National Collaborating Centre for Environmental Health

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From pipes and plumbing to little people:
A comparison of sampling protocols for lead in school drinking water

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October 30, 2019

CIPHI National SK PEDS

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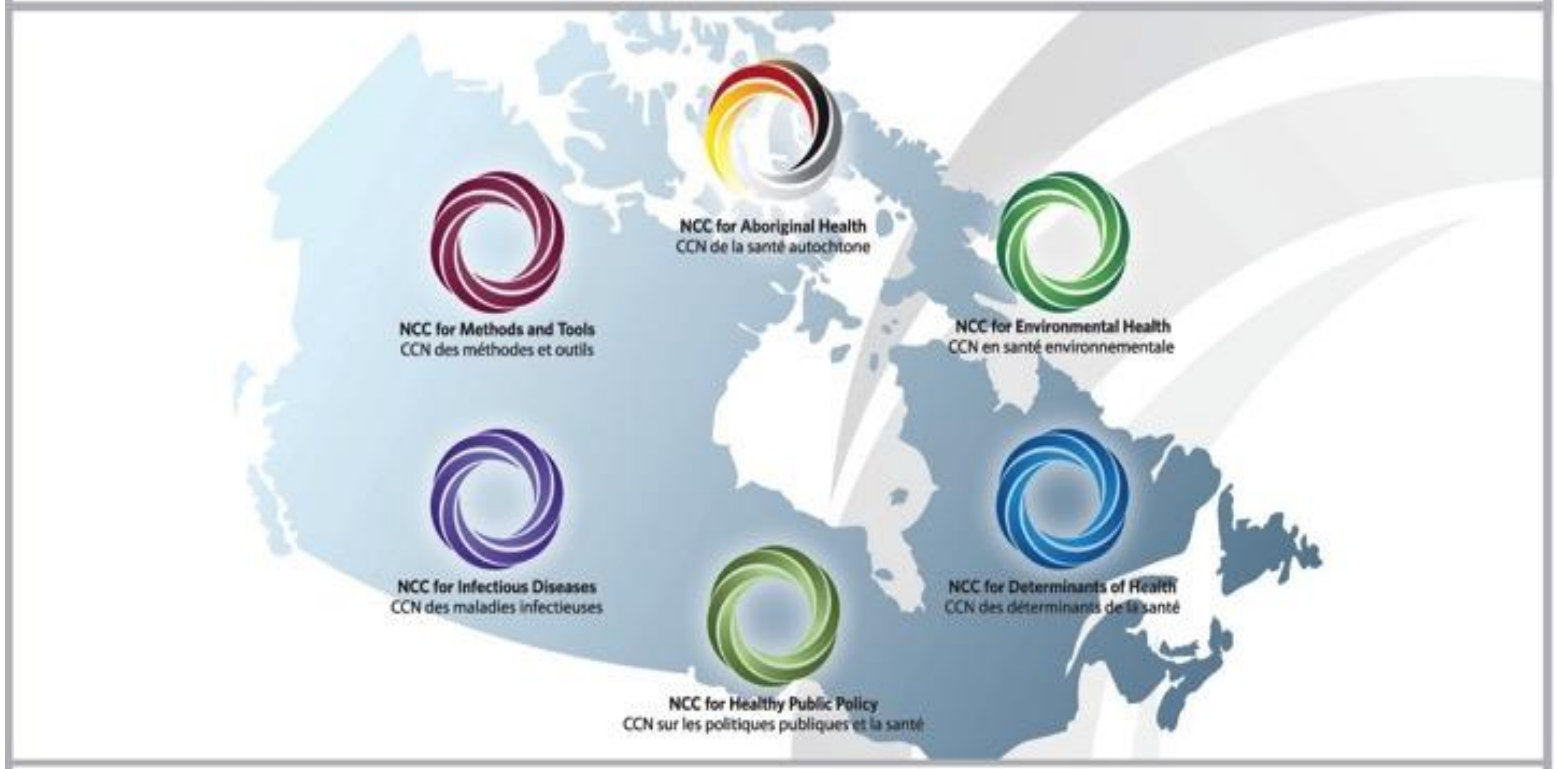


