**Practices for the Collection and Handling of**

**Drinking Water Samples**

**Version 3.0 Draft - Uncontrolled**

**Laboratory Licensing and Compliance Program, Central Region, Ministry of the Environment, Conservation and Parks**

**Date:\*\***

**Disclaimer**

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The sampling techniques may be used as guidance and an example of best practices for treatment plant owners/operators sampling to meet Ontario’s environmental regulatory and approval requirements.

Laboratories are recommended to use this document as a guide for the required information they need to provide to their samplers, but must ensure that the information provided to samplers correspond to the requirements of their analytical methods.

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# 1.0 Introduction

Safe drinking water in Ontario, is ensured by the regulation of drinking water systems and drinking water testing under the Safe Drinking Water Act, 2002. This Act and its associated regulations govern the sampling and testing of municipal and non-municipal drinking water systems. The Act also requires that Ontario drinking water testing must be conducted by a licensed laboratory. These test results are used to evaluate the safety of drinking water and demonstrate compliance with the regulations. Additionally, small drinking water systems that serve only public facilities like restaurants and hotels are jointly regulated under the Health Protection & Promotion Act (for treatment and sampling) and SDWA (for laboratory analysis and reporting adverse conditions).

The purpose of this document is to provide general guidance for the collection and handling of all drinking water samples that fall under the following regulations:

* Drinking Water Systems (O. Reg. 170/03) (SDWA)
* Schools, Private Schools and Child Care Centres Regulation (O. Reg. 243/07) (SDWA)
* Small Drinking Water Systems (O. Reg. 319/08) (HPPA and SDWA)

This document provides general information on the following:

* [Representative Samples](#2.0_Representative_Samples_and_Represent)
* [Sampling](#3.0_Sampling_)
* [Sample Types](#3.1_Sample_Type_)
* [Sampling locations](#_3.2_Sampling_Location)
  + [Raw](#3.3.1_Raw_Water_)
  + [Treated](#3.3.2_Treated_Water_)
  + [Distribution](#3.3.3_Distribution_System_Water_)
  + [Plumbing](#3.3.4_Plumbing_)
* [Sample Containers](#3.4_Sample_Containers_)
* [Sample Collection](#3.5_Sample_Collection_)
* [Specialized Sampling Techniques](#3.6_Specialized_Sampling_Techniques_)
* [Intermediate Sampling Equipment](#3.7_Intermediate_Sampling_Equipment_)
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* [Sample Preservation](#3.9_Sample_Preservation_)
* [Sample Labelling](#3.11_Sample_Labelling_)
* [Sample Storage and Transportation](#3.12_Sample_Storage_and_Transportation_)
* [Chain of custody](#4.0_Chain-of-Custody_)

These practices may be used as guidance by drinking water system owners/operators sampling to meet regulatory requirements. In addition, these practices are also applicable to samples taken by MECP provincial officers and laboratory staff.

These practices are intended to supplement the analytical quality assurance and control activities in testing at a laboratory. They provide a minimum level of quality assurance necessary to ensure that the samples tested accurately reflect the quality of the water supply.

The licensed drinking water testing laboratory may also use these practices as their sample collection and handling directions. When used by the laboratory, the laboratory must ensure that the information corresponds to the specific requirements of their licensed analytical methods and that their policies and procedures clearly reflect they have used this document unedited.

Laboratories and drinking water systems may have their own standard operating procedures for the collection and handling of drinking water samples. Where they exist, those procedures must incorporate best practices for ensuring the integrity of the sample. These procedures may incorporate information from this guide and should be referenced accordingly.

**Accredited and licensed drinking water analytical methods can only produce accurate and reliable results when both laboratory and field personnel use sample collection and handling best practices consistently.**

## 1.1 Limitations

This document is intended to apply only to grab samples that are collected and transported to a licensed laboratory for the analysis of regulated parameters. Operational checks of the treatment process, including continuous in-line monitoring for operational parameters are beyond the scope of this document. In situations such as emergency and priority responses, it may be necessary for deviations from these guidelines depending on the circumstances. These situations are beyond the scope of this document and the licensed laboratory should be contacted for specific sample collection and handling directions.

