



Lead in Water:  
Background and Sampling  
Procedures

# Health Effects in Children

- CDC has stated that “No safe blood level has been identified and all sources of lead exposure for children should be controlled or eliminated.”
- Lead is persistent and can accumulate in the body over time.



# Health Effects in Children

Lead exposure has behavioral and physical effects at lower exposure levels in children than adults. It can cause:

- Nerve damage (central and peripheral)
- Behavior and learning problems
- Slowed growth
- Impaired hearing
- Impaired formation and function of blood cells
- Seizures, coma, and/or death (in rare cases)



# What is Lead Poisoning?

- IDPH currently considers 5  $\mu\text{g}/\text{dL}$  to be an elevated blood lead level consistent with federal reference guidelines
  - 1 microgram = 0.000001 grams
  - 1 deciliter = 0.1 liters
  - $\mu\text{g}/\text{dL}$  is the whole blood sampling unit (water is  $\mu\text{g}/\text{L}$ )
- Lead poisoning may be due to a combination of sources

# Costs of Lead Poisoning

- Lead-poisoned children are more likely to struggle in school, drop out, get into trouble with the law, and have lower lifetime earnings.
- The economic consequences of childhood lead poisoning include billions of dollars in public spending on education, juvenile justice, and other social services.



Health Impact Project. (2017) "10 Policies to Prevent and Respond to Childhood Lead Exposure: An assessment of the risk communities face and key federal, state, and local solutions."

# Sources of Lead in Drinking Water

- Corrosion of lead service lines (LSL's)
- Brass faucets and fittings or chrome-plated brass fixtures
- Galvanized pipe
  - Lead particles can attach to the surface of pipes and can slowly be released into the water
- Fixtures or piping with lead solder
- Contaminated source water
  - Not a common source of lead in water



# Factors Contributing to Lead in Drinking Water

- Plumbing materials containing lead
- Corrosive water
  - Water that is “soft” and acidic
- Temperature of water
  - Hot water solubilizes lead salts
- Amount of wear in the pipes
- Water age
  - How long the water sits in the pipes
- Scales or coatings inside the plumbing materials
  - Orthophosphates are used in water treatments for corrosion control



# Learn More About Your Incoming Water

- Community water supplies
  - EPA requires all community water systems to prepare and deliver an annual water quality report called the Consumer Confidence Report (CCR).
- Wells and private water supplies
  - Check with your local health department or with a nearby water utility that utilizes ground water for information about contaminants of concern in your area.



# Understand Your Plumbing System

- Age of facility/plumbing system
- Plumbing material(s)
  - Water distribution piping and service line material
  - Joints and fittings (solder, flux, brass, etc.)
  - Appurtenances and fixtures
- Fixtures used for drinking, cooking, and making baby formula

# Home Age

- Homes built before 1986 often contain faucets, fixtures, fittings, pipes, solder, and flux containing lead
- Federal Rules on Lead in Water
  - **1986:** Safe Drinking Water Act Amendments: prohibition on use of lead pipes, solder, and flux in public water systems and plumbing
  - **1991** Lead and Copper Rule (LCR)
    - <https://www.epa.gov/dwreginfo/lead-and-copper-rule>
    - Rules restrict lead and copper in drinking water.
  - **2011:** Reduction of Lead in Drinking Water Act
    - Modified definition of “lead free” effective January 2014

# Pipe Identification: Characteristics

- Lead:
  - Grayish, soft metal with dull gray finish
  - Distinctive bulge when connecting to a joint
  - Can be scratched with a coin, will be very shiny once scratched
- Galvanized Iron:
  - Shiny, flaky finish
  - Rigid (hard) silver color
  - Threaded (screwed) connections to joints
- Copper:
  - Same color as a penny; will dull as it ages
  - Soldered connections to a joint
- Brass:
  - Yellowish brown appearance similar to bronze
  - Threaded or soldered connections

# Authority

- The Illinois Department of Children and Family Services (DCFS) is the Agency authorized to enforce requirements for lead in water testing for licensed daycare facilities.
- IDPH guidance does not necessarily constitute compliance with DCFS rules.
- Licensed daycare facilities should contact their DCFS licensing representative with any questions.

# Importance of Sampling

- Testing is the only way to confirm if lead is present in your water
  - You cannot see, smell, or taste lead in water



# Choosing a Certified Laboratory

- When testing your water for lead you should use a certified laboratory.
- A list of IEPA-accredited laboratories can be found at:  
<http://www.epa.illinois.gov/topics/certification-training/lab-accreditation/accredited-labs/index>.