STRENGTHENING PUBLIC HEALTH ACROSS CANADA | APPUYER LA SANTÉ PUBLIQUE AU CANADA

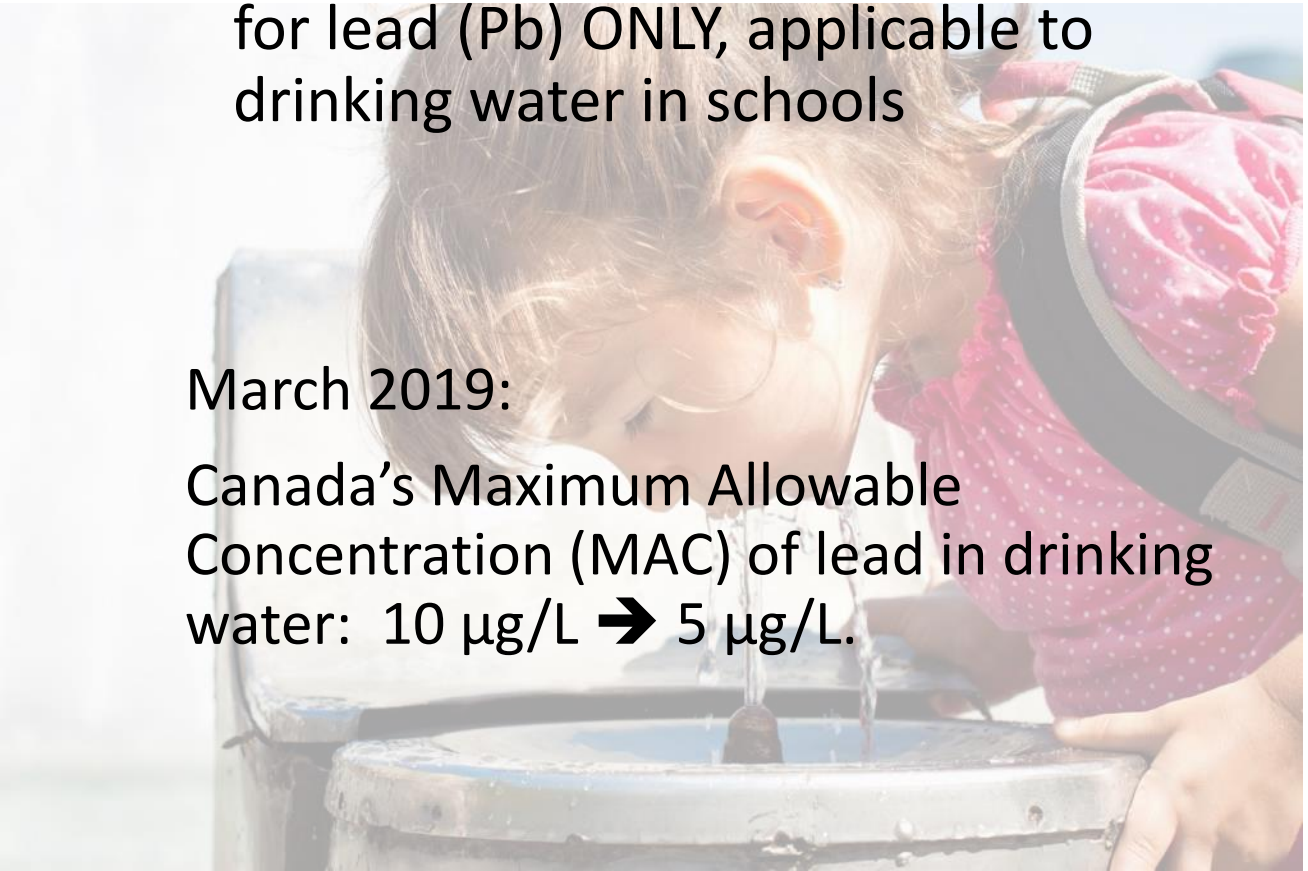
Evidence-based knowledge synthesis and translation

Identify knowledge gaps

Foster networks, build capacity for Canada's public health system

What this presentation is …

- Background of this KT project
- A comparison of sampling protocols for lead (Pb) ONLY, applicable to drinking water in schools



March 2019:

Canada's Maximum Allowable Concentration (MAC) of lead in drinking water: 10 µg/L ➔ 5 µg/L.

What this presentation is **not** …

- A how-to guide to sampling of drinking water
- Sampling of contaminants other than Pb
- New technologies and methods
- Examining applications to all settings (urban vs rural; municipal vs small water systems)
- Comparing with other sources of exposure to lead (cooking utensils, cosmetics, food items, other environmental contamination)

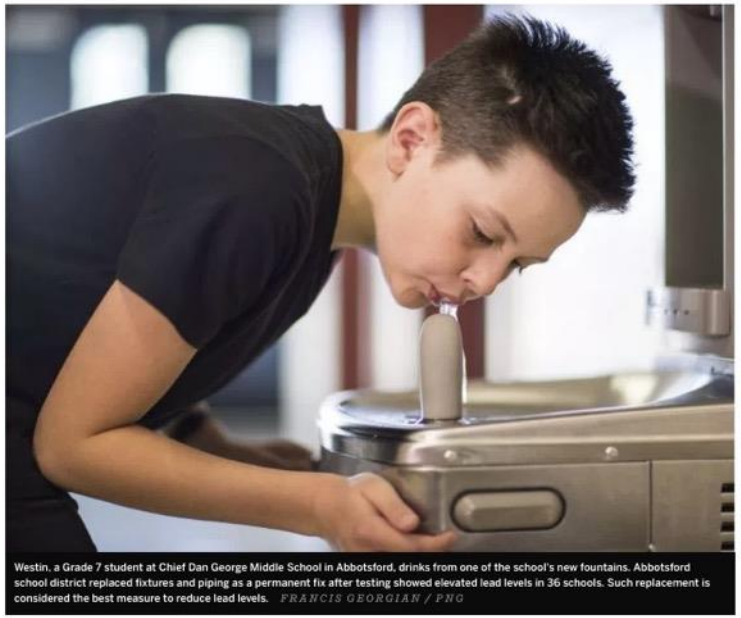
1975		Up to this point National Plumbing Code (NPC) allowed Pb as pipe material. Also allowed use of lead-based solder in plumbing until 1986.
1989		Building Code changed - water lines and mains no more than 8% lead content
2013		NPC amended to conform with plumbing standards (Canadian Standards Association): 0.25% limit for Pb
2016 Sept		BC Ministry of Education released policy – required public schools to test for Pb. Mitigation was required when concentrations > MAC (10 ug/L). Schools must be tested once every 3 years in: • Schools built before 1989 • No new plumbing installed near time of testing • Not scheduled to be closed soon Only 33% *eligible* schools are tested each year; reporting must be done by March 30th, 2017.
2017		BC Ministry of Education released similar policy for independent schools BC Ministry of Health released Interim Guidelines on Evaluating and Mitigation Lead in Drinking Water Supplies, Schools, Daycares and Other Buildings.

In the news In 2016-17 and more recently (just search on internet)

VANCOUVER SUN | NEWS | BUSINESS | SPORTS | ARTS & LIFE | HOMES | TRAVEL | CAREERS | OBITS | CLASSIFIE

More than half of B.C.'s school districts had unsafe lead levels in drinking water sources in 2016

GORDON HOEKSTRA & LORI CULBERT Updated: September 15, 2017



Westin, a Grade 7 student at Chief Dan George Middle School in Abbotsford, drinks from one of the school's new fountains. Abbotsford school district replaced fixtures and piping as a permanent fix after testing showed elevated lead levels in 36 schools. Such replacement is considered the best measure to reduce lead levels. FRANCIS GEORGIAN / PNG

More than 640 Ontario schools and daycares failed lead tests in the past two years

By **Jayme Poisson** News reporter
Ainslie Cruickshank Staff Reporter
Andrew Bailey Data Analysis
Fri., Oct. 6, 2017 | ⏱ 8 min. read

CANADA July 11, 2019 3:00 am Updated: July 11, 2019 1:38 pm

Quebec children at risk of lead exposure from water in schools and daycares: report

By Mike De Souza, National Observer Special to Global News

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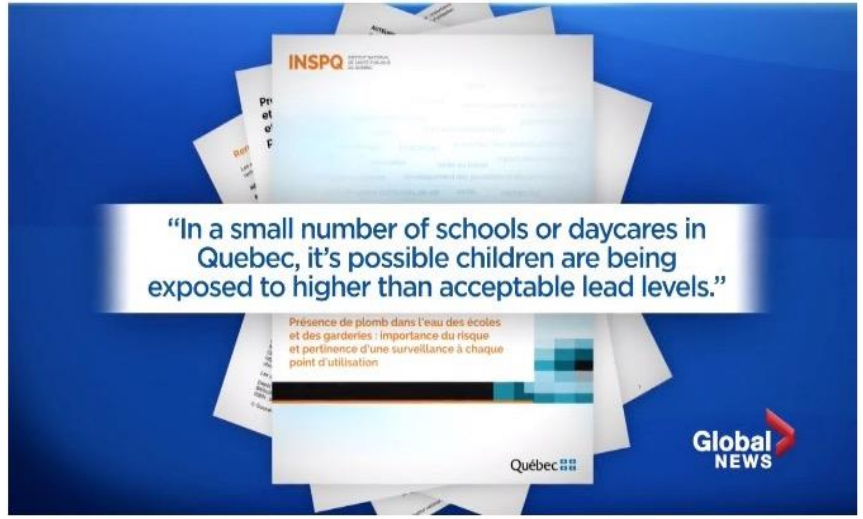


WATCH: A Quebec Public Health report published online earlier this month suggests that kids could be at higher risk of lead exposure from drinking water at daycare and school. Global's Dan Spector has more.

October 9, 2019
CBC News

Montreal

Quebec orders schools to test water fountains for lead

As soon as a source of water is deemed inadequate, it should be off-limits, says education minister

CBC News · Posted: Oct 09, 2019 9:46 AM ET | Last Updated: October 9

Photo credit: Global News & CBC News Thomas Gerbet/Radio-Canada

October 23, 2019
CBC News

City of Montreal: $557M to replace > 48K lead pipes in the municipal water network by 2030.

Pipes of private properties: owner's responsibility.

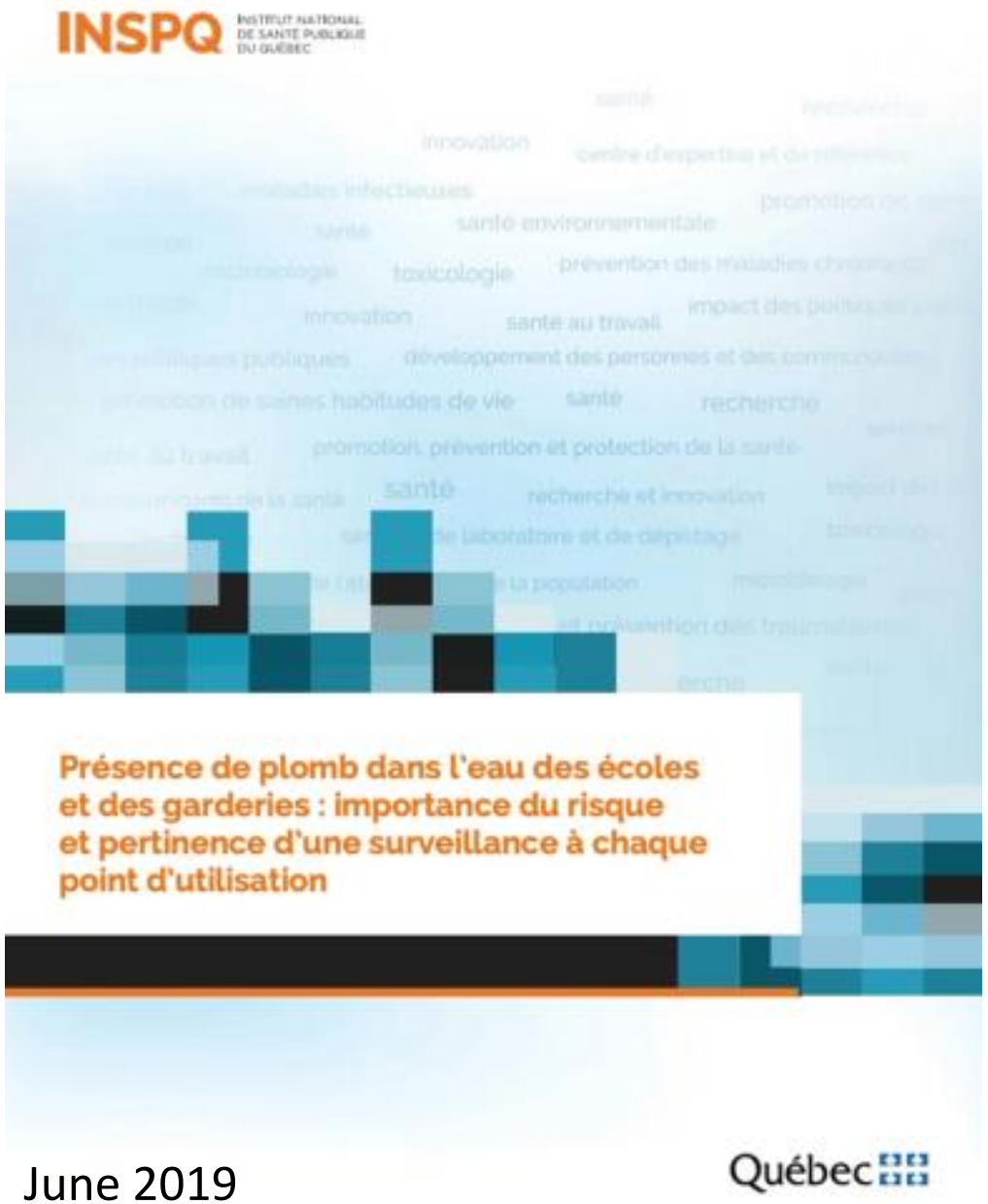
Montreal now drafting bylaw to mandate property owners to replace old lead pipes. If not, City will replace and bill owners, giving them 15 yrs to pay off debt owed to City.

Montreal

How Montreal is reducing lead exposure from water pipes, and what you can do now

As many as 300,000 Montrealers may be exposed to lead contamination

Colin Harris · CBC News · Posted: Oct 23, 2019 1:38 PM ET | Last Updated: October 23



In 2017, the **Institut national de santé publique du Québec** sampled tap water quality in 51 schools in Montreal.

Data varied but reported 16% schools in Montreal tested for Pb exceeded Health Canada guidelines

Sampling method (QC Min of Env):

5-min. flush prior to sampling

Tableau 1 Concentrations en plomb mesurées dans diverses écoles et garderies au Québec et ailleurs au Canada (suite)

Source et territoire échantillonné	Type d'établissements	Nombre d'établissements	Nombre d'échantillons	Mode de prélèvement	Nombre d'établissements > 10 µg/L (%)	Concentrations mesurées µg/L	Concentration maximale µg/L
Au Québec (suite)							
Ville de Québec (2015-2016)[C] Ville de Québec	Écoles	29	29	1 min d'écoulement après 30 min de stagnation	0	Médiane : 0,3	3,7
			29	5 min d'écoulement après 30 min de stagnation	0	Médiane : 0,3	2,6
			29	15 min d'écoulement après 30 min de stagnation	0	Médiane : 0,2	1,9
Hors Québec							
Nouveau-Brunswick[D] **(2011-2012)** Province du Nouveau-Brunswick	Écoles	314	1 969	1er jet après stagnation de 8-24 h	125 (40)	Médiane : 1,7 99e percentile : 112,3	2 679
			1 970	30 secondes d'écoulement après une stagnation de 8 à 24 h	83 (26)	Médiane : 1,4 99e percentile : 50,0	710
Gouvernement de l'Ontario, 2018 Province de l'Ontario 2016-2017	Écoles	5 033	5 700	1er jet après stagnation d'au moins 6 h	280 (5,6)	Médiane : 0,81 99e percentile : 46,0	2 000
		5 029	5 706	1er jet après stagnation de 30 min	76 (1,5)	Médiane : 0,5 99e percentile : 19,1	3 120
	Garderies	1 774	1 987	1er jet après stagnation d'au moins 6 h	43 (2,4)	Médiane : 0,5 99e percentile : 22,7	1 030
		1 767	1 979	1er jet après stagnation de 30 min	12 (0,7)	Médiane : 0,4 99e percentile : 8,9	69,4

https://www.inspq.qc.ca/sites/default/files/publications/2550_plomb_eau_ecoles_garderies.pdf

INSPQ June 2019

BC schools water testing for Pb

In 2018:

Sampling results for 2016-17 were accessed through an FOI

Data made available through Vancouver Sun online database

Critical issues: BC schools water testing for Pb

Review of 2016-17 school water Pb testing database (CAREX Canada)

Lack of consistency in testing

No systematic sampling protocols

Each district determined how samples were collected

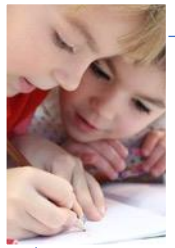
Variable logistics

Time of day samples collected

How frequently the fixture is used

First draw vs flushed samples

Non-standardized laboratories



Some observations had multiple samples taken although only one result was presented

Data entry errors (e.g., “0” entered could mean “did not test” or that result was <limit of detection