# 2.0 Representative Samples and Representative Data

The water sampling and analyses required by the regulations are intended to ensure the provision of safe drinking water in Ontario. As such, sampling and analysis must be done in a manner that produces data that are accurate and represent the quality of the water used in drinking water systems. The test results are used to provide an accurate picture of the drinking water system.

A *representative* sample is one that is an accurate reflection of the water source being sampled. The objective is that the sample collected should have the same characteristics and analyte concentrations as the water source. The location, time and method of sample collection are important aspects to ensure a representative result. These will be discussed detail in Section 3.

Sample collection and handling procedures are necessary to ensure that the sample remains representative from collection until testing. The integrity of the target analyte(s) must be maintained, and the physical, chemical and biological characteristics of the sample must not be compromised. Temperature control and chemical preservation are the two most important ways to stabilize a sample. The time between sample collection and analysis must also be limited to minimize potential changes in analyte concentration.

Best practices must also be followed for recording sample information, maintaining chain-of-custody, and for sample labelling. Following these practices will ensure that the drinking water sample collected will be traceable from start to finish and accurately reflect its location, time and date of collection. In summary, the test results are only as good as the sample that was collected.

# 3.0 Sampling

Sample collection and handling in the field is the first step to ensure accurate and reliable results. This document provides general guidance to ensure an appropriate sample is collected.

The sampler must be aware of the conditions that the collected sample represents. Sampling points must be selected to address the intent of the regulations. Sampling at the same point at a given frequency can be useful to identify trends and monitor variability over time.

When selecting the time and location of sampling, consideration must be given to the following:

* peak usage periods
* isolation of the effects of reservoir or storage
* dead ends in the system
* the extremities of the distribution system
* residential plumbing

The sample handler or analyst may incorporate additional quality assurance activities into sampling, which will improve the analytical data. In some cases, local conditions (geology, industry, etc.) will necessitate additional sampling beyond the regulatory requirements. Additionally, an approval or order may specify sampling in addition to the regulation’s requirements for specific parameters or conditions of concern.

## 3.1 Sample Type

In general, there are two types of samples: *composite* and *grab* samples. The choice of sample type must ensure that the data gathered meets the monitoring objectives.

*Composite* samples are most appropriate where the sampler is seeking to obtain information on the average value in systems or process that are highly variable over time. Composite samples are not used for routine regulatory purposes and are outside of the scope of this guide.

*Grab* samples represent the characteristics of the water sampled at a specific time. If multiple containers or a series of samples are required, they should be collected within approximately 15 minutes or less from the time the first container is filled. Grab sampling methods are used for the requirements of the Regulations unless specifically stated.

## 3.2 Sampling Location

O. Reg. 170/03 requires the collection and testing of raw, treated and distribution water samples. Corrective actions in Schedules 17 and 18 of O. Reg. 170/03 have additional sample location requirements. The sampling locations must be carefully chosen to ensure a representative sample is collected. If the sampler is unclear about sample location requirements, they are to contact the local MECP office for clarification.

The Schools, Private Schools and Child Care Centres (O. Reg. 243/07) regulation has instructions on the sampling points, procedures and frequency of sampling for those types of facilities. Operators/owners of these facilities should check the current version of this regulation for the most recent instructions and follow any changes to sampling requirements as described at the time of sampling.

Choosing the most appropriate sampling points for an audit should consider the existing locations routinely used for sampling. Documenting location differences from routine sampling points will assist in assessing and providing context to the audit sample results. In general, MECP-provincial officer audit samples should be taken from the same location as regulatory samples.

### 3.2.1 Raw Water

Raw water refers to the source water prior to any treatment. Its characterization is necessary to determine the treatment requirements. O. Reg. 170/03 should be consulted for the system’s raw water monitoring requirements. Raw water characterization with respect to all parameters listed in the ODWQS and O. Reg. 170/03 may be required in the preparation of an Engineering Evaluation Report (New or Altered System).

The raw water sample must be collected before any treatment process. This includes any pre-disinfection treatment processes such as aeration/oxidation and pre-chlorination. It is preferable that raw water samples are collected before the water enters any storage/pressure tank. If samples are taken after storage units, the unit should be purged to allow a complete exchange of water. If samples are taken before a storage unit, taps located after the storage tank should be opened to prevent backflow. If it is necessary to turn off any treatment to obtain a raw water sample, the resulting untreated water must not be allowed to enter the distribution system.

#### Groundwater systems

For groundwater systems using more than one well supply, grab samples for microbiological testing are required from each production well. If many wells are used and the water is blended at or before the high lift pumps, samples of the raw water from each well before blending must be taken. If this is not possible, the system must contact the MECP to obtain approval to use blended raw samples.

Ideally, samples should be collected from a tap located as close as possible to the well. Usually a tap in the pump house is used. A continuously running tap that does not drain back into the well can also provide a representative raw water sample. If a tap is not available, it may be necessary to shut down the pump and open the sanitary seal.

#### Communal Wells

The protocol for sample collection at communal wells sometimes requires purging of the well to achieve a stable pH and turbidity measurement, before sample collection. Purging is not required for communal wells in which the pump runs continually and where in-line plumbing is present. For these wells, flushing the lines for a minimum of two minutes prior to sample collection is sufficient.

However, communal wells that are not currently used or that are used intermittently should be purged by flushing the lines with a volume of water equivalent to three to five times the volume of water standing in the well. (The volume will depend on the static level and the inside diameter of the well casing). For pumps that are operated intermittently, the purge volume must be calculated with respect to length of use and the size of storage/pressure tanks. If storage tanks are present, an adequate volume must be purged to ensure that the volume of water in the tank is completely exchanged.

In terms of chemistry, the United States Environmental Protection Agency (US EPA) recommends purging a well until pH and turbidity measurements stabilize and turbidity is less than 10 nephelometric turbidity units (NTU). For new, recently installed wells, purging is necessary to eliminate the effects of well installation. This document assumes that in-place plumbing and dedicated pumps can be used to facilitate purging. When this is not the case purging must be done with peristaltic, centrifugal or submersible pumps or with bailers. Discussion of these techniques and precautions for using these techniques is beyond the scope of this document and the reader is referred to reference #8 listed at the end of this document.

#### Surface Water Systems

In surface water systems, it can be difficult to collect samples at an intake that are a great distance from shore. However, near shore samples are not recommended as they can be subject to increased turbidity, algal blooms and bacteria and do not accurately represent the water quality at the intake.

Systems with high, intermediate and low level intakes in the water body can use different levels simultaneously as source water for treatment. The level(s) used may be different depending on the period of the year. For these reasons, samples are generally taken after non-chemical addition screening, pre-sedimentation, wet well storage and low lift pumping to the treatment facility. These samples will reflect any changes in source water quality resulting from these activities but are not expected to greatly alter the quality of the water for the purpose of regulatory sampling.

At some locations, however, it is necessary to pre-chlorinate at the intake for zebra mussel control. During certain months of the year it may not be possible to sample unchlorinated raw water at these locations. In these cases, the installation of a separate intake line with tap at the plant is advised to allow the collection of samples that have not received treatment. If multiple surface source waters or surface sources are used, each raw water source should be sampled separately.

### 3.2.2 Treated Water

Treated water refers to all water which has undergone one or more treatment processes and is ready to be distributed to users of the system. This includes treatments such as: chemically assisted filtration, iron and manganese sequestering, primary disinfection, corrosion control, softening and fluoridation.

Treated water locations must be selected to represent the water after all treatment processes are complete. The sampling location should be at the point of entry of the water to the distribution system. The location must be after the disinfection and before the first consumer. In those rare situations where disinfection is achieved in the first run of distribution pipe after the treatment facility, it is recommended that a sample line draw water from that point for the purpose of treated water sampling.

### 3.2.3 Distribution System Water

The term distribution system refers to the entire network that delivers the treated water from the drinking water system to consumers. This includes:

* storage tanks
* reservoirs
* standpipes
* pumping stations
* pumps
* service pipes

The objective for distribution water testing is to measure the quality of water being supplied to the consumer. Sampling of the distribution system is mandatory under O. Reg. 170/03 and O. Reg. 319/08. Depending on the regulation and the population served, some systems may require multiple samples to be collected. The sampling locations should represent and cover the entire distribution system. As such, the sample locations should be significantly beyond the point of entry to the distribution system unless stated in the regulation.

This should include locations where the degradation of water quality and disinfection residual are possible, and the formation of disinfection by-products is most likely. Consideration of sample location in the distribution system should include:

* elevated storage tanks
* dead ends
* ageing water mains
* distribution loops
* points with the potential for cross connection/back flow
* extremities of the distribution system.

Whenever possible, samples should be taken at dedicated sampling stations within the distribution system. These stations should eliminate the effects of residential plumbing. If residences are used, taps located on a service pipe connected directly to the water main are the preferable sampling point. Samples must not be taken from hot water taps, or after water softeners or any other home-treatment devices. The lines should be flushed prior to sampling to negate the effects of local residential plumbing. In general, this can be done by flushing tap until the water reaches a constant temperature (usually between two and five minutes).

Local plumbing problems such as line- breaches or illegal connection to cisterns that allow the entry of untreated water into the system must be avoided. Sample taps that are used infrequently should be avoided as localized microbial growth and mineral crusts within the plumbing may affect the sample. Similarly, changes in water pressure can break up and suspend biological growth and metal crusts from the walls of the lines. For this reason, locations where water pressure is not constant should be avoided. Leaking taps and taps where water tends to run up the side of the faucet should not be used.

### 3.2.4 Plumbing

The term plumbing refers to the pipes and fixtures that distribute water within a building. In general, plumbing is considered to begin at the property line, where it is connected to the service pipe, and distribution system. “Lead plumbing” is defined as plumbing and service pipes with a lead content greater than eight percent. This is normally found only in areas constructed prior to the mid-1950s. Solder is the material used to connect pieces of plumbing. “Lead solder” means solder with a lead content greater than 0.2 per cent and was permitted for use on drinking water lines prior to January 1, 1990. Sampling points for plumbing are specified within O. Reg. 170/03 and 243/07.

## 3.3 Sample Containers

**It is critical to use the sampling container provided by the testing laboratory. If the sampler is unsure of the sample container, the testing laboratory should be contacted for direction. Samples collected using an improper container will be rejected by the laboratory.**

***Container Type***

Sampling containers are usually provided by the testing laboratory. The type of container required depends on the specific test. For example, a test for metals requires a plastic container, most organic tests require glass, and microbiology tests require a sterilized container. Amber glass or opaque plastic containers are recommended for compounds that are light-sensitive. If this is not possible, the container should be wrapped in aluminum foil or stored in a light-proof case.

For other methods, such as volatile organic compounds (VOCs) tests, the analysis is done directly from the sampling container. For these methods, the laboratory will require a specific the type of vial with a TeflonTM septum cap.

*Contact the licensed laboratory for the specific sample containers for the tests requested.*

***Sample Volume***

There are specific sample volume requirements depending on the type of test. For example, many organic tests require 1-litre sample volumes. Some tests may require additional sample collection for quality controls such as duplicate samples or a travelling blank. The additional bottles and instructions will be provided by the laboratory.

Traveling blanks are typically high performance liquid chromatography (HPLC)-grade water or equivalent and may be provided by the testing laboratory. At the sampling location, the sampler must open the travelling blank bottle and transfer the HPLC-grade water from the supplier’s container to the individual sample bottles and label it appropriately. The travelling blank bottles are left open while the drinking water samples are collected and then sent to the laboratory.

*Specific information on containers must be confirmed with the licensed laboratory.*

## 3.4 Sample Collection

The collection and handling of samples is crucial to obtaining reliable test results. Person(s) collecting regulatory samples should be properly trained in sample handling. This includes appropriate cleanliness of hands and clothing, as well as the appropriate health and safety considerations for the location and type of sample. This is important especially when handling chemical preservatives. Contact the laboratory for specific health and safety information.

Disposable gloves may be worn, and care must be taken that the inside of the container and cap do not touch anything other than the atmosphere. If the inside of the sampling container is touched, it must be considered contaminated and should not be used. While the sample is being taken, the exterior of the cap should be held in the sampler’s fingertips.

The collection of drinking water grab samples is generally done from taps located at the sampling points. Sampling taps should be free of aerators, hose attachments, strainers and mixing type faucets. Cold water taps must be used. Water from hot water heaters is stored under conditions not representative of the water supplied by the drinking water system. In general, unprotected outdoor taps should be avoided.

The best method for collecting a grab sample is to collect the sample directly into the container provided by the laboratory. This eliminates the potential for sample contamination from any an intermediate container or equipment.

In some situations, such as when taps do not have enough clearance from the floor, it is not possible to collect the sample directly into the laboratory container. In these cases, it may be necessary to collect the sample in an intermediate vessel and then transfer the sample to the laboratory container. Information on types and pre-cleaning methods for intermediate vessels is provided in the section, Intermediate Sampling Equipment.

**In the case of sampling for microbiological testing, volatile organic compounds, hydrocarbons, and oil and grease, the sample must always be collected directly into the laboratory sample container.**

Samplers should take care to avoid inadvertently contaminating the sample with the target analyte. This can occur in instances where the sample comes into contact with an improper or unsuitable preservative and will provide invalid results.

Sample containers that are pre-charged with preservative must not be rinsed prior to sample collection.

Also, sample containers for organic compound analysis should never be rinsed with the sample, as the organic compounds from the rinse may accumulate on the container walls and compromise the test results.

Sample containers should be filled slowly to prevent overflowing and bubble formation. Overflowing containers that are pre-charged with preservative can result in ineffective sample preservation and invalid results. If a pre-charged container overflows, it should not be used, and a sample should be collected into new pre-charged container.

## 3.4.1 Intermediate Sampling Equipment

Intermediate sampling equipment is generally not recommended. However, in rare situations the use of an intermediate sampling container may be necessary. In these situations, the laboratory should be contacted for direction on the suitability of the container. Usually, a glass or stainless-steel container is recommended. In general, the intermediate sampling containers should be cleaned with hot water, phosphate-free detergent and thorough rinsing with analyte-free (e.g., distilled) water. When sampling for organic compounds, additional solvent rinsing should be incorporated into the cleaning (the laboratory will advise on the choice of solvent). If funnels or tubing are required, Teflon™ or stainless steel should be used, as they have low friction surfaces that do not readily adsorb contaminants from water.

It is recognized that pumps (e.g., well pumps, high and low lift pumps) form an integral part of a water system. However, auxiliary sampling pumps should be avoided. They may contain brass, plastic, rubber and pump oil that can potentially contaminate samples. This is an important consideration for trace organic compounds and metals analysis. If auxiliary sampling pumps must be used, consult your laboratory for further instructions.

## 3.4.2 Sample Filtering

Drinking water samples shall not be filtered in the field or at the laboratory prior to analysis. It is not expected that consumers filter their water before drinking. Unfiltered samples will provide a more representative sample of what the consumer is drinking.

Pre-analysis filtration for non-routine tests must be approved in advance through a Part VII, SDWA Director’s Direction. This can be applied for using the [Drinking Water Laboratory Testing Licence](http://www.forms.ssb.gov.on.ca/mbs/ssb/forms/ssbforms.nsf/GetFileAttach/012-2152E~1/$File/2152E.pdf) application form. Those results may be used for investigative purposes but may not be used for regulatory compliance.

## 3.4.3 Sample Preservation

Chemical preservation may be required to stabilize the analyte in the sample from the time of collection until the analysis. This may prevent increases or decrease to the analyte concentration after sample collection.

The specific preservative depends on the target analyte and testing method and is provided by the testing laboratory. **Preservatives are not interchangeable.** **It is critical to follow the specific sample preservation requirements of the testing laboratory.** Contact the laboratory for information and instructions on the specific preservatives.

Containers that have been pre-charged with preservative must not be rinsed or allowed to overflow. If this happens the preservative will be diluted and may not be effective. As such, those samples should be discarded and a new one collected.

The two main types of chemical preservation for drinking water samples are dechlorination and pH control.

*Dechlorination*

Some analytes can potentially be affected by residual chlorine. These require a dechlorination preservative or quencher to neutralize residual chlorine. This is necessary to ensure the test results are representative of the time of sample collection. There are different types of preservatives for this purpose deepening on the laboratory and the testing method. Sodium thiosulphate is the most common of this type of preservative. It is frequently used for both microbiology and organic analytes. Dechlorination preservatives must be either pre-charged in the bottle or vial, or added to the sample at the time of collection.

*pH control*

Some analytes must be stabilized under acidic or basic conditions. For example, nitric acid is used for pH adjustment for metals testing. This improves the solubility of metals and ensures representative results.

When strong acid or alkali is used to preserve a sample taken in plastic sampling containers, it is recommended that the preservative be added after taking the sample. If the strong acid/alkali is added first, it may corrode the plastic container releasing contaminants to the sample. This is an important consideration in the preservation of samples with concentrated strong acid for trace metals analysis.

When preservatives are added to obtain a specific pH range, the sample should be swirled gently and left to equilibrate for two minutes. The pH should be checked with pH paper to ensure that the desired pH is reached. Different types of waters have different capacities for buffering (resisting a change in pH). It is recommended that the volume of preservative not exceed 1% of the sample. If this occurs, a note to this effect should be made on the sampling container label and the chain of custody.

## 3.4.4 Sample Holding Times

Holding time is defined as the time between the collection of the sample and the start of analysis. For certain tests, the sample must be received at the laboratory and analyzed within a short period of time. For example, microbiology analysis must be started within 48 hours of sample collection. Consult the testing laboratory for specific holding time requirements. Timely test results are important for continual monitoring of drinking water. Therefore, holding times must not exceed 60 days even if the target analyte is known to be stable longer.

Preservation can stabilize a sample to some extent, but may not prevent all possible reactions or changes that could compromise the sample. Consequently, refrigeration and delivery of samples to the laboratory immediately after collection is encouraged. This will help to ensure that samples are analyzed within the appropriate time frames.

## 3.5 Specialized Sampling Techniques

### 3.5.1 Volatile Organic Compounds (VOCs)

Volatile organic compounds are easily vaporized from the sample. For this reason, sample containers are vials with a screw caps with a hole and Teflon™-lined silicone septum. This type of vial can be placed directly in the auto-sampler of the analytical instrument.

Samples should be collected at least in duplicate and some laboratories may require triplicate. Some laboratories may also recommend the use of a travel blank. The laboratory will provide appropriate vials and direction on the collection of duplicates, triplicates and the use of travelling blanks.

Aerators and strainers must be removed from taps prior to sample collection. The water should be run slowly to prevent turbulence or splashing. The vials or bottles should be filled slowly to the top rim of the container so that a meniscus (bubble of liquid that sits slightly over the top of the vial without spilling) is present. A slight loss of sample may occur when the cap is applied. When capped, the cap (also called a septum) should be in contact with the sample so that no air is trapped in the sample container. No air bubbles should be present when the vial is turned upside down. The Teflon™ liner, not the silicone or rubber backing of the septum, must be in contact with the sample.

There are different preservative requirements for chlorinated and non-chlorinated water. It is important to use the vial pre-charged with the correct preservative. *Contact the laboratory for specific preservative requirements for chlorinated and non-chlorinated samples.*

*Chlorinated Water*

Chlorinated water requires a dechlorination preservative. This stops potential reactions with residual chlorine and keeps the sample representative of the collection time. The vials may be pre-charged with a dechlorination preservative.

*Non-chlorinated Water*

For raw water or non-chlorinated water, a dechlorination preservative is not required. However, an alternate preservative may be used to halt bacterial activity. Vials may be pre-charged with a preservative such as sodium bisulfate which will lower the pH and halt bacterial activity.

### 3.5.2 Microbiological

Aseptic techniques must be followed for microbiological sample collection. Failure to do so can cause invalid results.

Microbiology tests require sterile containers which are provided by the testing laboratory. Theses containers must remain closed until the time of sampling. It is recommended that sample container for microbiological testing have caps with tamper-proof seals. If the seal is broken the bottle should be discarded.

When filling the bottle, the sampler should hold the bottle near the base. The sample should be filled to the fill line on the bottle (if indicated) or the shoulder of the bottle. Enough space must be left in the bottle to allow for shaking before analysis. To prevent further bacterial growth in the sample after it has been collected, the sample should be refrigerated and transported to the laboratory on ice, but not frozen. Further details are provided in the section Sample Storage and Transportation.

