

Region 4
U.S. Environmental Protection Agency
Laboratory Services and Applied Science Division
Athens, Georgia

Operating Procedure

Title: Potable Water Supply Sampling	ID: LSASDPROC-305-R5
Issuing Authority: Field Services Branch Supervisor	
Effective Date: April 22, 2023	Next revision Date: June 11, 2023
Method Reference: N/A	Author: Landon Pruitt

Purpose

This document describes general and specific procedures, methods and considerations to be used and observed when collecting samples from public and private potable water supplies.

Scope / Application

When collecting water samples from a “Potable Water Supply,” the primary objective is to characterize the quality of the drinking water system. Sampling may be done for a variety reasons including assessing the safety and potability of the supply for both regulated and unregulated contaminants, or to assist in determining the source of any contamination that might have reached the system. Whenever health-based levels of contaminants are exceeded in potable water supply samples, the operators and/or users of the drinking water system need to be notified as soon as the finalized data is available.

An investigation often targets a specific analyte or group of analytes. Sampling protocols designed to meet the needs of the investigation’s data quality objectives need to be used and detailed in the site-specific Sampling and Analysis Plan. For example, an investigation’s objective might be to simulate worst-case conditions, so the sample design would include sampling the initial flush of water from the pipes.

EPA’s National Primary Drinking Water Regulations (NPDWRs) are legally enforceable primary standards and treatment techniques that apply to public water systems by limiting the levels of contaminants in drinking water. When a public drinking water supply is being monitored for compliance with the NPDWRs, approved “drinking water” analytical methods are required. However, there are cases when using alternative analytical methods, such as EPA SW-846 methods, may be more appropriate. An example of using a non-drinking water method is when monitoring residential wells near a Superfund site where the homes have been provided an alternate drinking water source.

The procedures contained in this document are to be used by field personnel when collecting and handling potable water supply samples in the field. On the occasion that LSASD field personnel determine that any of the procedures described in this procedure are inappropriate, inadequate or impractical, and that another procedure must be used to obtain a potable water supply sample, the variant procedure will be documented in the field logbook, along with a description of the circumstances requiring its use.

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1.0 General Potable Water Sampling Guidance

1.1 Site Access / Owner Information

Before collecting samples from potable water supplies, permission from the property owner or resident is required. The Program Office requesting LSASD's assistance is responsible for obtaining site access prior to the field sampling investigation.

Applied Science Branch (ASB) staff are required to obtain the following information when collecting samples of potable drinking water:

- the name(s) of the resident(s), property owner or water supply operator
- the exact physical address of the sampling location
- the exact mailing address (if different from the physical address)
- the resident's / operator's home, work and mobile telephone numbers (when available)

The above information is required so the residents or water supply owner / operators can be informed of the analytical results of the sampling. Immediately upon receipt of potable water analytical data, Branch personnel shall carefully examine the results for the presence of contaminants that exceed NPDWR standards or other health advisory levels. If there are exceedances of health advisories, or of primary or secondary drinking water standards, the ASB Supervisor and the requesting program's Branch Supervisor should be immediately notified.

1.2 Laboratory Coordination

Collecting samples from residential potable wells or public drinking water supplies require close coordination with the laboratories conducting the analyses to ensure that data quality objectives are met. If a contract laboratory is used, the Project Leader should determine if a National Environmental Laboratory Accreditation Program (NELAP) certified Drinking Water laboratory is required along with the appropriate documentation for data verification and validation.

NPDWR standards and treatment techniques protect public health by limiting the levels of contaminants in drinking water. The types of regulated contaminants include microorganisms, disinfectants, disinfectant by-products, inorganic and organic chemicals, and radionuclides. Because of the types and numbers of contaminants of interest, there are many different tests and analytical methods used to quantify them. Due to the number of laboratories and instruments conducting various drinking water analyses, it is critical to closely coordinate with the laboratory conducting the analyses for all details of the potable water supply

sampling. These details include sample containers, container filling, sample volume, preservatives, dechlorination agents, holding times, sample handling procedures, and quality control samples.

