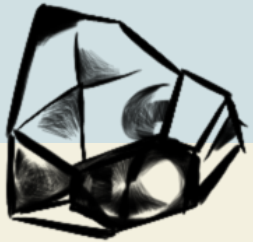
4.14.25

Lead in School Drinking Water

Data Analyzation Slideshow

Youth Contest Group Entry

Introduction – Origins of Lead



Lead is categorized by the World Health Organization as 1 of 10 chemical elements that pose a major concern to public health. Though it originates from the Earth's crust, the industrial extraction of lead for construction and human product creation has caused widespread exposure of the element. Exposure occurs primarily through inhalation and ingestion of contaminated soil, water, dust, and food.

Construction

-Lead pipes
-Solder (for pipes)
-Plumbing fixtures
-Pigments
-Paint
-Stained Glass

Other Products

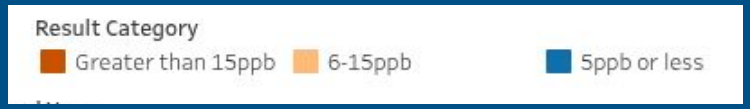
-Imported Jewelry, Toys, Medicine, Cosmetics, and Candy
-Ceramic glazes
-Tea Kettles
-Old Gasoline

How Lead Enters Drinking Water

In water, exposure to lead is often facilitated by corrosion in lead pipes, plumbing fixtures, and faucets. Additionally, lead paint and pigment can flake, sending lead particles into air and water. Through these ways, adults and children at home and school may drink contaminated water and accumulate lead into their bodies -called bioaccumulation- that causes serious health and psychological damage. These effects are most pronounced and detrimental in children, who are still in their vulnerable developmental stage.

Our claim is that the ubiquity of lead and the dire consequences of exposure are what make it imperative that proactive preventative measures be taken, for the health of all Washingtonians and humans in general.

Science of Lead Testing



In reviewing the following collection and analysis of data, it is important to understand the scientific measurements used to understand lead concentrations. In blood, the concentration of lead is measured in micrograms per deciliter, or (ug/dL). In water, however, the concentration of lead is measured in micrograms per liter (ug/L), also known as “parts per billion” (ppb).

- ★ The Center of Disease Control and Prevention states that public health actions should be taken when blood lead concentration is “3.5 micrograms per deciliter (ug/dL) or more.”

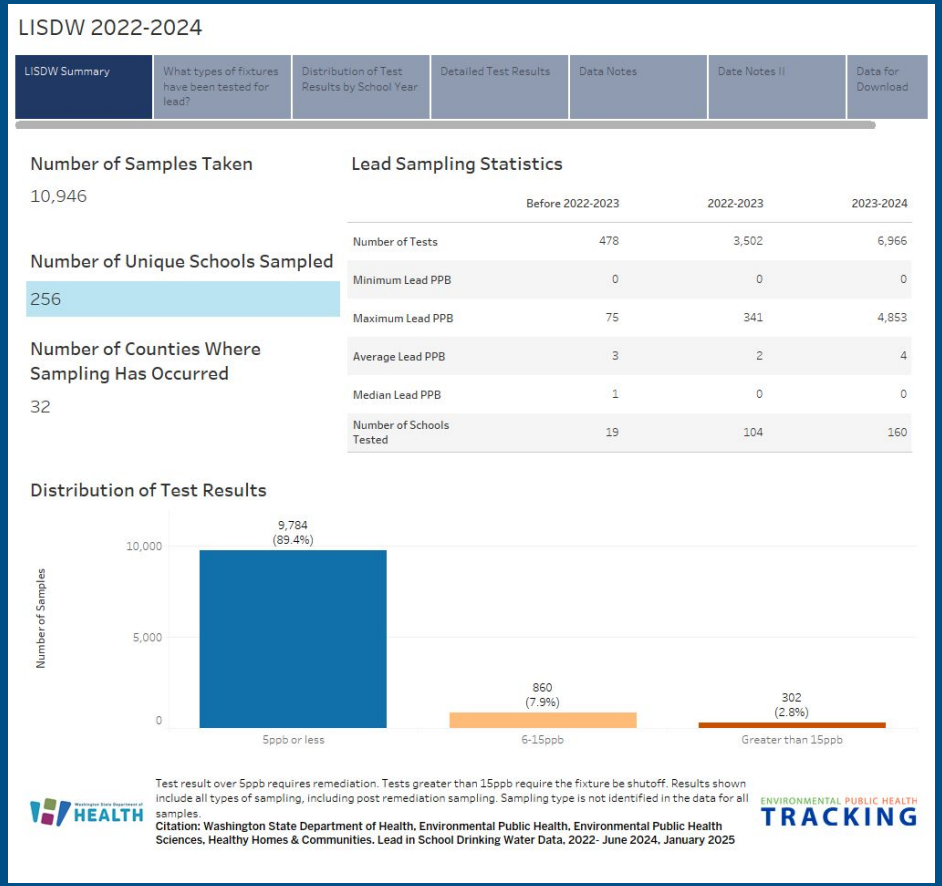
A deciliter (dL) is 1/10th of a regular liter, and so the concentration in ug/dL is 10 times that of ug/L or ppb, making 35 ppb the blood threshold to be considered a hazardous bioaccumulation. Considering that there is no known safe level of lead in blood, this number may be more hazardous than is currently known, a sentiment that is corroborated by the fact that the “safe” level of lead in water was lowered in 2021 in Washington from 10 ppb to 5 ppb (1/7th of blood concentration warning level) in response to community concerns.