### 3.5.3 Lead in Plumbing O. Reg. 243/07 and Schedules 15.1 and 15.2 of O. Reg. 170/03

There are specific sampling requirements for lead in plumbing testing, either for O. Reg. 170/03 or from facilities under O. Reg. 243/07. This includes:

* The location of the tap(s) to sample
* The timeframe for sample collection
* the time of standing/flushing before collecting the sample(s),
* the time between standing and flushed samples
* the volume of sample collected

There are different requirements than for a routine metals test. If there is an aerator on the tap, it is left in place, unlike samples collected for other tests. These require a 1-Litre sample volume to be collected. This is to ensure the sample is representative of the cumulative effects of the plumbing system.

Each sample should be a separate a 1-Litre container. However, if 1-Litre containers are not available, multiple smaller containers can be used. The total volume must be 1-Litre. For example, 2 x 500 mL containers could be used. When collecting the sample, the time switching the containers must be kept to a minimum. The laboratory must be notified if multiple containers were used to obtain the 1-Litre of sample. If multiple containers are used, the laboratory must combine all containers prior to taking an aliquot for analysis.

Detailed sampling instructions and additional information for O. Reg. 243/07 facilities is available here: (<https://www.ontario.ca/page/flushing-and-sampling-lead>). The website describes the steps to collect samples to test for lead in plumbing for O. Reg. 243/07 in schools, private schools and child care centres.

Owners/operators must consult the most recent version of the regulations for the current sample collection requirements.

### 3.5.4 Chlorate/Chlorite

For drinking water systems that use chlorine dioxide treatment, samples should be sparged (bubbled) with an inert gas (i.e., helium, argon, nitrogen) for approximately 5-10 minutes; otherwise, residual chlorine dioxide will continue to form chlorite and elevate the results. For sparging to be effective it must be done at the time of sample collection.

Ethylenediamine (EDA) must be added immediately after sparging. EDA is primarily used as a preservative for chlorite. EDA preservation for chlorite will also preserve the integrity of chlorate, which can increase in unpreserved samples as a result of chlorite degradation. For drinking water systems that do not use chlorine dioxide treatment, samples must be preserved with EDA at the time of sample collection, but sparging is not required.

## 3.6 Sample Labelling

Accurate and complete labelling of samples ensures that the sample’s identity is maintained. This is very important for sample tracking and interpretation of the test results. Sample identification is mandatory for sample data reporting and adverse water quality notification requirements under the regulations. It is advisable to pre-label all sample containers prior to taking the sample or to label each container **immediately** after the sample is taken to prevent confusion. A permanent marker or pen should be used, and the label should be able to withstand water. In most cases, the laboratory conducting the analysis will supply the sampling container. Sample containers may have labels affixed to the container itself; or the label or sample tag may be provided separately. If the tags/labels are separate, the sampler should attach them prior to or immediately after taking the sample. This will help prevent incorrect labelling.

When sample tags/labels are separate, a pre-printed sample identification number/code on the label may be available. This assigns a unique identification number/code to the sample in the field. If a pre-printed sample number is not assigned, it may be necessary for the sampler to create a field sample number. The sample ID generated should be simple and unique to the sampling set/batch collected. The following information should be recorded on either the sample label or on an accompanying chain-of-custody form.

* Marking to indicate that this is a *regulated drinking water sample*
* Sample type: raw, treated or distribution
* A unique sample identifier
* The legal name of the water system (available in DWIS).
* The waterworks number, if applicable
* O. Reg. 243/07 facility registration number, if applicable (this is different than the waterworks number and must be used for reporting lead exceedances)
* The date and time of sample collection (critical for perishable tests)
* The street address, if the sample is a distribution sample
* Preservative(s) used
* Pertinent field measurements (chlorine residual, turbidity, pH) (if room on the label/tag permits)
* The initials of the sampler (and in the case of provincial officers, their sampler ID number)

Much of this information can be put on the labels/tags in advance of sampling, either by the laboratory or the sampler. Pre-printed labels with the drinking water system name, number, sample type, etc., are convenient, provide the necessary information for the lab analyst and help prevent mix-ups in labelling.

The rapid identification of samples at the laboratory helps to ensure that samples are analyzed and reported promptly.

## 3.7 Sample Storage and Transportation

The laboratory will provide specific instructions for sample delivery to the laboratory. The laboratory will also provide specific instructions on drop off depots if they are used.