Missing data and inconsistent reporting of results

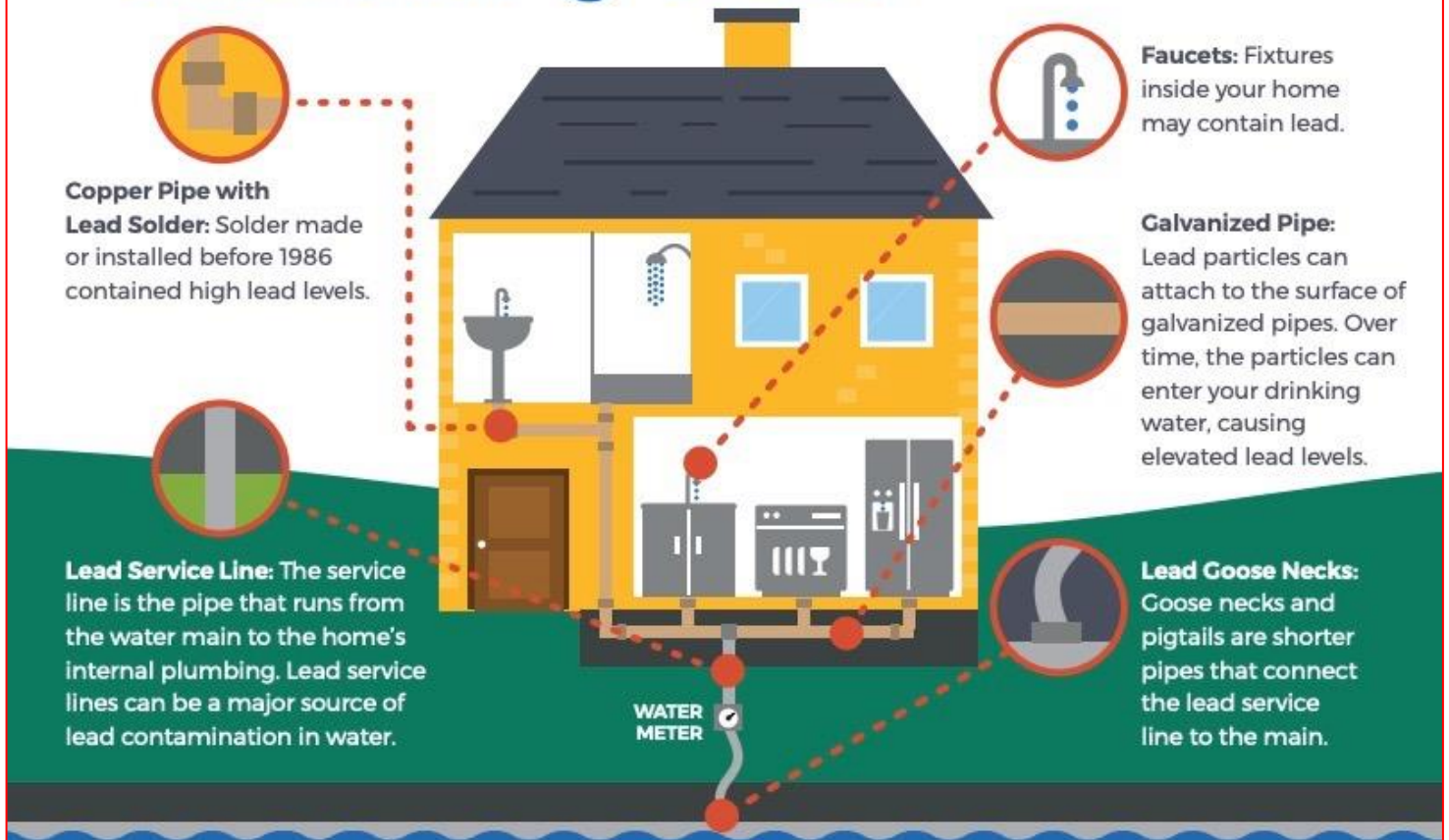
Data gaps without explanation

Information on mitigation measure not complete

EPA

CONCERNED ABOUT LEAD IN YOUR DRINKING WATER?

Sources of **LEAD** in Drinking Water



Copper Pipe with Lead Solder: Solder made or installed before 1986 contained high lead levels.

Faucets: Fixtures inside your home may contain lead.

Galvanized Pipe: Lead particles can attach to the surface of galvanized pipes. Over time, the particles can enter your drinking water, causing elevated lead levels.

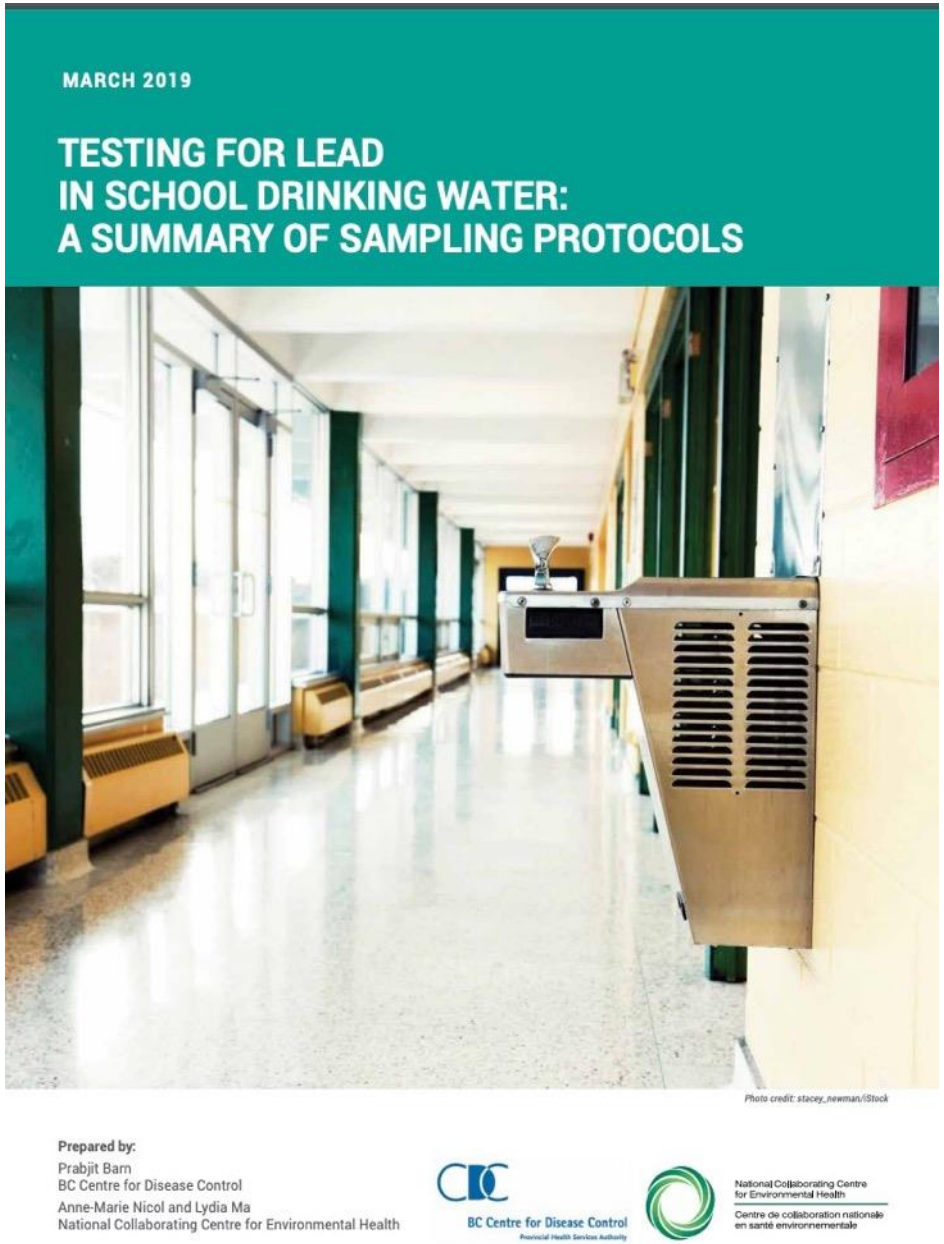
Lead Service Line: The service line is the pipe that runs from the water main to the home's internal plumbing. Lead service lines can be a major source of lead contamination in water.

