule.