Module 5: Conducting Sampling and Interpreting Results

Detailed Fixture Evaluation

Communication Plan: Don't forget to communicate your plans to test your facility, and to prepare for communicating results.

The purpose of the detailed fixture evaluation is to pinpoint where (i.e., fixtures, cooler, interior plumbing) lead is getting into drinking water so that appropriate corrective measures can be taken.

Because the composition and dimensions of these fixtures vary, there are different sample collection procedures for each fixture. Using the partnerships established with the 3Ts Program, you may choose to request assistance with sampling from entities like public water systems, state drinking water programs, or certified laboratories.

The following pages break down the sampling for five types of fixtures and explain how to interpret results:

- **Drinking Water Fountains**
- **Cold Water Faucet**
- **Drinking Water Fountains with Coolers**
- **Ice-Making Machine**
- **Central Chiller Unit**

Note: The graphics in this factsheet are meant to provide a general depiction of the plumbing being sampled. Each outlet is a little bit different; there may be instances where more or less of the plumbing is covered in the sample than is shown in the graphics.

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Drinking Water Fountains

Schools and child care facilities will want to collect water so that the sample water has been in contact with the fixture and has been in contact with the connecting pipes (Exhibit 1). If the fountain has a chiller unit, see the Central Chiller Unit Section for additional sampling.

Helpful hint: Read the full instructions before sampling.

Sample 1A: Sampling the Outlet

Take this sample before the facility opens and before any water is used. Try to predict the arc of the water and take a 125-mL sample. Note this is a sequential sample. This sample is representative of the water that may be consumed at the beginning of the day or after infrequent use. It consists of water that has been in contact with the fountain or bubbler valve, shut-off valve, and connecting pipe.

Sample 2A: Sampling the Connecting Pipe

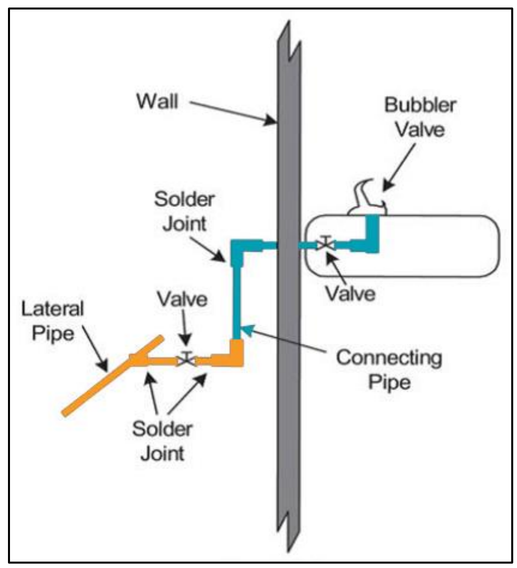
Without shutting off the water, take another 125-mL sample, trying not to spill. Be sure to record which sample was the first and which was the second sample. This is also a sequential sample.

This sample consists of water that has been in contact with the plumbing upstream of the outlet and the lateral pipe.

Sample 3A: Sampling the Interior Plumbing

Again, without shutting off the water, take a final 250-mL sample trying not to spill any water in between samples. This is also a sequential sample. This sample is representative of the water that is in the plumbing upstream from the fountain.

Exhibit 1. Targeted Locations of Water in Plumbing for Drinking Water Fountains



Interpreting Results: Drinking Water Fountains

To determine the source of lead in the water, compare the test results of Samples **1A**, **2A,** and **3A**.

- **IF** the lead level in the first 125-mL sample (**1A**) is higher than that of the second 125-mL sample (**2A**), **THEN** the fixture may be contributing lead and might need to be replaced.
- **IF** the lead level in the second 125-mL sample (**2A**) is higher than that of the first sample (**1A**), **THEN** the lateral pipe or shut-off valve may be contributing lead.
- **IF** the lead level in the 250-mL sample (**3A**) is lower (below 5 ppb), **THEN** very little lead is being picked up from the plumbing upstream from the outlet. The majority or all of the lead in the water is likely contributed from the drinking water fountain.
- **IF** the lead level in the 250-mL sample (**3A**) significantly exceeds 5 ppb (for example, 10 ppb), **THEN** lead in the drinking water could also be contributed by the plumbing upstream of the drinking water fountain.

Compare all sample results to prioritize follow-up sampling and remediation. Outlets with elevated lead levels should not be made available for consumption.

Cold Water Faucet (i.e., Water Faucet, Water Tap, Kitchen Sink)

Water in this sample should consist of water that has been in contact with the faucet fixture and the lateral pipe (Exhibit 2).

Sample 1B: Sampling the Faucet

Take a 250-mL sample before the facility opens and before any water is used. **Note this is a sequential sample.**

Sample **1B** is representative of the water that may be consumed at the beginning of the day or after infrequent use. It consists of water that has been in contact with the fixture and the plumbing connecting the faucet to the lateral pipes. See Exhibit 2.

Sample 2B: Sampling the Interior Plumbing

Without shutting off the water, take a second 250-mL sample, trying not to spill. Note this is also a sequential sample.

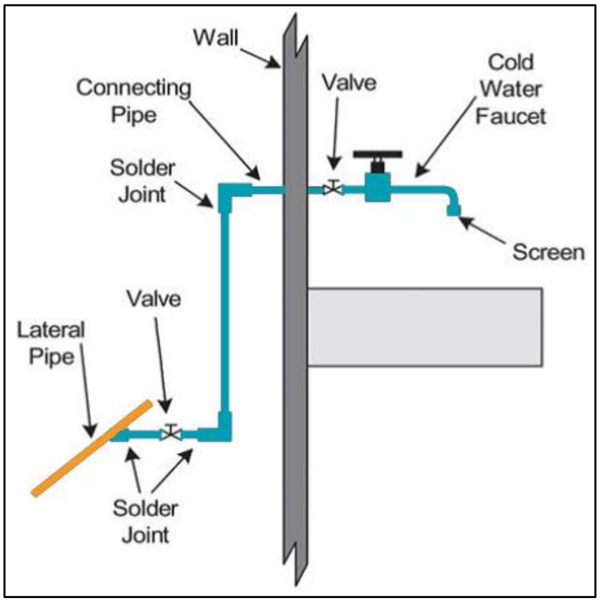
This sample is representative of the water that is in the plumbing upstream from the faucet.

Interpreting Results: Cold Water Faucets

To determine the source of lead in the water, compare the results of Samples **1B** and **2B**.

- **IF** the lead level in sample **1B** is higher than that in sample **2B**, **THEN** the source of lead could be the water faucet and/or the plumbing upstream from the faucet.
- **IF** the lead level in sample **2B** is lower, close to 5 ppb, **THEN** very little lead is coming from the plumbing upstream from the faucet. The majority or all of the lead in the water is likely from the faucet and/or the plumbing connecting the faucet to the lateral.
- **IF** the lead level in sample **2B** significantly exceeds 5 ppb (for example, the level is 10 ppb), **THEN** lead may be coming from the plumbing upstream from the faucet.

Exhibit 2. Targeted Locations of Water in Plumbing for Cold Water Faucets



Drinking Water Fountains with Coolers

Two types of water coolers are used in drinking water fountains: the wall-mounted and the free-standing types. Water in these coolers is stored in a pipe coil or in a reservoir. Refrigerant coils in contact with either of these storage units cool the water. Sources of lead in the water may be the internal components of the cooler, including a lead-lined storage unit; the section of the pipe connecting the cooler to the lateral pipe; and/or the interior plumbing of the building (Exhibit 3).

Flushing the Afternoon Before

In order to sample this outlet, you need to flush the outlet the afternoon before sampling. Flushing times will be dependent on the cooler tank size, but a 15-minute flush should get to the piping upstream of the cooler and ensure that no stagnant water is left in the storage unit.

Sample 1C: Sampling the Outlet

Take a 125-mL sample before the facility opens and before any water is used. Collect the water immediately after opening the fountain or bubbler valve without allowing water to run. **Note this is a sequential sample.**

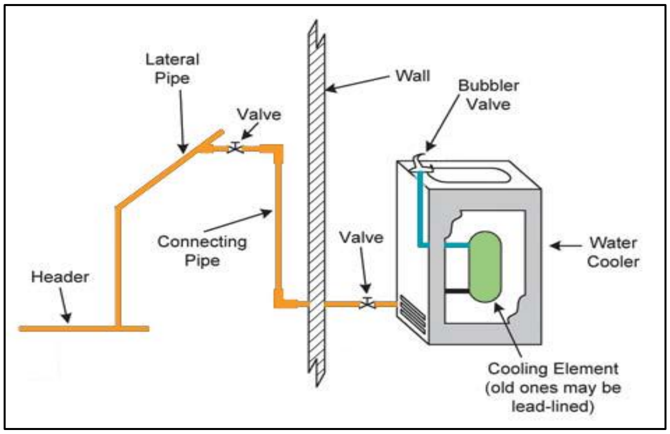
The sample consists of water that has been in contact with the fountain or bubbler valve and the plumbing inside the outlet.

Sample 2C: Sampling the Water Cooler

Without shutting off the valve, take a 250-mL sample immediately after sample 1C, trying not to spill any water. This is also a sequential sample.

Because the water in the cooler was flushed the previous afternoon, this sample is representative of the water that was in contact with the cooler overnight, not in extended contact with the plumbing upstream

<u>Exhibit 3</u>. Targeted Locations of Water in Plumbing for Water Fountains with Coolers



Interpreting Results: Drinking Water Fountain Coolers

To determine the source of lead in the water, compare the test results of samples **1C** and **2C**.

- **IF** the lead level concentration in the first 250-mL sample (**2C**) is high AND is greater than or equal to the lead level concentration of sample **1C** and **3C**, THEN the source of the lead may be sediments contained in the cooler storage tank, screens or the plumbing upstream from the cooler.
- **IF** the lead level concentration in the first 125-mL sample (**1C**) is greater than the sample **2C** concentration, **THEN** the bubbler valve may be contributing lead.

Eliminating Particulate Lead as a Source

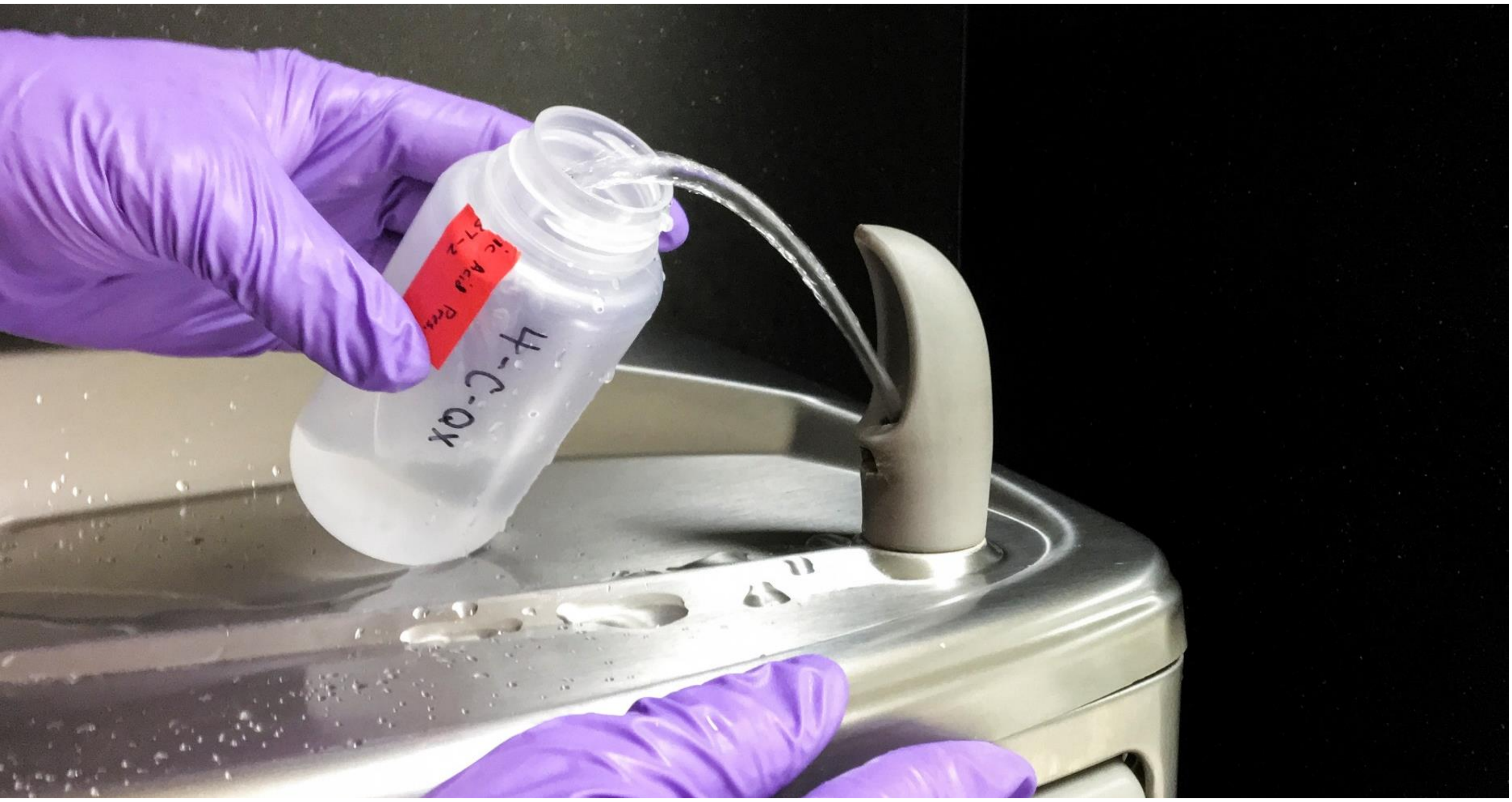
If the detailed fixture results reveal there are high lead levels of lead in the cooler sample, a contributing source of the elevated levels could be the debris in the aerator or screen of the fixture. By cleaning the aerator or screen and retesting, you can determine whether the debris is a contributing source to elevated lead levels in their facilities.

Determining aerator/screen debris contribution:

Turn off the valve leading to the cooler. Disconnect the cooler from the plumbing and look for a screen at the inlet. Remove the screen. Some coolers also have a screen installed at their bubbler or fountain valve. Carefully remove the valve by unscrewing it. Some coolers are equipped with a drain valve at the bottom of the water reservoir that may also catch debris. Clean it all. Then take a 250-mL sample (**3C**).

Interpreting Results: Cooler

- **IF** the concentration of sample **3C** is less than 5 ppb, **THEN** the lead could be coming from debris in the cooler or the screen.
- **IF** the concentration of sample **3C** is much greater than 5 ppb, **THEN** the lead is likely coming from debris in the cooler or on the screen.
- **IF** the concentration of sample **4C** is much greater than 5 ppb AND less than sample **1C**, **THEN** the source of lead may be sediments contained in the cooler, screens, and/or the upstream plumbing. Routine flushing practices should be implemented to reduce exposure from lead particulates.



Ice-Making Machine

Schools and child care facilities will want to collect water so that the sample water has been in contact with the ice making machine and with the plumbing upstream (Exhibit 4).

Sample 1D: Sampling the Ice

Fill a suitable container (250-mL or larger, wide-mouthed bottle or other container) provided by the laboratory at least three-quarters full with ice. Do not touch the ice with bare hands. Use the non-metal scoop or disposable plastic gloves provided by the laboratory to place the ice in the container. The results of **1D** can be used to determine if sample **2D** is needed.

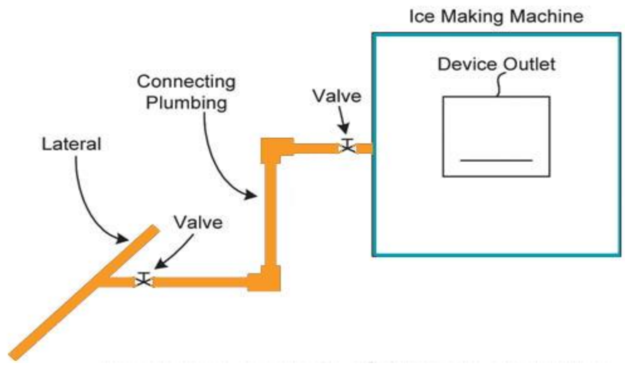
Note: If there are high lead levels in the initial sample (**1D**), then collect sample **2D** to determine if the source of the lead is the plumbing or the ice making machine itself.

Sample 2D: Sampling the Plumbing

Disconnect the ice maker from the plumbing and look for a screen at the inlet. Remove the screen. Clean out the debris, if debris is present. Clean the screen routinely to avoid accumulations of debris.

Collect the sample from the disconnected plumbing as close to the ice maker as possible. Fill the sample container with 250-mL of water immediately after opening the faucet or valve. If no faucet is available, contact the ice machine manufacturer for recommendations that will minimize disruption of existing plumbing.

Exhibit 4. Targeted Locations of Water in Plumbing for Ice Making Machines



Interpreting Results: Ice-Making Machine

- **IF** the lead level in sample **2D** is lower (below 5 ppb), **THEN** the source of the lead may be in the ice maker.
- **IF** the lead level in sample **2D** significantly exceeds 5 ppb (for example, the level is 10 ppb), **THEN** lead could also be contributed from the plumbing upstream from the ice maker.
- Follow-up samples from the supplying system may also need to be taken to identify the source of lead.

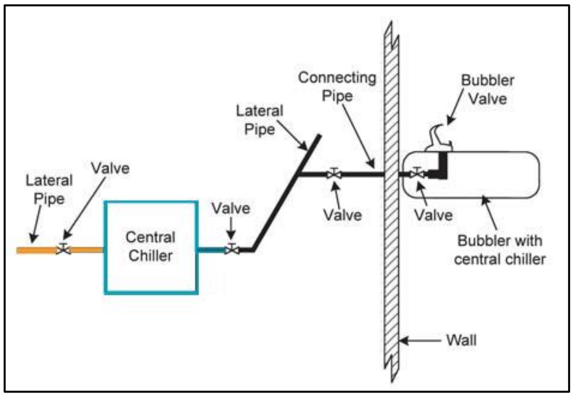
Central Chill Unit

Sample 1E: Sampling the Plumbing Supplying the Chiller

Take a 250-mL sample from a faucet or valve as close to the inlet of the chiller as possible. If no outlet is available, contact the chiller manufacturer for recommendations that will minimize disruption of existing plumbing. If a sample faucet or valve is available, collect the sample immediately after opening the outlet, without allowing any water to go to waste.

This sample is representative of water that has been in contact with the plumbing supplying water to the chiller.

Exhibit 5: Targeted Locations for Water in Plumbing for Central Chillers



Sample 2E: Sampling the Connecting Pipe

Take a 250-mL sample from a faucet or valve as close to the outlet of the chiller as possible. If no outlet is available, contact the chiller manufacturer for recommendations that will minimize disruption of existing plumbing.

This water sample consists of water that has been in contact with the chiller unit and the plumbing upstream, which supplies water to the chiller. Often, water supplied to the fountains is recirculated to the chiller unit. In this instance, sample 2E consists of a mixture of water from the water supply and any water that may be recirculated from the plumbing supplying water to the fountains.

Interpreting Results: Central Chiller Unit

Note: Schools and child care facilities will need the results from samples collected at the drinking water fountain (Exhibit 1) covered earlier in this section.

- **IF** the lead level in sample **3A** (the drinking water fountain sample) is higher than that in sample **2E** (the second 250-mL central chiller sample), **THEN** lead could be contributed by the plumbing supplying the water from the chiller to the fountain.
- **IF** the lead level in sample **2E** is higher than in sample **1E**, **THEN** a portion of the lead may be coming from the chiller.
    - **Note**: Sludge and sediments containing high levels of lead may accumulate in chiller tanks. If the test results indicate that lead is coming from the chiller unit, check for the presence of debris and sludge. Remove any of these materials from the chiller, flush the chiller unit, and resample the water.
- **IF** the lead level in sample **1E** is lower (close to 5 ppb), **THEN** very little lead is being picked up from the plumbing upstream from the chiller. The majority or all of the lead in the water may be attributed to the chiller and the plumbing downstream from the chiller.
- **IF** the lead level in sample **1E** is very high (above 20 ppb), **THEN** there could be lead sources upstream from the chiller and you may need to contact a plumber to further diagnose.

Additional Sampling Information

Sample Documentation

Record the unique sample identification number on each sample bottle and on the recordkeeping form. An example form is provided in Module 7. The information recorded will include:

- Type of sample taken (e.g., initial first-draw).
- Date and time of collection.
- Name of the sample collector.
- Location of the sample site.
- Name of the outlet manufacturer and the outlet's model number, if known.
- Model number of faucets, valves, and other visible fixtures; include digital photos in sampling records, if possible.
- Water treatment already in place in the building (i.e., point-of-entry (POE) devices) or filters (point-of-use (POU) devices).

Additional Interior Plumbing Samples

In general, if lead levels remain high in samples taken from drinking water outlets, and the source cannot be determined, additional samples from upstream sample sites in the interior plumbing should be collected. The Detailed Fixture Evaluation can further help in determining potential lead sources.

The configuration of interior plumbing will vary depending on the layout of a given building and type of outlet. Construction materials may also vary, especially in larger buildings where additions and repairs have been made to the original structure.

At this point, if not done already, you may also want to contact a professional to assist in collecting interior plumbing samples. You should also consider the installation of filters.

Sampling for Other Parameters

In addition to monitoring for lead, you may wish to monitor for other parameters that may provide an indication of problems in your plumbing. However, note that analysis costs will increase as the number of parameters increases. Some other parameters include bacteria, cadmium, color, copper, iron, turbidity, and zinc. See Table below.

Contaminant	Limit	Concern
Bacteria	Absent	Bacteria are present throughout our environment. They have adapted to live and reproduce in a variety of environments, including inside animals and humans, and in water, soil, and food. If bacteria are present in drinking water sources, most are removed during the disinfection process. However, some may survive and enter the distribution system (the building's pipes and plumbing). Bacteria can also grow within the plumbing system, water fountains, and faucets.
Cadmium	5 ppb	A regulated toxic metal found in low levels in galvanized pipe. The maximum allowable level at the water treatment plant is 5 ppb. However, the presence of cadmium at any level indicates that corrosive conditions may exist in the plumbing.
Color	15 color units	An aesthetic parameter that may indicate the presence of iron oxides. Iron oxides are often present in iron or steel pipe as a result of corrosive conditions.
Copper	1300 ppb	A regulated metal used to make copper piping. The presence of copper in water samples taken from copper piping is not unusual, but higher levels indicate that corrosive conditions may be a concern.
Iron	300 ppb	An aesthetic parameter that is indicative of corrosive conditions at higher levels. See also color and turbidity. (Galvanized pipe is made of iron.)
Turbidity	1 turbidity unit	A measurement of the clarity of water. Higher turbidity values may indicate the presence of iron oxides. Iron oxides are often present in iron or steel pipe as a result of corrosive conditions.
Zinc	5000 ppb	An aesthetic parameter that is indicative of corrosive conditions at higher levels. Zinc is used in making galvanized piping products. The presence of zinc in water samples taken from galvanized piping is not unusual, but higher levels indicate that corrosive conditions may be a concern.