

**Implications of the state of NYC Water Filtration Systems—Public schools
face high risks for lead poisoning**

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Summary:

An essential resource of life, water, faces a pervasive risk of lead contamination due to aging infrastructure. In the discourse of this paper, we delved into the persuasive issue of lead contamination in water filtration systems, particularly within New York City, and an extended analysis of its global implications. Throughout history, despite numerous legislative efforts, the issue's roots have yet to be resolved. The existence of outdated lead pipes, called service lines, continues to endanger public health across all facets of infrastructure, especially within educational institutions. Effects of lead poisoning are severe in all populations, such as bodily failure and cognitive impediments, especially in children during their formative years. However, initiatives led by organizations such as the Water Keepers Institution and American Water Works Association light a beacon of hope. They take matters into hand by advocating for infrastructure upgrades and providing outreach help toward underserved communities not just in New York, but across the globe. Furthermore, international collaboration through entities like the World Health Organization underscores the global imperative of addressing lead contamination. Despite economic constraints, we can safeguard public health by prioritizing pipe replacement, robust monitoring, and community engagement. Ensuring universal access to safe drinking water necessitates collective action.

Introductory Matters:

Water is perhaps life's most essential ingredient, following air. Approximately 90% of our blood, which facilitates our bodily functions, such as transporting nutrients and wastes, is water. Yet, it also exists as a medium that allows harmful agents to infiltrate our bloodstream. One such substance is lead, a naturally occurring metal element found in water pipes. Why might lead be harmful to humans? Since Ancient Rome, lead was preferred over iron for piping due to its malleability and corrosion resistance. Under normal conditions, the metallic coat of lead does

not react with water. However, over prolonged exposure to moist air, its resistances are bound to degrade, forming a toxic layer called lead hydroxide, which leaks into our water systems.

The ongoing struggle to reduce lead levels has been prevalent for many decades. Before the nation's Environmental Protection Agency (EPA) establishment in 1970, lead was already recognized as a potent agent in inducing cognitive and physical disabilities., especially in children. In 1986, Congress amended the "Safe Drinking Water Act, prohibiting the further use of pipes, solder, or flux that were not "lead-free" in public water systems or plumbing in facilities providing water for human consumption." However, due to the immense costs, Congress allowed pipes already laid in the ground, called *service lines*, to remain in use. Decades later, nearly 9 million Americans continue to use tap water from their aged service lines (EPA 2024). Rather than pushing for replacements, the EPA attempted to monitor lead levels through their proposed Lead and Copper Rule in 1991 over several decades. Unfortunately, many do not realize that the LCR is not a health-based standard but rather a guide for identifying and preventing overall contamination within a community. It rules that "10% of periodic tests on tap water must have lead levels under 15 parts per billion"(CFR 2021). As minuscule as this ratio may appear, no population should contact any amount of lead.

One state has established itself early on as a pioneer for urban water security against lead levels. In 1961, New York banned the installations of lead service lines, two decades before the nation's ban. Nevertheless, as one of America's oldest urban infrastructures and reservoir systems, many preexisting lines remain in use, which leaves nearly 21% (NRDC 2023) of the city's residents at risk. In this discourse, we aim to discuss the implications of elevated lead levels within New York and other regions with inadequate filtration.

Lead Contamination in School's Water System

Water is used for many purposes, from the water used for bathing to the water used to wash your hands. What impacts your body the most is the water that enters your body. Although a tremendous amount of New Yorkers face the issue of lead-contaminated water, there exists an even more lethal form of dispersion in our community, which is through our school system. Residents of NYC may not be drinking water from the faucet all the time, so a “safe” mechanism was placed in schools to provide drinkable water to the students. However, these systems are hard to replace, and need funding to get it started, which makes it difficult for these schools to achieve clean drinking water. A study shows that over 82 percent of over 5,000 public schools have been drinking lead-infused waters, which can be over 2 million students throughout the city (Greenfield, 2018). This affects not only the students but also the staff who use the water fountains as well, some of whom could already be in a critical medical group, with weaker immune systems and more prone to infections given by lead poisoning. NYC public schools have tried to find alternate water systems, such as buying gallons of water tanks (which have been tested to show no signs of lead) to use as drinking water for the school. However, the issue with this is the little endorsement given to the schools, since the scale is extremely large. Having to pay for dozens of barrels a day, for each school, and throughout the school year would cost millions of dollars, which is problematic given how many schools are under NYC's Department

of Education's jurisdiction.