Table 1 provides some of the common drinking water methods along with LSASD's capabilities and sample collection details. Since analytical methods and standard operating procedures are continuously revised, the Project Leader should verify that the version of the standard(s) is current prior to sampling.

1.3 Potable Water Sample Site Selection Considerations

- Taps selected for sample collection should be supplied with water from a service pipe connected directly to a water main in the segment of interest.
- Whenever possible, choose the tap closest to the water source, and prior to the water lines entering the residence, office, building, etc., and prior to any holding or pressurization tanks.
- The sampling tap must be protected from exterior contamination associated with being too close to a sink bottom or to the ground where contaminants may splash into the sample containers. Additionally, there must be adequate clearance so that the sample container does not touch the faucet, which is a potential source of contamination. If the tap is too close to the ground for direct collection into the appropriate container, it is acceptable to use a smaller container to transfer sample to a larger container. The smaller container should be made of similar material as the large container and should be pre-cleaned to the same standards.
- Leaking taps that allow water to discharge from around the valve stem handle and down the outside of the faucet are a potential source of contamination and should be avoided.
- Disconnect any hoses, filters, or aerators attached to the tap before sampling. In addition to these devices ability to alter the water chemistry, they can harbor a bacterial population if they are not routinely cleaned or replaced.
- Taps where the water flow is not constant should be avoided because temporary fluctuation in line pressure may cause clumps of microbial growth that are lodged in a pipe section or faucet connection to break loose. A smooth flowing water stream at moderate pressure (without splashing) should be used.
- The sample should be collected without changing the water flow. It may be appropriate to reduce the flow for the volatile organic compounds aliquot to minimize sample agitation.
- When both hot-water and cold-water taps are present at a proposed location, sample the cold-water tap.
- When the investigation's objective allows it, outside taps are more practical and efficient to sample than interior residential kitchen or bathroom faucets.
- Sampling outside taps during heavy precipitation or dusty conditions should be avoided.

**Table 1. EPA's Region 4 Laboratory Services and Applied Science Division (LSASD)
Capabilities for Drinking Water Methods**

Analysis	Drinking Water Method	LSASD can analyze	Container	Preservative	Dechlorination	Holding Time	Filling	Ice
Total Residual Chlorine	SM4500-CL G-2011	In-situ	Glass vial	None	None	In-situ	Neck of container	N/A
Total / free chlorine test strips	various manufactures	In-situ	Plastic	None	None	In-situ	Neck of container	N/A
Nitrate (as N)	353.2	Yes	Plastic (2)	Sulfuric acid	None	28 days	Neck of container	<4° C
Nitrite (as N)	353.2	Yes	Plastic (2)	None	None	48 hours	Neck of container	<4° C
Total Organic Carbon	SM 5310	Yes	Glass / plastic	Sulfuric acid	None	28 days	Neck of container	<4° C
Metals	200.7 rev 4.4/ 200.8	Yes	Plastic - wide mouth	Nitric acid	None	6 mos	Neck of container	<4° C
Mercury	200.8 / 245.1	Yes	Plastic - wide mouth	None	None	28 days	Neck of container	<4° C
Fluoride	300.0	Yes	Plastic - wide mouth	None	None	28 days	Neck of container	<4° C
Bromide	300.0	Yes	Plastic - wide mouth	None	None	28 days	Neck of container	<4° C
Semi-Volatile Organic Compounds / Pesticides	525.2	Yes	Amber glass	Hydrochloric Acid	Sodium sulfite	14 days to extract, followed by 30 days	Neck of container	<4° C
Volatile Organic Compounds	524.4	Yes	40 ml glass vials	Maleic acid	Ascorbic acid	14 days	Zero headspace	<4° C
Total Trihalomethanes	524.4	Yes	40 ml glass vials	Maleic acid	Ascorbic acid	14 days	Zero headspace	<4° C
Haloacetic Acids (HAAs)	552.3	No	Amber glass	Ammonium chloride	None	14-28 days	Neck of container	<4° C
per&polyfluoroalkyl substances (PFAS)	537	No	250 ml polypropylene	None	Trizma	14-28 days	Neck of container	<10° C
Total coliform / E. coli	SM 9223 B-2004	No	Sterile plastic	None	Sodium thiosulfate	8 - 30 hours	100 ml line or neck	<10° C

Analyzing water samples using Drinking Water methods are non-routine analyses for the LSASD laboratory. Therefore, Drinking Water methods shall be specified when the project is scheduled with the lab and on the chain-of-custody when the samples arrive at the custody room.