Testing Standard

Water testing in Washington State uses ppb units, where 6-15 ppb requires remediation and >15 ppb requires immediate shut-off.

Lead Testing Changes

Prior to 2021, lead testing was optional for schools. However, after the policy change, it became mandatory for all pipes and fixtures installed before 2016 to do a testing before 2026 and once every 5 years afterwards. Predictably, this caused an increase in unique schools that sampled their water. Increasing from 19 before 2022-2023 (likely for the 2018 to 2020 time period, for which there is older data) to 160 for 2023-2024, the number of schools tested experienced an 842% approximate increase. The number of samples rose from 478 to 6966, showing an even larger 1457% approximate increase.

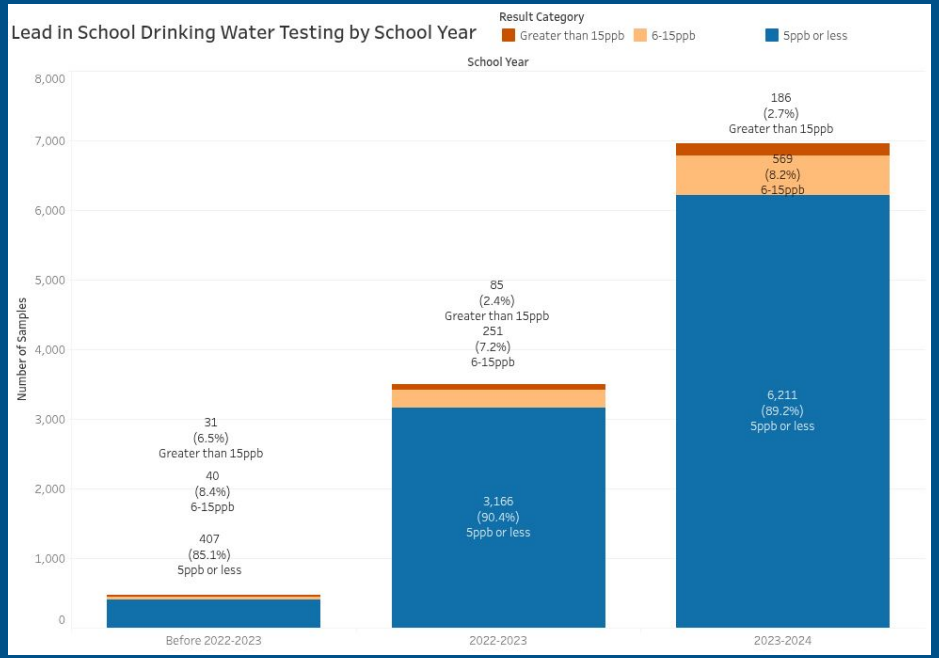


Test Change Significance

Why is this significant? Well, the wider range of schools and pipes tested found that 10.8% of samples in 2023-2024 held a greater lead concentration than 5 ppb, requiring the water source to be remediated or shut off. Comparatively, before 2022-2023 14.9% of samples flagged the same warning signs*. However, what is key is to consider the number of samples taken.

