Lead in School Drinking Water: Approaching a Public Health Issue from an Occupational Hygiene Perspective

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National Collaborating Centre for Environmental Health
Centre de collaboration nationale en santé environnementale

BC Centre for Disease Control
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Outline

- Lead and health
- Lead in school drinking water
- Applying a hygiene model to mitigation
- Summary

Lead and Exposure

- Removal of lead from gasoline & lead paints has resulted in decreased exposure
  - Median blood lead levels decreased from **15 µg/dL** in 1980 to **1.9 µg/dL** in 1999 (among US children 1-5 years of age)
- BUT residual, low level exposure sources have not been adequately addressed

Low Level Exposure and Health

- Effects seen even at levels previously considered “safe”
- Blood lead levels < 10 µg/dL associated with cognitive changes and neuropsychiatric disorders in children
- Early exposures associated with social & economic costs
  - Annual loss of $43.4 billion in lifetime earnings due to lead-induced IQ deficits estimated in the US (based on mean blood lead level of 2.4 µg/dL among 5-year old children)

School Drinking Water Is A Source

- Testing of Ontario schools in 1997 found:
  - 28 % of “first draw” samples > 10 µg/L Canadian drinking water guideline (n= 3,669)
  - 9 % of “30 second flush” samples > 10 µg/L (n= 3,479)
- Small incremental increases in exposure can be problematic
  - Some children already have a high lead body burden from exposure to other lead sources

How does lead get into water?

- Leaching from lead-containing plumbing is the most common route

- The degree of leaching depends on 3 key factors:
  1. Distribution system & building plumbing
  2. Water chemistry
  3. Water usage patterns

1. Plumbing

- Lead-containing plumbing
  - Lead pipes, tin-lead solder, brass fittings
- Age of buildings
  - May have more lead plumbing = higher leaching
  - Pipes may have more buildup = less leaching
- Other factors
  - Pipe length
  - Pipe diameter

2. Water Chemistry

FACTOR	EFFECT ON LEACHING
Low pH	⬆
Low alkalinity	⬆
Soft Water	⬆
Corrosion inhibitors	⬇
Cold water	⬇

3. Water Usage Patterns

- Longer contact times = more leaching

- Water outlets in schools are used intermittently
  - Lead levels can increase during non-use periods (weekends & holidays)
  - Morning “first draw” typically have highest lead levels
  - Levels at lunch-time can reach morning levels

Why Schools in Particular?

- Water usage patterns
  - Intermittent use

- Types of outlets
  - Drinking fountains: narrower pipes, more solders
  - Water coolers: require long contact times for cooling purposes

What is Being Done?