1.4 Special Sampling and Handling Precautions

- A clean pair of new, non-powdered, disposable gloves shall be worn each time a different location is sampled, and the gloves should be donned immediately prior to sampling. The gloves should not come in contact with the media being sampled and should be changed any time during sample collection when their cleanliness is compromised.
- Samplers should be careful when handling acids and other preservatives and take necessary precautions by wearing gloves and eye protection.
- Do not rinse the bottle containing the preservatives or dechlorination agents before it is filled and avoid overfilling the container during the sampling process.
- During sample collection, make sure that the tap or spigot does not contact the sample container.
- Samples collected in zero-headspace vials (i.e. volatile organic analysis (VOA), or total trihalomethanes (TTHMs)) must not have any headspace (see Section 1.5). All other sample containers must be filled with an allowance for ullage. Some sample containers may have designated fill lines that indicate how much sample should be placed in them.
- All samples requiring preservation must be preserved as soon as practically possible, immediately after sample collection is ideal. Adequate mixing should be conducted to thoroughly mix the preservative with the sample.
- Samples requiring reduced temperature storage should be placed on ice immediately.

1.5 Specific Analyte Requirements

- VOAs and TTHMs: Samples should be collected with as little agitation or disturbance as possible. The vial should be filled so that there is a meniscus at the top of the vial and absolutely no bubbles or headspace should be present in the vial after it is capped. After the cap is securely tightened, the vial should be inverted and tapped on the palm of one hand to see if any undetected bubbles are dislodged. If a bubble or bubbles are present, the vial should be topped off using a minimal amount of sample to re-establish the meniscus. Care should be taken not to flush any preservative out of the vial during topping off. If, after topping off and capping the vial, bubbles are still present, a new vial should be obtained, and the sample re-collected.
- Biological Contaminants: Sample containers are sterile, so care must be taken not to contaminate the bottle or cap. Once the distribution line is flushed and the flow reduced, quickly open the container. DO NOT set the cap down and hold the cap by its outside edges only. Fill the sample bottle to just above the 100 mL line (leaving headspace) before promptly capping.
- Lead and Copper Rule Compliance Samples: Select a cold-water faucet for sampling which is free from devices that are designed to change the water

composition, such as water softeners or point of use filters. DO NOT remove any screens or aeration devices. If you are collecting a first-flush sample for lead/copper, allow the water to sit undisturbed in the water line for at least six hours. DO NOT intentionally flush the water line before the start of the six-hour period. Place a wide-mouth 1 L container under the faucet. Open the faucet and collect the first water out of the tap (initial flush). For more detailed sampling instructions, refer to the EPA's "Clarification of Recommended Tap Sampling Procedures for Purposes of the Lead and Copper Rule" at: https://www.epa.gov/sites/production/files/2016-02/documents/epa_lcr_sampling_memorandum_dated_february_29_2016_508.pdf.

1.6 Dechlorination Agents

Potable water samples that have been treated with chlorine require the addition of dechlorination agents for certain parameters to remove free chlorine and prevent analytical interference. ASB staff can check for the presence of chlorine in the potable water while they are in the field. Maleic acid is used to dechlorinate the samples being analyzed for Volatile Organic Compounds (VOCs) and THHMs. Sodium sulfite is used to dechlorinate the samples being analyzed for Semi-Volatile Organic Compounds. Sodium thiosulfate is used to dechlorinate samples being analyzed for bacteriological contaminants, and Trizma® is used to dechlorinate samples being analyzed for per & polyfluoroalkyl substances (PFAS). The laboratory conducting the analyses will be able to provide the correct dechlorination agent for the specific analysis of concern.