# Testing Methods and Detection Limits

- Laboratories should use approved methods, including:
  - EPA 200.5
  - EPA 200.8
  - EPA 200.9
  - ATSM D3559-06
  - ATSM D3559-08 D
  - Method 1001
  - Standard Method 3113 B
- The minimum detection limit of the selected method should not exceed 2.0 ppb.



# Selecting Sampling Sites

- Establish a sampling plan to identify and prioritize sampling sites
- Reminder: You want a representative sample
  - Do NOT collect daycare center samples on Mondays or after extended holidays
    - Daycare centers should develop a program to flush plumbing fixtures after extended closings
  - Do NOT flush plumbing fixtures before stagnation period

# Selecting Sampling Sites

- USEPA recommends the following sampling sites:
  - High priority:
    - Drinking fountains, both bubbler and water cooler style
    - Kitchen sinks
    - Classroom combination sinks and drinking fountains
    - Any sink known to be or suspected to be used for consumption (cups are nearby)
  - Medium priority:
    - Class room sinks (potential for cups used for drinking, classroom cooking projects)
    - Bathroom faucets (children may drink from these)
  - Low priority:
    - Utility sinks and hose attachments, unless used to fill water jugs
    - Hot water outlets



# Sampling Procedures for Homes

1. The first fixture must be sampled three times; all other fixtures must be sampled twice.
2. Ensure water has been stagnant (unused) in pipes and fixtures for a minimum of 6 hours and no more than 18 hours prior to sampling.
3. Before sampling, label the sample bottle with an alphanumeric identifier (ex. A1). Do not open sample bottles until you are ready to collect the water sample.
4. Position the first 250 mL sample bottle beneath the fixture and turn on the water. Fill the bottle completely and turn the water off. Cap the bottle tightly. Do not allow the water to spill.
5. Turn the water back on and allow the water to run at full force for 30 seconds before filling the second 250 mL sample bottle. Cap the bottle tightly. Do not allow the water to spill.
6. **Note: This step is only for the first fixture sampled.** Turn the water back on and allow the water to run at full force for 2 minutes before filling the third 250 mL sample bottle. Cap the bottle tightly do not allow water to spill.
7. All sample bottles should be labeled with the date, time, alphanumeric identifier, and a sample description (1<sup>st</sup>, 2<sup>nd</sup> or 3<sup>rd</sup>).
8. Fill out the chain of custody form with information from each sample. It is important that identifiers for each sample match the chain of custody.
9. Continue sampling all potable water fixtures until all samples are collected. Prepare the samples for shipping per instructions provided by the laboratory.

# Sampling Procedures for Day Care Facilities

1. Each fixtures must be sampled two times.
2. Ensure water has been stagnant (unused) in pipes and fixtures for a minimum of 8 hours and no more than 18 hours prior to sampling.
3. Before sampling, label the sample bottle with an alphanumeric identifier (ex. A1). Do not open sample bottles until you are ready to collect the water sample.
4. Position the first 250 mL sample bottle beneath the fixture and turn on the water. Fill the bottle completely and turn the water off. Cap the bottle tightly. Do not allow the water to spill.
5. Turn the water back on and allow the water to run at full force for 30 seconds before filling the second 250 mL sample bottle. Cap the bottle tightly. Do not allow the water to spill.
6. All sample bottles should be labeled with the date, time, alphanumeric identifier, and a sample description (1<sup>st</sup> or 2<sup>nd</sup>).
7. Fill out the chain of custody form with information from each sample. It is important that identifiers for each sample match the chain of custody.
8. Continue sampling all potable water fixtures until all samples are collected. Prepare the samples for shipping per instructions provided by the laboratory.

# Significance of Sampling Procedure

- Results should be compared to each other to determine likelihood of sources of lead
- First draw
  - If positive, may indicate lead in the sampled fixture
- 30 second flush
  - If positive, may indicate lead in the immediate line to the fixture
- 2 minute flush
  - If positive, may indicate lead in the service line to the home

