

**Methods for taking, preserving and analyzing
samples to monitor the water quality of pools and
other artificial reservoirs**

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INTRODUCTION

This guide contains information that details methods for the collection, preservation and analysis of samples required for the monitoring of analytical parameters prescribed under the *Regulation respecting the water quality of pools and other artificial reservoirs* in order to ensure that water for bathers is safe, sanitary and stable. It is therefore important to ensure good cooperation between reservoir managers, samplers and the personnel assigned to laboratory analysis.

This document has been prepared for all managers of artificial reservoirs to explain the general preparations necessary and the safety measures that must be implemented at the time of sampling. It also outlines methods for sample collection in pools and other artificial reservoirs of water. The document contains a section concerning on-site analysis of parameters required for the chemical analysis of swimming water and a section relating to collection and preservation methods for samples intended for laboratory analysis. It also details recommended sample volumes, preservatives, types of containers and the timeframes that must be respected between sampling and analysis.

1 GENERAL PRECAUTIONS

The manner in which samples are collected has a direct impact on the quality of analytical findings. To minimize the risks of sample contamination by the sample collector and to ensure sample integrity, basic precautions must be taken to obtain a representative sample. Samples can become contaminated through careless sampling techniques. It is therefore the responsibility of the sample collector or of an artificial reservoir manager to ensure the quality of sample collection, preservation and suitable transportation of samples that are sent to a laboratory accredited by the Ministère du Développement durable, de l'Environnement et des Parcs. The sample collector or of an artificial reservoir manager is also responsible for ensuring a representative sampling where on-site analyses are conducted.

2 ON-SITE ANALYSIS

2.1 Specific Precautions

The following precautions are necessary to prevent sample contamination:

- closely follow the instructions provided by the manufacturer of the chemical test kits used at the sampling site;
- always use contaminant-free containers and where possible, prepare containers and testing equipment at sampling sites;
- keep an accurate record of each sample collected using the correct form;
- always use devices or instruments that have been calibrated at the required frequency (thermometer and pH-meter);
- reagents that are used for analysis must be kept in a clean, dry, well-ventilated and dark location until use;
- always take measurements with reagents in a suitable location, since reagents must be protected from prolonged sun exposure;
- seal reagent bottles correctly after use;
- never place wet fingers on reagent bottles; this may lead to inaccurate results;
- check product expiry dates. After the prescribed date, you cannot be certain that results are reliable;
- discard expired products, in accordance with regulations in effect.

2.2 Preservation Methods

The methods of preserving the analytical parameters prescribed in the *Regulation respecting the water quality of pools and other artificial reservoirs* are closely tied to analysis methods and are described in Table 1.

Table 1: Preservation methods for chemical parameters (on-site analysis)

Parameter	Preservative *	Container*	Recommended volume (ml)	Time between sample collection and analysis
Alkalinity	N	P or G	10	30 minutes
Hardness	N	P or G	10	30 minutes
Total residual bromine	N	P or G	10	30 minutes
Chloramines	N	P or G	10	30 minutes
Free residual chlorine	N	P or G	10	30 minutes
Total residual chlorine	N	P or G	10	30 minutes
pH	N	P or G	10	2 hours
Water temperature	N	P or G	125	3 minutes

* See legend on page 12.

2.3 Sampling Method

Samples intended for chemical analysis must be collected during normal operating hours, 15 to 30 cm below the surface of the water or, where a reservoir is less than 30 cm deep, halfway between the surface of the water and bottom of the reservoir.

Samples must be collected in an area that is not very frequented by bathers at the time of sampling. It is also important to collect the sample in an area between the filtration system intake and water return. In the case of whirlpool baths, samples can be collected anywhere below the surface of the water.

It is important to carefully follow the instructions provided by the manufacturer of the chemical test kits used. It is also essential that the hands of the person who is collecting the samples be extremely clean to prevent subsequent contamination (by sweat, chemical residues, etc.) when handling samples.

The measuring cells of the kit must remain clean and transparent. Cells must be rinsed with the sample before their filling up and the level of liquid adjusted. They must then be wiped with a soft clean cloth before making colour comparisons, so that outer surfaces remain clean and dry. Always fill cells to the required level to prevent discrepancies in measurements.

2.4 Analysis Methods

2.4.1. Water temperature

For a water temperature reading, the following is required:

- collect a sample of water in a 125 ml wide-mouth glass or plastic bottle;
- dip a thermometer into the sample and wait at least 3 minutes for the temperature to stabilize;
- with the thermometer still in the sample, hold the bottle and thermometer at eye level and read the temperature;
- record the temperature to the nearest 0.5°C (adequate marking). Use only calibrated thermometers.

A water temperature reading can also be taken directly in the artificial reservoir.

2.4.2. Other Parameters

It is possible to obtain different types of test kits for on-site analysis of chemical parameters (pH; free, total and combined residual chlorine; alkalinity; etc.). These kits are very useful for verifying the principal parameters that can be used to analyze water quality and therefore ensure that treatment systems are operating correctly.

These kits generally include test containers, measuring cells and reactive products that help to determine concentrations of the products tested by using colorimetric comparators. Analyses must be conducted using reliable equipment and appropriate and not expired reagents.