2.0 Flushing / Purging of Potable Water Supplies

2.1 Initial Flush, Flushing and Purging Goals

The objective of a study will determine how long to flush or purge a potable water supply, or if a stagnation period, where the potable water in the system is not used for a specific time, is required. Public health is paramount when sampling drinking water supplies and should always dictate the sample design. In general, flushing and purging are conducted to obtain representative samples of the potable water supply while a stagnant period followed by sampling the initial flush is used to collect samples representative of the potable water supply with contributions from the distribution system. It is important to note that longer flush / purge times may yield more representative samples of the water supply, but it may not be protective of the public consuming the potable water. People do not usually pour a glass of water after flushing their faucet for 15 minutes.

The sampling investigation objective(s) should be detailed in a site-specific Sampling and Analysis Plan along with the sampling and flushing / purging protocols; sample initial flush, sample after a designated flush period (i.e. 5

minutes), or sample after water quality parameters of the water supply stabilize.

2.2 Flushing and Purging Adequacy

Flushing is a term associated with municipal drinking water, whereas purging is more associated with residential and monitoring well sampling. Both are done to remove stagnant water in lines immediately prior to sampling. To determine when an adequate flush or purge has occurred, field investigators should monitor the water quality parameters such as temperature, pH, specific conductance and turbidity of the water removed during purging. For potable water supply sampling, it is recommended to purge the system until field quality parameters are stabilized with the turbidity below five Nephelometric Turbidity Units (NTUs). Stabilization criteria for temperature, pH and specific conductance are for at least three consecutive measurements with the temperature constant ($\pm 0.1^\circ \text{C}$), the pH remains constant (± 0.1 Standard Units) and the specific conductance varies no more than approximately five percent. If the parameters have not stabilized after 15 minutes, it is at the discretion of the project leader whether to collect a sample or to continue purging.

3.0 Potable Residential Well Sampling

3.1 Potable Well Sample Tap or Spigot

Ideally, the sample should be collected from a tap or spigot located at or near the well head or pump house and before the water supply is introduced into any storage tanks or treatment units. If the sample must be collected at a point in the water line beyond pressurization or holding tank, a sufficient volume of water should be purged to provide a complete exchange of fresh water into the tank and at the location where the sample is collected. If the sample is collected from a tap or spigot located just before a storage tank, spigots located inside the building or structure should be turned on to prevent any backflow from the storage tank to the sample tap or spigot. It is generally advisable to open several taps during the purge to ensure a rapid and complete exchange of water in the tanks.

3.2 Stabilization for Potable Wells

During the purge period, obtain at least three sets of readings as follows: after purging for several minutes, measure the temperature, pH, specific conductivity and turbidity of the water. Continue to measure these parameters to assess for stabilization. After three sets of stabilized readings have been obtained, samples may be collected. If stabilization has not occurred after the 15-minute purge period, it is at the discretion of the project leader to collect the sample or continue purging and monitoring the parameters. This would depend on the condition of the system and the specific objectives of the investigation.

3.3 Potable Well Sample Collection

Samples should be collected following purging from a valve or cold water tap as near to the well as possible, preferably prior to any storage / pressure tanks or physical / chemical treatment system that might be present. Remove any hose that may be present before sample collection and reduce the flow to a low level to minimize sample disturbance, particularly with respect to volatile organic compounds. Samples should be collected directly into the appropriate containers. It may be necessary to use a secondary container, such as a clean 8 oz. (or similar size) sample jar or a stainless-steel scoop, to obtain and transfer samples from spigots with low ground clearance. All measurements for temperature, pH, specific conductance and turbidity should be recorded at the time of sample collection.

4.0 Public Water Supply Sampling

Samples should be collected directly into the appropriate containers. It may be necessary to use a secondary container, such as a clean 8 oz. (or similar size) sample jar or a stainless-steel scoop, to obtain and transfer samples from spigots with low ground clearance. All measurements for temperature, pH, specific conductance and turbidity should be recorded at the time of sample collection.

4.1 Potable Treatment Plant Sampling

Municipal water supply plants and wells that continuously operate require NO PURGE other than opening a valve and allowing it to flush for a few minutes. Remove any hoses on the sample taps. If a storage tank is present, a spigot, valve or other sampling point should be located between the pump and the storage tank. If not, sample from the valve closest to the tank. Measurements of temperature, pH, specific conductance and turbidity are recorded at the time of sampling when water quality parameters are required.

When sampling at a water treatment plant, samples are often collected from the raw water supply and from the treated or finished water after chlorination.

4.2 Potable Water Distribution Sampling

Occasionally, samples are collected to determine the contribution of system-related variables (e.g., transmission pipes, water coolers, water heaters, holding tanks, pressurization tanks, etc.) to the quality of potable water supplies. In these cases, it may be necessary to ensure that the water source has not been used for a specific time interval (e.g., six-hours or over a weekend). Sample collection may consist of collecting a sample of the initial flush, collecting a sample after

flushing for several minutes, and collecting another sample after the system being investigated has been flushed until one or more of the water quality parameters stabilize.

When sampling drinking water from the interior of residential homes, it is useful to record in the logbook both the interior plumbing and service line material (i.e. PVC, galvanized iron, copper and / or lead), and any filters which are in use. Also, photographs of the sample tap, and the underlying fixtures are recommended.

Additionally, federal and state regulations require monitoring water within the distribution system under three specific rules: Total Coliform Rule, Lead and Copper Rule, and Trihalomethane Rule. Consequently, when samples are being analyzed for one of these parameters, prescriptive sampling will need to be followed and approved drinking water methods will be required for the analyses.

- 4.2.1 Total Coliform Rule – controls the microbial water quality aspects by testing for coliform bacteria and chlorine residuals.
- 4.2.2 Lead and Copper Rule – deals with the corrosivity of water distributed to homes with lead and copper plumbing. Water is tested for lead and copper in the ends of water mains and from the drinking water taps of homes after a stagnant period. Other useful water quality measurements include pH, alkalinity and the residual of any corrosion inhibitor applied to the water.
- 4.2.3 Trihalomethane Rule – monitors for disinfection by-products such as Trihalomethanes and chlorine residuals.

5.0 References

SESD Operating Procedure for Potable Water Supply Sampling, SESDPROC-305-R3, May 30, 2013

US EPA. Laboratory Services Branch Laboratory Operations and Quality Assurance Manual. Region 4 SESD, Athens, GA, May 2019.

US EPA. 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. Region 4 Science and Ecosystem Support Division (SESD), Athens, GA

US EPA. Region 8. Quick Guide to Drinking Water Sample Collection (2nd Edition). Region 8 Laboratory, 16194 W. 45th Dr., Golden, CO 80403, September 2016

US EPA. Office of Ground Water & Drinking Water. “Clarification of Recommended Tap Sampling Procedures for Purposes of the Lead and Copper Rule” memorandum, February 29, 2016

Water Distribution System Operation and Maintenance (6th Edition), California State University, Sacramento, California, College of Engineering and Computer Science, Office of Water Programs, 2012

6.0 Revision History

This table shows changes to this controlled document over time. The most recent version is presented in the top row of the table. Previous versions of the document are maintained by the LSASD Document Control Coordinator.

History	Effective Date
Replaced Chief with Supervisor; ASB with FSB; General formatting revisions.	April 22, 2023
ASBPROC-305-R4, Potable Water Supply Sampling, replaces SESDPROC-305-R3	June 11, 2019
SESDPROC-305-R3, <i>Potable Water Supply Sampling</i> , replaces SESDPROC-305-R2	May 30, 2013
SESDPROC-305-R2, <i>Potable Water Supply Sampling</i> , replaces SESDPROC-305-R1	January 29, 2013
SESDPROC-305-R1, <i>Potable Water Supply Sampling</i> , replaces SESDPROC-305-R0	November 1, 2007
SESDPROC-305-R0, <i>Potable Water Supply Sampling</i> , Original Issue	February 05, 2007