Public Health
MADISON & DANE COUNTY
Healthy people. Healthy places.

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Overview of lead in drinking water and its Impact on children, including testing recommendations for Dane County Schools and Childcare centers (Family, Group, Certified and Day Camps).

Significant progress has been made to reduce lead exposure and decrease blood lead levels (BLLs) in children over the last several decades.[1, 2] Despite this success, lead is still a public health challenge in our community and efforts to identify and reduce/or eliminate potential sources of exposure continue to be a priority.

The Centers for Disease Control and Prevention (CDC) recommends public health action for children that have tested at or above the current reference level of 5 micrograms of lead per deciliter of blood (5 µg/dL).[2] However, there is compelling evidence indicating that BLLs less than or equal to 5 µg/dL are also associated with adverse health outcomes; highlighting the fact that there is no safe level of lead.

Association between adverse health outcomes and BLLs in children

Children are more susceptible to health problems from lead exposure because lead is a neurotoxin that can interfere with their brain and neurological development. In addition, children typically receive larger doses of lead from exposure due to smaller body size and higher rate of lead absorption, immature bodily detoxification systems, and longer availability of lead in the child's bloodstream following exposure.[2 - 4]

As a result, extensive evidence indicates that several health implications are associated with low level lead exposure in children.

Evidence shows BLLs less than 10 µg/dL are associated with.[1-3, 5-7]

- Delayed puberty
- Reduced postnatal growth
- Hearing loss
- Decreased academic achievement
- Decreased IQ scores
- Attention related behavioral problems
- Anti-social behaviors

There is sufficient evidence to show that decreased academic achievement and IQ scores, attention related behavior problems and anti-social behaviors are also associated with BLLs **less than 5 µg/dL**; further demonstrating the need of continued diligence in the prevention of lead exposure to children.[3]

Drinking water is a source of lead exposure

Drinking water is a common source of lead exposure. On average, the United States Environmental Protection Agency (US EPA) estimates that drinking water can contribute approximately 20% of a person's total exposure to lead, however aging infrastructures that contain water service lines made from lead, lead solder, and/or plumbing materials and fixtures that contain lead can provide significantly higher exposure. Homes, businesses, child care centers, and schools built prior to 1986 have an increased likelihood to contain potential sources of lead in water systems.[8]

The potential health impact of lead in drinking water depends on:

- The concentration of lead in the water – measured in parts per billion (ppb)
- The amount and frequency of water consumption

Consumption of drinking water contaminated with high levels of lead can result in a rapid elevation of BLLs in the exposed populations.[9, 10] However, at lower levels of lead contamination in drinking water, any potential impact to reported BLLs is more challenging to evaluate due to a vast array of potential factors. These include, but are not limited to, the actual amount of water ingested, other potential sources of lead exposure, and the diet, weight, and age of the child. In addition to these biological factors, limitations of study design and sample collection methodologies result in further difficulty in determining the impact of low levels of lead exposure.[2, 3, 11] Many of these factors can complicate the ability to compare studies and reliably discern a level of exposure to lead in drinking water and any corresponding measurable and predictable change in BLLs.

National Standards and Recommendations for Lead Levels in Drinking Water

United States Environmental Protection Agency

The US EPA's non-enforceable Maximum Containment Level Goal (MCLG) is the maximum level of a contaminant in drinking water at which there is no known or anticipated adverse health effects. The MCLG for lead is 0 ppb due to the recognition that there is no safe level of lead; however, reaching this level is limited by achievability and feasibility.[1, 2, 3, 8]

The US EPA currently defines the Action Level for lead in drinking water at 15 ppb (equivalent to 15 µg/L); this concentration, if exceeded in over 10% of drinking water taps tested, triggers treatment action that the water system must conduct in order to reduce drinking water lead levels. However, this is not a health based standard, but based on the US EPA assessment of feasibility using effective corrosion control to lower the concentration of lead in the drinking water to levels below 15 ppb.[3]

American Academy of Pediatrics

Recently, the American Academy of Pediatrics recommended that lead levels in water fountains in schools should not exceed lead concentrations of 1 ppb but the ability to reach this goal, similar to the MCLG, is also hindered by feasibility and resource availability.[3]

Public Health Madison & Dane County recommendations for lead reduction in water sources in schools and childcare centers

Given that:

- Emerging evidence has associated health implications with BLLs lower than 5 µg/dL.
- More research is needed to estimate how low concentrations of lead in water correspond to changes in BLLs.
- Children are most susceptible to adverse health outcomes associated with lead exposure.
- Children spend a large portion of their day in schools and childcare centers. While the consumption of water from a school drinking fountain would be expected to compose a small portion of a child's daily water intake, for some children it comprises more. For instance, formula fed infants could receive significantly higher levels of lead exposure if lead containing drinking water is used during feeding.

PHMDC recommends that school districts and childcare centers in Dane County aim to reduce potential exposures to lead in their water systems. Based on current research and feasibility, our recommendations are that all Dane County schools, 4K programs, and childcare centers:

1. Implement a testing plan and test all sources of drinking water in their facilities if testing has not already been initiated.

2. Develop a progressive response plan that is implemented at 5ppb lead in water and focuses available resources on the fixtures with the highest lead levels. Steps that can be taken to reduce lead levels that would include routine flushing, repair, replacement, or filtration.

This recommendation is a third of the current US EPA Action Level of 15 ppb. Although concentrations of lead in water at or below the current standard of 15 ppb have not been statistically associated to a significant increase in BLLs, the lower target level of 5 ppb would be considered a protective measure until a better understanding of the contribution of low concentrations of lead in drinking water to measurable changes in BLLs is reached.[2, 3, 12]

Regardless of age, there is no safe level of lead and efforts to eliminate or reduce this potential source of exposure are essential to the health of our children and our community.

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