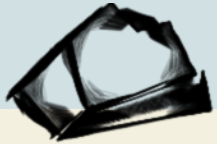
- ★ Prior to 2022-2023, 14.9% of 478 tests showed 71 water sources to have been contaminated.
- ★ For 2023-2024, 10.8% of 6966 tests showed 752 water sources to have been contaminated.

752 is over ten times higher than 71, showing the new mandatory testing policy to have been more successful in preventing lead exposure in schools. This shows how important it is to have strict preventative measures in place, because without the recent data collected likely thousands or even tens of thousands of students and teachers would have continued to accumulate lead in their bodies without knowing the truth.



*It is interesting to note that the previous samples had a greater percentage of samples with high lead concentrations. This may be because testing was optional at this point in time, meaning that when a school reached out to get tested, it was often because they already had evidence or a suspicion of lead contamination in water. Another consideration is that because testing methods have changed over the years, past results may be less reliable than recent data.

Psychological Effects of Lead Exposure



Lead can have varying impacts on the nervous system of children that can hinder their development. Examples of these effects include...

- Lowered IQ
- Damage to the brain and nervous system
- Learning difficulties
- Increased risks of depression, anxiety, aggression and antisocial behavior

These effects also have a tendency on being witnessed in children in their adult stages even after the exposure has stopped.

Health Effects of Lead Exposure

Through bioaccumulation of lead, there can be physical health impacts imposed on people. These symptoms can vary depending on the age of the impacted. However, as our study group are kids.

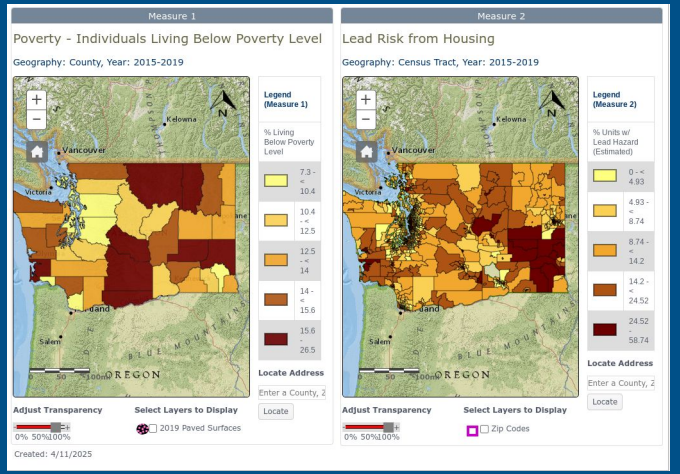
Symptoms implicated on them can be like...

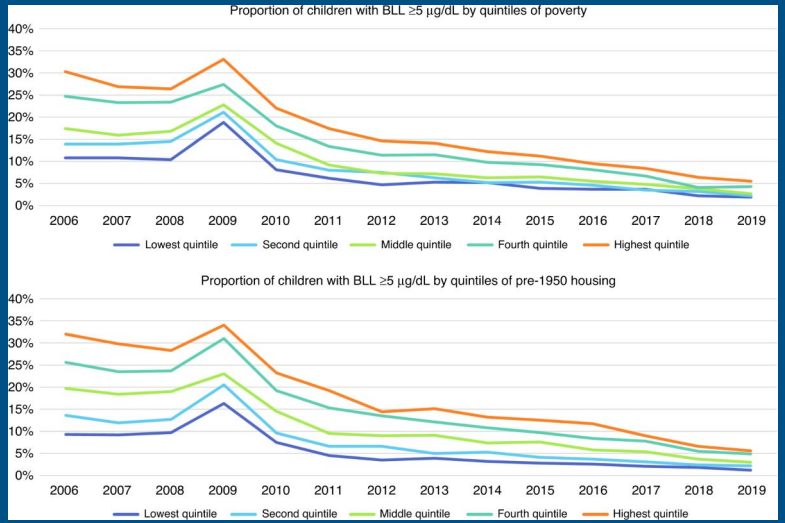
- Damage to the brain and nervous system
- Slowed growth and development
- Learning and behavior problems
- Hearing and speech problems

Correlation with Poverty

According to the graphs to the right, there is a definite correlation between lead exposure and poverty, with specific data for lead exposure risks from housing built before the 1978 ban on lead based paint, which up until then was commonly used. This is a result of older houses being in worse conditions, generally, making them more affordable for those in poverty. This trend in housing is likely a key factor in why greater levels of lead exposure are seen among poor populations.