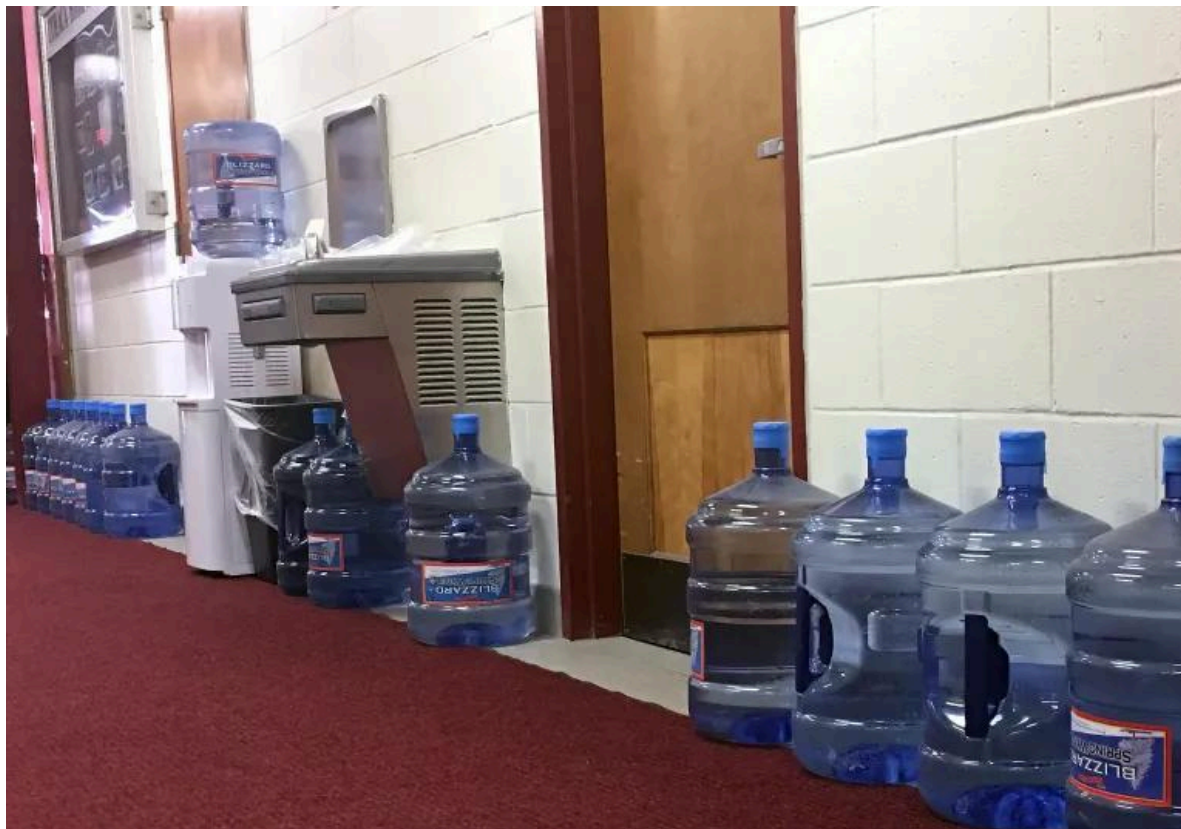


Figure 1: A school in New York shut down water dispensers due to lead infestation and used water containers instead.

These public schools are derived from older buildings, which would make their existing pipework outdated. With this, their pipes build up a series of lead due to their deterioration, and the water that is meant to be used as a drinking source gets exposed to the large student bodies within these schools, that is when the damage is done. Within these populations may have people who have many different conditions, and may not have the best immune system to fight against lead poisoning, leading to risks of fatality in some cases.

Bodily Impacts of Lead Poisoning

Lead poisoning through our water systems has been an enduring issue, causing major illnesses to children even outside of the United States. Places like South America are leading in lead poisoning fatalities, including over 50,000 children under the age of four developing mild retardation (Payne, 2008). Children undergo myelination, which is a part of their brain that develops synaptic impulses which is essential to a human's daily function, where the myelination process only stops after 30 years of age. Although the process may last a very long time, harming the process early on can drastically affect the speech, motor function, and neurological development of that child's foreseeable future. As seen in figure 2, when testing the lead cumulation in their blood, results have shown to have abnormally high levels for these 6-year-olds. This study focused its research on finding lead-contaminated areas (water systems) and its safety for the community, where it is shown to have a huge impact by poisoning thousands of children every year (DHS, 2024)