The reservoir manager must at least have a test kit capable of measuring free residual chlorine to between 0.2 mg/l and 5.0 mg/l with a precision of 0,2 mg/l. If using brome as a disinfectant, it is also necessary to have a test kit capable of measuring total brome to between 1.0 mg/l and 5.0 mg/ with a precision of 0.5 mg/l.

Test kits must also be capable of measuring pH with a precision of 0.2 units, hardness and total alkalinity of the water with a precision of 10 mg/l.

3 LABORATORY ANALYSIS

3.1 Specific Precautions

- all samples sent for microbiological analyses must always be collected in sterile containers provided by a laboratory accredited by the Ministère du Développement durable, de l'Environnement et des Parcs;

- always begin a sampling campaign with microbiological samples, after, collect the chemical samples;
- always leave an air space of at least 2.5 cm between the surface of the liquid and the container lid. This helps to produce a homogenized sample for laboratory analysis;
- the necessary aseptic conditions must be respected when a sample is collected (e.g. avoid inserting fingers or other objects in the mouth or on the lid of the container and minimize exposure of the container to air at the time of sampling);
- samples should never be collected in unknown origin containers (always use laboratory-supplied containers);
- never rinse containers provided by a laboratory because some contain preservatives required for analysis;
- store sampling equipment in a clean and well-ventilated location;
- carefully close all containers tightly after sampling;
- where possible, precool samples in a refrigerator before sending them (particularly in summer);
- make a detailed record of all samples as soon as possible after sampling, using the appropriate forms, if samples are shipped to a laboratory;
- carefully pack samples to prevent breakage or leakage and use labeled shipping containers designed for sample shipment;
- use a reliable transport service to ensure sample integrity and delivery within the prescribed analytical timeframe.

3.2 Preservation Methods

The preserving methods for the analytical parameters prescribed in the *Regulation respecting the water quality of pools and other artificial reservoirs* are closely tied to laboratory analysis methods. In fact, the desired sensitivity and quantification limits can be used to determine the volume and type of sample to be collected. The type of container and sample preservation technique are also determined on the basis of the analysis method. It is therefore vital to work in close cooperation with laboratory staff to obtain the proper additional information. In addition to the specific provisions detailed in Table 2, the following general considerations apply:

- from the moment samples are collected to the time they are received by a laboratory, all samples must be preserved at a temperature of approximately 4 °C (use ice boxes or refrigerants) or chilled in an environment where an ambient temperature of approximately 4 °C is maintained;
- if ice boxes are used, they must remain clean and, where possible, reserved exclusively for water analysis of pools and other artificial reservoirs;
- preservation and transportation are the responsibility of the sample collector or reservoir manager. Working in close cooperation with the laboratory is essential.

Table 2: Preservation methods for microbiological and chemical parameters (laboratory analysis)

Parameter	Preservative*	Container*	Recommended volume (ml)	Time between sample collection and analysis
MICROBIOLOGY				
<i>Escherichia coli</i>	ST3	PPS or GS	100	48 hours
<i>Pseudomonas aeruginosa</i>	ST3	PPS or GS	100	48 hours
<i>Staphylococcus aureus</i>	ST3	PPS or GS	100	48 hours
Fecal coliforms	ST3	PPS or GS	10	48 hours
CHEMISTRY				
Turbidity	N/A	P or G	125	48 hours

* See legend on page 12.

3.3 Sampling Method

Samples sent for microbiological and turbidity analysis must be collected during normal operating hours, 15 to 30 cm below the surface of the water or where the reservoir is less than 30 cm deep, halfway between the surface of the water and the bottom of the reservoir. Samples must be collected in an area that is not very frequented by bathers at the time of collection and in an area between the filtration system intake and water return. In the case of whirlpool baths, samples can be collected anywhere below the surface of the water. Bottles must be filled to the rim, leaving an air space of at least 2,5 cm and the lid must be sealed immediately after collection.

For water samples from an artificial reservoir destined for microbiological analysis, sampling containers contain a liquid reagent. This reagent neutralizes the residual disinfectant present in the water when a sample is collected. To preserve the reagent, ensure that you tip the container towards the bottom of the reservoir at a 45° angle in one motion. This preventive measure is essential, otherwise results may be negatively distorted. It's also possible to collect sample by adding immediately and aseptically a sterile solid tablet of sodium thiosulfate in the sample. Samples for microbiological analysis must be collected with very particular attention paid to avoiding hand contamination, even when a collector has washed his or her hands before. If more than one sample is required, always begin with microbiological samples, and after with the chemical samples, to avoid dipping a microbiological analysis container in water that has been contaminated by the collector.

LEGEND

CONTAINERS	
P	Bottles and lid linings are made of the following plastics: high- or low-density polyethylene, polypropylene, polystyrene, polyvinyl chloride or teflon
PPS	Sterile polypropylene bottle
G	Glass bottle
GS	Sterile glass bottle
PRESERVATIVES	
N	No preservative required
ST3	Sodium thiosulfate at a final concentration of 0.01 % (p/v)
OTHER	
N/A	Not applicable