★ The following slides explore other ways that poverty is linked to lead exposure.





Connection: Nutrition

Image source: Birmingham Gastroenterology

Children with empty stomachs absorb more lead, especially those with low iron because lead and iron are absorbed in the same area of the gastrointestinal tract--meaning that low iron causes increased activity, enhancing lead absorption. Poverty often goes hand in hand with less nutritional and less filling diets, contributing to greater lead absorption.

Absorbs more Toxic Metals

Iron Deficiency → **Higher Lead Level** → **Neurodevelopmental Deficit**

Connection: Pica Disorder

On a similar line of reasoning to nutrition, Pica is a disorder where a child has compulsive hand to mouth eating behavior even when the object being handled is not food. This is also linked to malnutrition (as well as stress and developmental problems), which establishes a connection to poverty. A common outcome of Pica is lead poisoning, as contaminated products such as paint chips and soil have a much higher chance of being consumed by a child with Pica.

Connection: Location

Location is also connected to lead exposure. Areas closer to waste management plants, airports, smelters, and battery manufacturers are also at a higher risk of contamination. The surrounding areas are less appealing places to live for most, which often leads to poorer crowds ending up in those spaces. Additionally, the labor intensive jobs offered by those industries also rely disproportionately on those in poverty, which may result in parents bringing home lead contamination to their houses and children.

Connection: Immigrant/Refugee Status

Lastly, immigrants and refugees have greater rates of lead exposure. This may be linked to poverty as well, as many of them arrive in the US with less education and often face prejudice in the workplace for their race, culture, or religion. Another factor is that immigrants and refugees are more likely to import products from outside of the US from countries that have less or no restrictions on lead in products, including in children's toys. Consequently, they may be at greater risk for lead exposure.

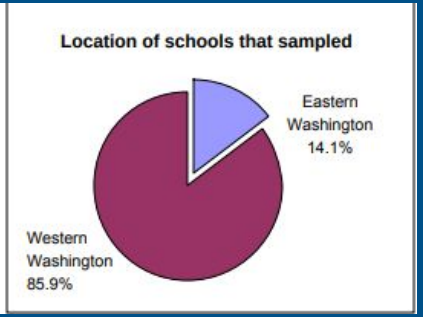
With poverty playing such an influential role in lead exposure, an inequitable situation is being polarized into an even larger disparity. The irreversible effects of lead that damage IQ, brain functioning, and health are making it more difficult for those in poverty to find success and contentment. Therefore, the current process of water-lead testing should be focused on areas of poverty, where the need is greatest.