Lead Goose Necks: Goose necks and pigtails are shorter pipes that connect the lead service line to the main.

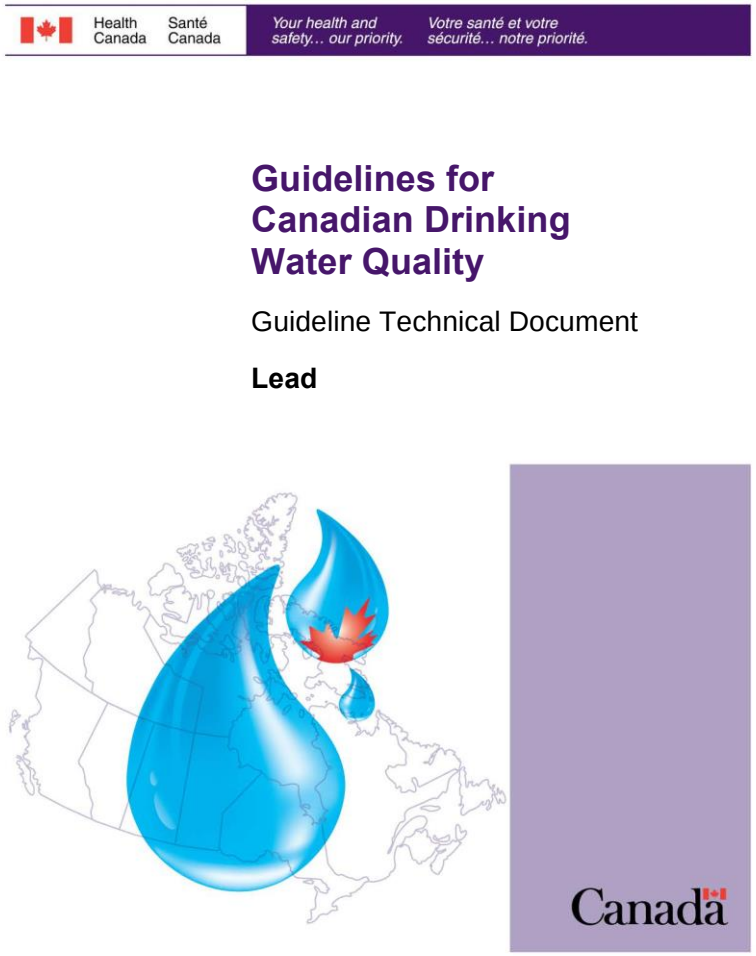
Background

- Results of testing of BC schools lead in drinking water might have reflected difference in sampling strategies or approaches

- Having clear objectives, assumptions, hypotheses, and proper methods for sampling is essential.



Document available on NCCEH.ca (http://bit.ly/2Hp72uL)



Canada's new Maximum Allowable Concentration (MAC) for Pb in drinking water: 10 µg/L to 5 µg/L

Based on health effects: Lead is harmful even at extremely low levels

Up to each province/territory to:

- implement new guideline (or not) and when it will adopt this new MAC;
- transition time to allow utilities to achieve new target;
- how testing and reporting will be done
- how to convey public education, plan to work with property owners to replace lead service lines

Sampling Protocols: key considerations

- Identify the desired sampling objective
  - Identifying sources of lead?
  - Controlling corrosion?
  - Assessing compliance?
  - Estimating exposure to lead?
- Sampling after changes to plumbing
  - Renovations or repairs made to plumbing system
- Timing and frequency
  - When schools are in session; weekdays vs weekends
- Location: All outlets used for food prep or for drinking

Sampling protocols for testing lead in school drinking water (Canada; US)

Agency	Health Canada[5] (Lead in Drinking Water document)	Health Canada[6] (Guidance on Controlling Corrosion in Drinking Water Systems document)	Ontario Ministry of the Environment and Climate Change[2]	Québec Ministère de l'Environnement et de la Lutte contre les changements climatiques	US Environmental Protection Agency[7]	California Environmental Protection Agency[8]
Objective	To assess typical exposures	To investigate potential sources of contamination	To conduct routine required monitoring	To conduct routine required monitoring	To investigate potential sources of contamination	To conduct routine required monitoring
When?	In either June or October for schools, and between June and October for multi-dwelling and large buildings (i.e., when fully occupied and functional)	As needed to investigate exceedances and to determine if corrosion control is required	Between May 1 and October 31	Between July 1 and October 1	Not specified	During months when schools are in session