It is recommended that all samples be delivered to the laboratory as soon as possible after sampling. Samples should be kept cool (refrigerated), but not frozen if immediate shipping is not possible. Samples should be packaged to avoid breakage during shipping. Samples must be shipped to arrive at the laboratory with enough time for analysis before the holding time expires.

Samples for microbiological testing should be packed with ice packs or a suitable leak-proof container of ice and shipped in insulated boxes/coolers. Packing the sample with loose ice is not recommended as it may contaminate the sample. The ice should be encased in waterproof packaging or a sealed container.

If possible, optimal temperatures conditions before packing and during transport are less than 10°C. If the temperature of the sample at the time of collection is above 10°C, there still must an attempt to keep the sample cool during transport. Although samples must be cool, samples for microbiological testing must not freeze during shipment. Some courier companies offer shipping in heated vehicles during the winter months.

The inclusion of maximum/minimum thermometers beside the sample(s) during shipment may provide further information on sample conditions during transport.

The sample container should be sealed for shipping. Doing so will help make obvious any evidence of tampering. This may simply involve the use of a label or similar item that must be torn to open the box/case. The chain-of-custody form must be included in the shipping box/case. The sampler should keep a record of shipping, including the time, date, carrier and any tracking numbers.

# 4.0 Chain-of-Custody

As previously mentioned, proper sample labelling is crucial to maintaining the identity of a sample. However, additional measures are then required to ensure a sample is traceable from the time of collection through to its analysis. This will ensure the integrity of the sample and resulting data. A sample or set of samples is considered to be “in custody” if it is in a custodian’s physical possession or view, if it was in the custodian’s physical possession and was then secured to prevent tampering, or if it is placed in a secured area.

In the case of drinking water samples, a chain-of-custody form must accompany samples to the point of receipt by the laboratory. The intent of this form is to document the transfer of custody of the samples from the sample custodian (sampler) to any other person and to the laboratory. The chain-of-custody form can be obtained from the licensed laboratory. Contact the laboratory to ensure that the current revision of the chain-of-custody form is used.

It is recommended that the fewest number of people as possible be responsible for sample collection and transfer to the laboratory. If common carriers are used, receipts should be kept and, if packages are mailed, they should be registered and return receipts requested. These should be kept as part of the chain-of-custody documentation by both the system owner/operator and the laboratory.

Once the samples have arrived at the laboratory, the chain-of-custody form must be signed off by an authorized person at the laboratory. A copy of this signed chain-of-custody should be returned to the system owner/operator.

# 5.0 Summary

Continual verification of safe drinking water requires that samples represent the water supply. This can only be done if the sample represents the drinking water’s physical, chemical and biological attributes. Representative samples will result in the earlier detection and resolution of potential water quality problems. These recommended practices are intended to be accompanied by appropriate analysis at a licensed laboratory. Contact the licensed laboratory for information regarding the suitability of testing methods.

Both the sampler and the laboratory are responsible to follow best practices in sample collection and analysis. The quality of the results relies on rigorous quality assurance in the entire process of sampling and analysis. In short, the test results will only be as good as the sample that was tested.

# 6.0 References

1. Ontario Ministry of the Environment. *Protocol of Accepted Drinking Water Testing Methods* (as amended from time to time).
2. Ontario Regulation 170/03, Drinking Water Systems, made under the Safe Drinking Water Act, S.O. 2002, Chapter 32*.*
3. Ontario Regulation 169/03, Drinking Water Quality Standards, made under the Safe Drinking Water Act*,* S.O. 2002, Chapter 32*.*
4. Ontario Regulation 248/03, Drinking Water Testing Services, made under the Safe Drinking Water Act, S.O. 2002, Chapter 32.
5. Ontario Regulation 243/07, Schools, Private Schools and Child Care Centres, made under the Safe Drinking Water Act, S.O. 2002, Chapter 32.
6. Ontario Ministry of the Environment (2007), *Flushing and Testing for Lead in Drinking Water*, <https://www.ontario.ca/page/flushing-and-sampling-lead>.
7. Ontario Regulation 319/08, Small Drinking Water Systems, made under the Health Protection and Promotion Act, R.S.O. 1990, Chapter H.7*.*
8. <https://www.ontario.ca/document/water-supply-wells-requirements-and-best-practices/well-disinfection#section-13>