# Example Chain Of Custody Form

Site Name:					Contact Name:	<i>Jane Doe</i>			
Address:					Contact Phone:				
City/State/Zip:					Contact Email:				
Building Description:					Contact Fax:				
Lab Sample ID	Analysis	Field Sample ID	Sample Location	Fixture Type (e.g. water fountain, sink, ice machine)	Sample Type (e.g. first draw, 30 second flush)	Date Collected	Time Collected	Samplers Initials	Comments
		<i>A1</i>	<i>Kitchen</i>	<i>Sink</i>	<i>First draw</i>	<i>08/01/18</i>	<i>9:31 AM</i>	<i>JD</i>	
		<i>A2</i>	<i>Kitchen</i>	<i>Sink</i>	<i>30 second flush</i>	<i>08/01/18</i>	<i>9:32 AM</i>	<i>JD</i>	
		<i>A3</i>	<i>Kitchen</i>	<i>Sink</i>	<i>2 minute flush</i>	<i>08/01/18</i>	<i>9:35 AM</i>	<i>JD</i>	
		<i>B1</i>	<i>Kitchen</i>	<i>Ice machine</i>	<i>N/A</i>	<i>08/01/18</i>	<i>9:40 AM</i>	<i>JD</i>	
		<i>C1</i>	<i>Bathroom</i>	<i>Sink</i>	<i>First draw</i>	<i>08/01/18</i>	<i>9:51 AM</i>	<i>JD</i>	
		<i>C2</i>	<i>Bathroom</i>	<i>Sink</i>	<i>30 second flush</i>	<i>08/01/18</i>	<i>9:52 AM</i>	<i>JD</i>	

The example above is a chain of custody completed for a home where six samples were collected from three fixtures.

# Sampling Guidance for Specific Fixtures

- Ice making machines
  - Fill a suitable container provided by the laboratory at least three quarters full of ice
  - Do not touch the ice with your hands
  - Use a non-metal scoop or disposable plastic gloves provided by the laboratory to place ice in the container



# Testing Results

- Test results will be reported in either parts per billion (ppb) or micrograms per liter ( $\mu\text{g}/\text{L}$ )

# Lead Check Swab

- Typically used to check for lead in paint, however it can be used to check for lead pipes
  - Confirmation tool
- Procedure
  - Dust/wipe pipe
  - Follow instructions on Lead Check Swab
  - Red color indicates presence of lead

# Potential Mitigation Strategies

- Removing all sources of lead is the best strategy to reduce the concentration of lead in water
- If validation testing confirms the presence of lead after replacing fixtures and lead service lines, other components of the plumbing system (e.g. joints, connections, appurtenances) may need to be replaced
- Validation
  - Mitigation strategies should be validated through follow up sampling

# Potential Mitigation Strategies

- Long-term strategies
  - Replace plumbing materials (fixtures, piping, fittings, service lines, etc.) containing lead with other materials approved under the Illinois Plumbing Code (77 Ill. Adm. Code 890)
  - Replace components known to contain lead (e.g. lead service line, brass fittings, etc.)
    - Partial lead service line replacements will increase the lead concentration within the water and are therefore prohibited under Title 77 IAC 890.110 b) and d) and 890.140 d)
  - Replace fixtures suspected of containing lead as identified from sampling data
    - Prioritization of replacement should consider frequency of use of fixture for consumption and concentration of lead from fixtures

# Potential Mitigation Strategies

- Temporary strategies
  - Isolate contaminated fixtures and provide alternate source of water (e.g. bottled water, distilled water, etc.)
    - If fixtures are shutoff, a plan should be in place to ensure water does not stagnate within branch plumbing
  - Installation and proper maintenance of point-of-use filters certified by NSF for lead removal (NSF 53 & NSF 58)



# Potential Mitigation Strategies

- Temporary strategies continued

- Flushing

- If a fixture is believed to be contributing to the concentration of lead in water, then the fixture should be flushed for approximately 30 seconds prior to using for consumption
    - A plumbing system or branches of plumbing should be strategically flushed after extended periods of non-use (weekends, school breaks, etc.) to ensure fresh water within all branches of the plumbing system
    - Lead concentrations increase the longer the water is in contact with the pipes or plumbing fixtures containing lead
    - Reducing the water age (how long water sits in the pipes) will temporarily reduce lead levels in the water. However, concentrations of lead can increase quickly after flushing occurs
    - Flushing can increase the amount of orthophosphate in the pipes which can protect against corrosion
    - Holding tanks should be routinely flushed to remove sediment



# Best Practices to Reduce Exposure to Lead in Drinking Water

- Use cold water when cooking, drinking, and making baby formula
  - Lead leaches more easily into hot water than cold water
  - Water age increases as water is stored in hot water tanks
  - Sediment accumulates in hot water tanks
- Clean or remove aerators whenever a plumbing system is known to contain lead
  - Small screens on the end of a faucet can trap sediments containing lead





# Questions

If you have additional questions or concerns, please contact the Plumbing and Water Quality Program at [DPH.LeadH2O@Illinois.gov](mailto:DPH.LeadH2O@Illinois.gov).

# Additional Resources

- USEPA: <https://www.epa.gov/ground-water-and-drinking-water/basic-information-about-lead-drinking-water>
- CDC: <https://www.cdc.gov/nceh/lead/tips/water.htm>
- IDPH: <http://www.dph.illinois.gov/topics-services/environmental-health-protection/lead-in-water>