	Health Canada	Health Canada	ON MoECC	QC	US EPA	California EPA
Which outlets?	All drinking water fountains and cold water taps where water is used for drinking or food preparation. Outlets that are used for consumption should be prioritized over infrequently used outlets	Drinking water fountains and outlets used for drinking and cooking should be prioritized	All drinking water fountains and outlets used for drinking or food preparation. Outlets in change rooms, bathrooms, and any outlets in classrooms that are not used for consumption can be excluded.	An outlet that has been confirmed or suspected to contain lead parts, including lead solder. The outlet should be accessible to consumers, frequently used, and should not be connected to a treatment device (e.g. point of use filter)	Any outlets used for drinking, including fountains, home economic room sinks, teachers' lounge sinks, nurse's office sinks, sinks in special education classrooms, and other sinks known to be used for consumption	Up to 5 of the busiest outlets in the school should be selected. Selection should be made after observing use of all outlets by students and staff during morning, break and lunch periods. Large industrial sinks providing water not intended for consumption can be excluded
How often?	At least once per year	At least once per year when corrosion control is implemented (i.e., to assess its effectiveness)	Annually, unless the facility is eligible for reduced sampling every 3 years[a]	Depends on the size of the water system supplying the facility. In general, schools should be tested no less than once every 5 years	Not specified	Not specified, but all schools should be tested at least once before November 1, 2019

Sampling Procedures: Key components

Type of sample

- First draw vs flushed samples
- Stagnation period

Volume of water, flow rate, temperature

- Small vs larger volume; higher vs lower flow rates; cold vs hot water

samples

- Plumbing profile of building

Who conducts sampling

- Qualified persons

Laboratory analysis

- Contact laboratory prior to sampling
- Accredited lab experienced in analyzing lead in water; analytical method used; detection and/or reporting limits of method

Comparison of sampling procedures: Health Canada, ON, QC, US EPA, US California EPA

Recommended steps to follow, including:

- When to test
- How much to draw
- Other details

TABLE 2. SAMPLING PROCEDURES OUTLINED IN SAMPLING PROTOCOLS DEVELOPED IN CANADA AND THE US TO ASSESS WATER LEAD LEVELS IN SCHOOLS

Health Canada[5] (Lead in Drinking Water document[a])	Health Canada[6] (Guidance on Controlling Corrosion in Drinking Water Systems document)	Ontario Ministry of the Environment and Climate Change[2]	Québec Ministère de l'Environnement et de la Lutte contre les changements climatiques[3]	US Environmental Protection Agency[7]	California Environmental Protection Agency[8]
Random Day Time (RDT) sampling. Collect two 125 mL samples per outlet. Samples should be collected randomly during the day without prior flushing: no stagnation period is prescribed, to better reflect consumer use. Water should flow at a medium or high flow rate and aerators should not be removed. The lead concentration at each outlet is determined by averaging the results of the two samples.	Two-tier sampling. Collect samples after plumbing has not been in use for a minimum of 8 hours, but not more than 24 hours. Do not remove aerator. Sampling is conducted in two steps (Tier 1 and Tier 2). Tier 1 sampling is to be conducted at all outlets selected for sampling. Tier 2 sampling is to be conducted only at outlets where elevated levels were found in Step 1. Tier 1 and 2 sampling can be conducted at the same time, with Tier 2 samples only being analyzed if exceedances are found for Tier 1 samples. **Tier 1 sampling:** 1. Collect a 250 mL first draw (i.e. no prior flushing) sample from each outlet. 2. Collect a 250 mL 5-minute flushed sample from an outlet closest to the service connection **Tier 2 sampling:** Collect a 250 mL 30-second flushed sample.	Develop an inventory of all outlets. Collect samples after plumbing has not been in use for a minimum of 6 hours. Do not remove aerator, and if applicable, do not remove point of use filter. Collect two 1 L samples per outlet. 1. Collect a first draw sample (i.e. no flushing prior to sample collection). Water should flow at a normal rate. 2. Flush the outlet for 5 minutes by turning on the cold water and letting it flow at full volume. Wait 30 minutes and collect a second 1 L sample; do not use the outlet during this 30-minute period.	Collect at minimum 1 sample per facility. The outlet should be flushed for 5 minutes prior to collecting a sample. For outlets with both hot and cold water values, the hot water should be run for 2 minutes, followed by the cold water for 3 minutes. Do not remove aerator prior to sampling.	Develop a plumbing profile for the facility (guidance provided). Collect samples before the facility opens and before any water is used. Water should ideally sit in pipes for 8 to 18 hours. Collect one 250 mL sample per outlet. Sampling is conducted in two steps (Step 1 and 2). Step 1 sampling is to be conducted at all outlets selected for sampling. Step 2 sampling is to be conducted only at outlets where elevated levels were found in Step 1. **Step 1:** Collect a first draw (i.e. no prior flushing) sample from each outlet. **Step 2:** 1. If applicable, remove aerator/screen and clean the debris. Collect a first draw sample. 2. If the outlet does not have an aerator or screen, flush the outlet for 30 seconds and collect a sample.	Collect samples on a Tuesday, Wednesday, Thursday or Friday morning, after plumbing has not been in use for a minimum of 6 hours. Do not remove any filters, aerators, or screens prior to sampling. Collect one 1 L sample per outlet. Initial sampling is required at all outlets selected for sampling. Repeat, second repeat, and corrective action sampling is required at all outlets where initial sample exceeds the action level. **Initial sampling:** Collect first draw samples from all selected outlets. **Repeat sampling:** Collect a 1 L sample, using procedures used for initial sampling, at all outlets where the initial sample exceeds the action level. Sampling should be conducted within 10 days of receiving results from initial sampling. **Second repeat sampling:** Collect a 1 L sample, using procedures used for initial sampling, at all outlets where the repeat sample exceeds the action level. Sampling should be conducted within 10 days of receiving results from repeat sampling. Corrective actions should be taken at outlets where the second repeat sample exceeds the action level. **Corrective action sampling:** Collect a 1 L sample, using procedures used for initial sampling, at all outlets where corrective actions were undertaken.