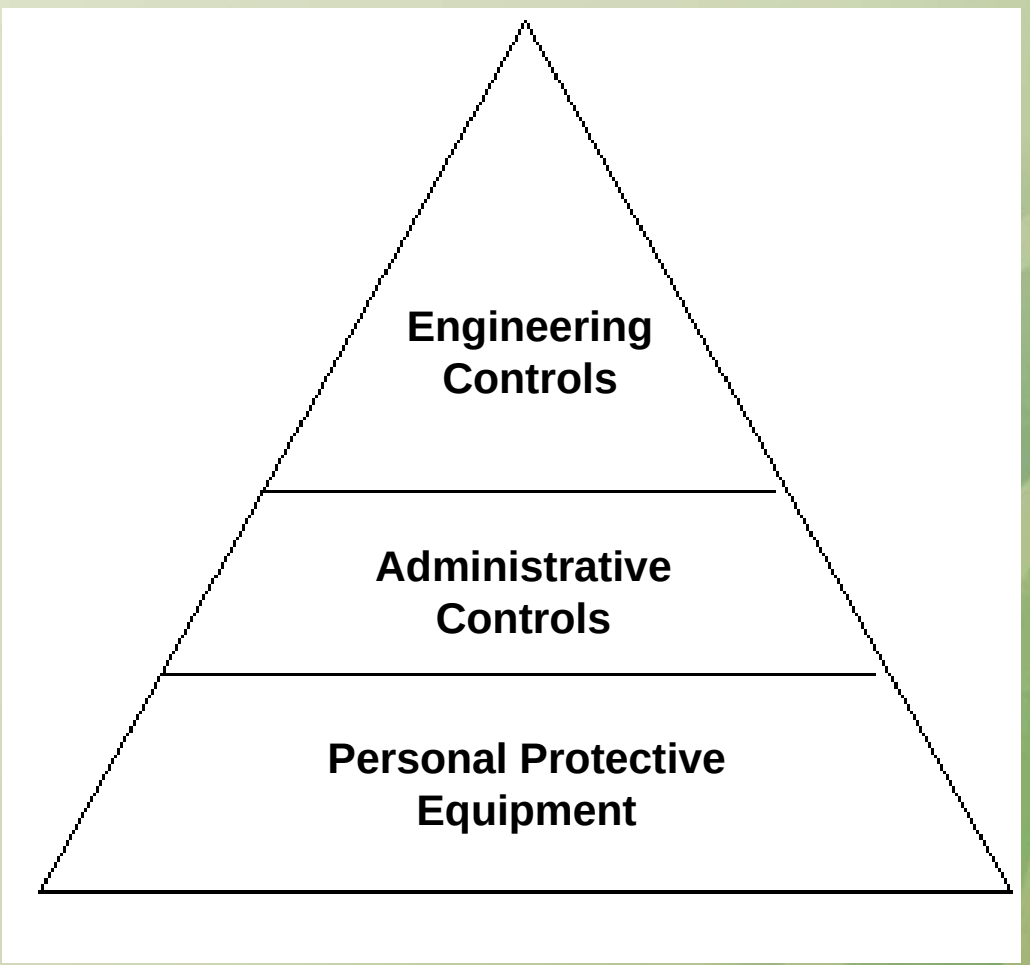
- No national regulations around testing or monitoring in schools
  - Health Canada's corrosion control guidelines provide guidance on sampling, interpretation & mitigation
- Ontario is the only province that requires annual testing by schools & day cares

The Hierarchy of Controls

Engineering: Isolate or remove the contaminant

Administrative: Change procedures to reduce exposure to contaminant

PPE: Final barrier between contaminant and individual



Mitigation Strategies

LEVEL	APPROACH
Engineering	Replacing lead-containing plumbing
	Altering water chemistry (at water treatment level)
Administrative	Regular flushing of plumbing system in building
	Use of only cold-water taps
	Use of alternative drinking water
Personal Protective Equipment	Water filtration

In-Practice

- Replacement of plumbing is expensive, but may save $ in the long run

- Flushing is more commonly implemented
  - Considered a less costly option
  - Must be done every morning; need to consider staff cost and time, and water wastage
  - Recommended times vary depending on building size, plumbing, type of outlets

Summary

- Low level lead exposures are associated with health effects in children
- Residual sources, including school drinking water, need to be addressed
- Lead concentrations in water depend on plumbing, water chemistry and water usage patterns
- Mitigation strategies can be prioritized into the “hierarchy of controls” used in the occupational hygiene realm

Thank You

Questions?
Comments?

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References

Bellinger DC. Very low lead exposures and children's neurodevelopment. *Curr Opin Pediatr* 2008;20(2):172.

Committee on Environmental Health. Lead Exposure in Children: Prevention, Detection, and Management. *Pediatrics* 2005;116(4):1036-46.

Landrigan PJ, Schechter CB, Lipton JM, Fahs MC, Schwartz J. Environmental pollutants and disease in American children: estimates of morbidity, mortality, and costs for lead poisoning, asthma, cancer, and developmental disabilities. *Environ Health Persp* 2002;110(7):721-8.

Ontario Ministry of the Environment. O. Reg 243/07: 2007 Lead Data Results Release. 2009.




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