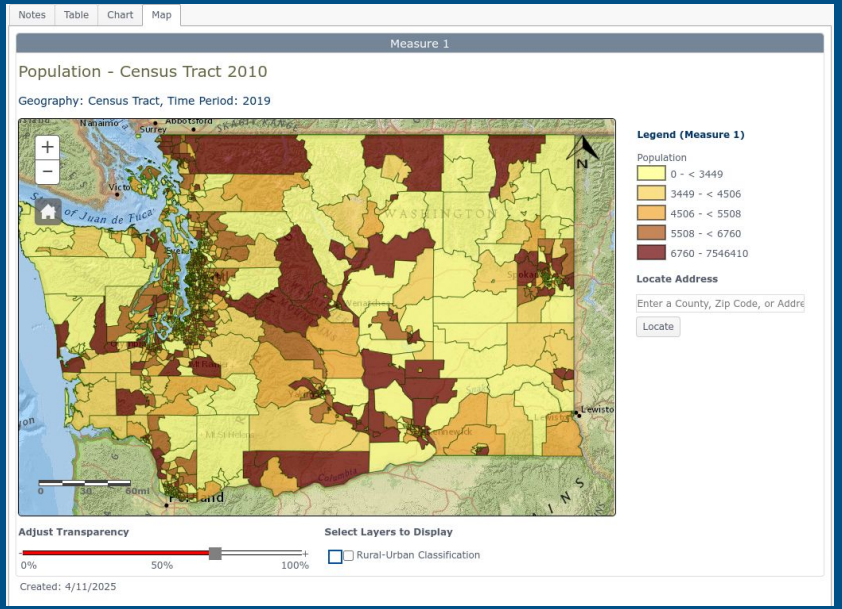
Solution – Outreach Efforts

It should be taken into account that poor and/or less densely populated areas, such as those in Eastern Washington, may have more difficulty obtaining testing or even information about testing requirements. This is shown in a 2005 grant program, where in response to reimbursed lead testing only 21% of eligible Eastern Washington Schools responded as opposed to the 45% of Western Washington schools -- With Western Washington being more densely populated, as shown by the lower graph. Thus, extra efforts should be taken to reach more isolated schools in particular. These efforts should improve communication with schools, which could be accomplished by making transportation more accessible between the east and west, dedicating a specialized communication service for sending Washington Health Department announcements to schools, or diverting flow of testing resources and advertising to ensure no school is left out.

Of the 455 schools that sampled, 14.1 percent (64/455) are in Eastern Washington and 85.9 percent (391/455) are in Western Washington.

OSPI reports that 302 of eligible schools are in Eastern Washington and 861 are in Western Washington. Therefore, proportionately more Western Washington schools (45 percent of eligible schools) participated than Eastern Washington schools (21 percent of eligible schools).

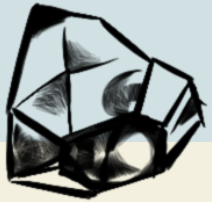




Solution – Cautionary Measures

There are also ways to minimize lead exposure through cautionary measures. These options include regular cleaning of filters and faucet screens, using cold water when cooking, running water in alternative ways to drinking (flushing toilets, taking showers) before drinking, and learning about nearby lead risks; for example a lead service line or nearby construction that may disturb pipes and cause flaking behavior. Knowledge of these measures should be communicated to the public as they have the potential to prevent lead from reaching drinking water, especially in older houses and schools that have lead pipe and lead plumbing apparatus.

Discussion of Project Significance



The significance of this project is that it identifies many of the connections and correlations surrounding lead exposure in communities. Referencing data from past years, the project proves that changing testing policy to be more strict and mandatory has had the positive effect of identifying more lead in school water sources. It also reviewed the psychological and health impacts of lead, especially on children, to show the importance of prioritizing their safety. Finally, it also explored the correlation between poverty and lead exposure, to show what common indicators of lead risk are, so that a more targeted and effective response can be undertaken to equalize remediation of contaminated water sources.

Reflection – Project Reason & Approach

We chose Lead in School drinking water because the general consensus in our group was that we didn't have a high degree of confidence in the water quality from our school drinking fountains. Wanting to see if our suspicions were unfounded, we were able to locate data on our school to discover that our water quality met the state lead standards - except with one rather minor 6ppb (1 ppb higher) instance in the athletics building. Still, the knowledge that our water quality was tested to be lead-safe is what has given us more faith in our school water.

In approaching the subject, the biggest question that stood out to us was where lead comes from, with the underlying question of why it has not been eradicated yet. In finding out how very small concentrations can accumulate in bodies, it became clear that lead is not a battle that can be won necessarily, but rather one where the objective is to prevent as much lead exposure as possible. To do this we really had to dig into what factors are correlated with exposure to more accurately predict where lead might be.

Reflection – Challenges & Outside aid

Even knowing that correlation does not equal causation, we found it challenging to not just write off the issue of lead as the cause of one thing or another. Is poverty the cause of lead exposure? Perhaps, but more likely is that it is just one possible contributing factor among several other independent variables. All we can do is show relationships and investigate why they might exist. Of course, another challenging part of the task was realizing just how many factors are involved in lead exposure, and deciding how to organize our excess of ideas.

And finally, no outside or artificial intelligence assistance was received; we relied on teamwork to overcome any obstacles faced along the way and to bounce ideas off of one another.

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