Source:
Testing for Lead in School Drinking Water: A Summary of Sampling Protocols

NCCEH, March 2019
http://bit.ly/2Hp72uL

Health Canada[5] (Lead in Drinking Water document[a])	Health Canada[6] (Guidance on Controlling Corrosion in Drinking Water Systems document)	Ontario Ministry of the Environment and Climate Change[2]	Québec Ministère de l'Environnement et de la Lutte contre les changements climatiques[3]
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US Environmental Protection Agency[7]	California Environmental Protection Agency[8]
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https://www.lslr-collaborative.org/

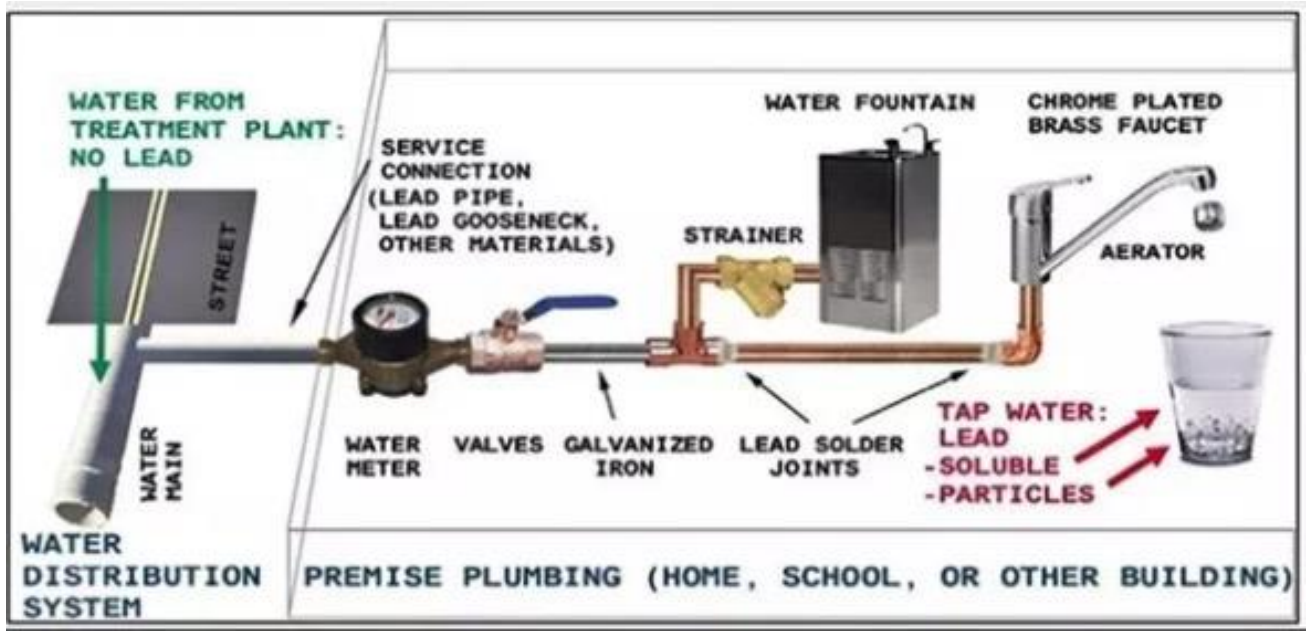
“Momentum builds across US to replace lead water pipes: Water contamination an issue for millions”

The Nation’s Health July 2019
American Public Health Association

Mitigation options: Remove lead, reduce exposure

- **Remove source of Pb**: replace lead service lines and upgrade plumbing material
- **Corrosion control**: actions at the treatment plant
- **Point-of-entry and point-of-use filters certified for lead removal** at outlets tested positive for contamination (*short-term*);

- **Eliminate stagnant water**: flushing (*short-term*)
- Use of **cold water** for drinking and food preparations
- **Proper signage & deactivation of problematic water sources**
- Public education, public finances, find ways to work with property owners to participate in replacement programs.



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Opportunities

for public health to collaborate with schools and daycares to address lead in plumbing:

Communicating risk:

- Help school and child care facilities understand source of Pb in drinking water and how Pb leaches from facility plumbing

- Testing for Pb in school drinking water:
  - Develop sampling plan
  - Conduct sampling
  - Interpret /report results
  - Recordkeeping

- Sampling locations – where? Track?
- Proper timing of sampling events
- Sampling protocols
- Proper sampling technique
- Management and reporting of sampling results
- Accountability – entry errors (units confusion – mg vs ug)

Explore sources of funding and share with stakeholders

E.g., BC Ministry of Education's School Enhancement Program and Annual Facilities Grant (can apply to cover costs for testing and remediation)

Start national conversation: Community of Practice - School Drinking Water Network?

- Sharing information, challenges, insights, ideas, experiences
- Funding opportunities

Useful resources

- **Health Canada**. **Guidelines for Canadian drinking water quality: Guideline technical document - Lead.** 2019 March.

  https://www.canada.ca/en/health-canada/services/publications/ healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-lead/guidance-document.html

- **US Environmental Protection Agency. 3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities. Revised Manual. 2018.**

  https://www.epa.gov/sites/production/files/2018-09/documents/final_revised_3ts_manual_508.pdf

- **NCCEH EH topic page: Lead in Drinking Water: Homes and Schools**

  http://www.ncceh.ca/environmental-health-in-canada/health-agency-projects/lead-drinking-water-homes-and-schools

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