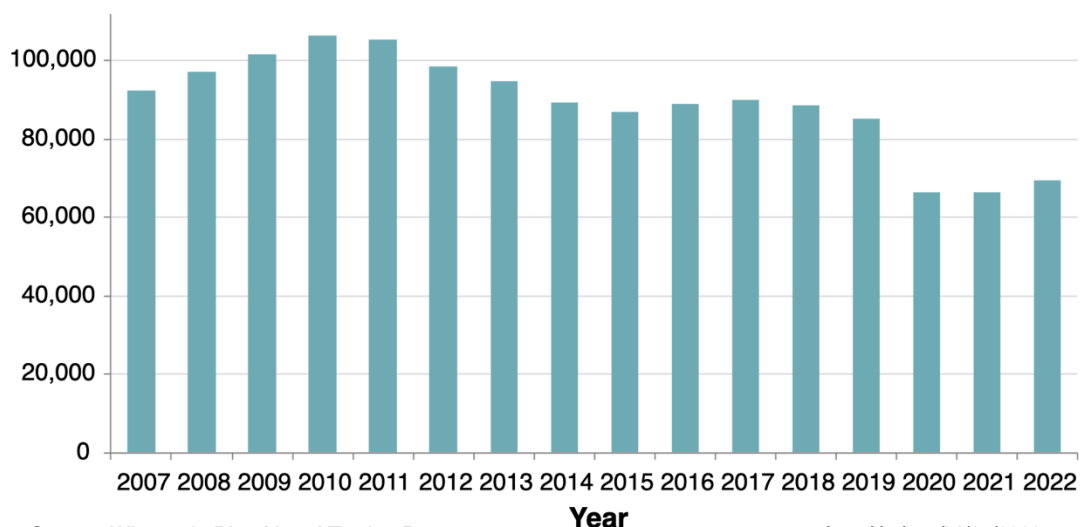


Figure 2: Number of children under the age of 6 who have high lead concentrations in their blood, study done on 4/7/2023.

Places that have the least funding to help resolve the issue are impacted the most, for example, certain areas in Europe experience hardship in getting the funding to replace the lead pipes that supply the drinking water to their towns, which is critical given that lead is undetectable through human senses. Luckily, the World Health Organization, which fights alongside the United Nations, helps countries in need of health improvements within their communities. They conduct a concatenation of research within these countries to better evaluate the health situation so that they can come up with a plan to help them. With their help, more muscle power is given to replace these outdated pipes and thousands, if not millions of lives are saved from it.

Contributors to the Sustainability

An additional unsung hero providing their services to help get clean drinking water to all is the American Water Works Association. Their operation works towards a replacement plan for communities living over outdated pipe systems, through the use of copper and zinc lining throughout these systems, making it lead-free (AWWA, 2024). Their organization has also been given a tremendous \$15 billion, in contribution to their replacement plan. This fund also covers the identification of lead in these water systems, documentation, and the complete removal of these service water lines, to be repurposed. This shines only sun to the stormy weather NYC has been faced with throughout these years, and with it, more children get to grow up without the concern of lead in their water, as well as parents being able to rebuild their trust in the school's water system. An amazing part about the organization is that they do not hold back on their outreach of help, they provide limitless aid even outside the United States. They provide their services to places in need of their help, throughout the entire North America. Besides having a primary target of decontaminating the water system, they overall look to better the public's environment economically, as well as its safety from infectious substances like lead.



Figure 3: Close-up on the process of the water supply's replacement plan, swapping the lead pipes with a more sustainable and safer material, copper.

Partnered with the AWWA, is the Waterkeeper institution, which shares the common goal of cleansing our water system of lead. The Waterkeeper institution holds various leadership roles in volunteering to clean our water system not only of lead but of other pollutants. Countries with the reality of toxins such as coal being dumped into the rivers, needed as a water supply for many (WK, 2024). This not only provides a harmful supply to humans but also makes the wild and marine life, where their populations rely on that water supply to survive. They believe in making the water swimmable, fishable, and most importantly, drinkable, ensuring the safety of

all organisms in need of it. With their help, New York can improve the current tragedy of lead contents in their water system and help future actions far from allowing this type of poisoning from occurring ever again.

Concluding Matters:

The elimination of lead contamination within America's water systems remains a persistent issue, particularly in the city of New York, as it houses the nation's largest school system. Lead's potency in affecting overall health, especially in vulnerable populations, is well documented and cannot remain unchecked. While the federal government has attempted to combat these challenges by establishing legislation and agencies such as the EPA and LCR, substantial issues remain at hand, such as the existence of past service lines. However, there lies hope through potential solutions and proactive initiatives. Sustainability-based organizations such as the American Water Works Association and the Waterkeeper institution are exemplars of dedicated efforts to combat lead contamination through infrastructure upgrades and advocacy for clean water. Moreover, international collaboration as exemplified by the World Health Organization, underscores the global significance of addressing this issue. By prioritizing the replacement of outdated lead pipes, implementing robust monitoring and mitigation measures, and fostering community engagement and awareness, we can safeguard the health and well-being of current and future generations.

Recommendations:

Despite unfavorable economic situations, we must work resourcefully—when in doubt about lead levels, do not attempt to boil the lead away. This is because water will naturally evaporate, resulting in a greater lead-to-water ratio than the initial amount. Only use cold tap water for cooking and drinking, as lead dissolves more easily in hot water. If possible, purchase a reliable water filter. We must work collectively to ensure access to safe and clean drinking water for all. Change begins with you.

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