Potable Water Quality

Management Program

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Contents

This program was developed by Buller Crichton Environmental Inc. for the University of Ottawa.

1.0 PURPOSE

This procedure describes the Potable Water Quality Management Program used by the University of Ottawa. This program has been established to:

1. Provide a framework to maintain water quality on campus, establish the water quality parameters to be sampled, and present the potential health risks associated with elevated levels of contaminants;
2. Annually monitor the water quality parameters typically found in potable water throughout the site in accordance with the Ontario Drinking Water Quality Standards (Ontario Regulation 169/03). The Guidelines for Canadian Drinking Water Quality (GCDWQ), published by Health Canada, will be used to set warning levels in cases where the maximum allowable concentrations in the GCDWQ are severe than those set out in O. Reg 169/03;
3. Comply with requirements of Ontario's *Occupational Health and Safety Act* (OHSA), which states that employers covered by the OHSA have a range of legal duties, including the obligation to take every precaution reasonable in the circumstances for the protection of a worker [clause 25(2)(h)].; and
4. Provide measures and procedures to adequately monitor potable water in light of adverse sampling results, when issues or problems with the potable water distribution system arise, and after extended periods of stagnation.

2.0 APPLICATION

All workers at the University of Ottawa performing work related to potable water quality must follow this procedure. Contractors performing work on behalf of the University of Ottawa must meet the requirements of this program. **Appendix A** provides a list of sampling parameters, their corresponding limits, and their health effects. **Appendix B** lists the points of consumption (PoC) at the University of Ottawa.

3.0 DEFINITIONS

For Health and Safety related definitions, acronyms and positions (ex: competent person, Supervisor, Worker, Facilities, HSRM), refer to the Occupational Health and Safety Management System.

"Lead employer" – employer who contracts for the services of one or more other employers or independent contractors in relation to potable water quality in the lead employer's own workplace, or in another employer's workplace.

"Longest residency time - LRT" is the point of consumption (PoC) within the potable water system that has the longest stagnation time.

"Point of Consumption - PoC" Examples include, but are not limited to water fountains, kitchen sinks, ice machines and coffee machines directly connected to the domestic water system. Other water fixtures, such as washroom faucets, wash basins, and workshop and janitorial sinks, are not considered PoCs and would only be sampled as part of investigations.

"Point of Entry - PoE" is the PoC nearest the location where the potable water supply enters the building.

4.0 RESPONSIBILITIES

Employer (uOttawa)

- Ensure compliance with the requirements of Ontario's *Occupational Health and Safety Act* (OHSA), which states that an employer covered by the OHSA has a range of legal duties, including the obligation to take every precaution reasonable in the circumstances for the protection of a worker [clause 25(2)(h)]

Management (Senior Management)

- Appoint only "competent persons" as supervisors and ensure that the Potable Water Quality Management Program is implemented and maintained
- Ensure that the program has the appropriate assessments, documentation, and procedures

Facilities – Management

- Ensure that all PoC have been inventoried and that any high-risk areas of stagnation have been identified and communicated
- Coordinate training with respect to the Potable Water Quality Management Program for all University of Ottawa workers who will be working on, or with, the potable water distribution system

Ensure that workers (both employees and contractors):

- Follow the requirements of the University of Ottawa Potable Water Quality Management Program
- Work in compliance with Ontario's *Occupational Health and Safety Act* and its Regulations as well as the requirements of the University of Ottawa

Facilities – Operations

- Collaborate with Facilities – Health and Safety to ensure all points of consumption are identified and any high-risk areas of stagnation (i.e., dead-legs in plumbing) are documented
- Be informed of the program requirements and how to apply them, if working with the potable water distribution system

Facilities – Health and Safety

- Maintain the Potable Water Quality Management Program documents
- Coordinate the Potable Water Quality Management Program for the University of Ottawa
- Collaborate with Facilities – Operations to ensure all points of consumption are identified and any high-risk areas of stagnation (i.e., dead-legs in plumbing) are documented
- Review the program following receipt of sampling data, changes in legislation, and at least every five years
- Report deficiencies in the program to management as soon as possible
- Keep the documentation on all PoC inventories and identification of high-risk areas of stagnation conducted by Facilities staff

University employees and students

- Report any program deficiencies to management as soon as possible
- Report any foul tastes or smells associated with the potable water system (by calling ext. 2222)
- Report any damaged points of consumption (by calling ext. 2222)

Joint Health and Safety Committee (JHSC)

The JHSC has a right to the following documents, when requested:

- A copy of any potable water sampling document
- A copy of the program

The JHSC also has the right to :

- Be consulted by the University of Ottawa on the development and maintenance of the Potable Water Quality Management Program
- Be consulted regarding the development of worker training
- Be present during water sampling activities

5.0 POTABLE WATER SAMPLING PROGRAM

Frequency and Quantity of Sampling

- For most uOttawa buildings (i.e., buildings without lead service lines), sampling will be conducted annually. At least 25% of all PoCs in each building will be sampled each year, such that over the course of a four-year sampling program, 100% of PoCs are sampled in each building. The PoE and LRT are mandatory sampling points for every sampling event.

- Buildings with lead service lines, or with a history of lead exceedances, will be sampled every semi-annually (i.e. every six months). At least 25% of all PoCs in each building will be sampled every six months, such that over the course of a two-year sampling program, 100% of PoCs are sampled For every sampling event, the PoE and LRT are mandatory sampling points. Note that every other the semi-annual sampling event will focus solely on sampling for lead. **Appendix C** lists the buildings to be sampled on a semi-annual basis.

- Each building has a sampling plan, which identifies the sequence to take samples from each sampling point. This sequence is designed to protect each sample from being flushed by an upstream fixture. The plan focuses on points of consumption that are more susceptible to water quality issues (i.e., low pressure zones, PoCs on the edges of the distribution system).

- The sampling plan for each building ensures that the PoC closest to the water service entry pipe/pipe source is collected first, then the next closest PoC, second, third etc., moving away from the source line entry point up to the PoC furthest away (“LRT”), which is the last point sampled. The list of known consumption points is attached as **Appendix B**.

- Each building-specific sampling plan must be identified in each potable water quality report.

- In accordance with the Health Canada Technical Guideline for Lead, sampling should be conducted during the time period most likely to produce adverse results for lead. As such, all

samples shall be collected as random daytime sampling events (RDT) between June and October, with samples collected between 9 a.m. and 4 p.m. from occupied areas, unless otherwise specified in the sampling protocol.

- Zero-minute samplings are for **information purposes** but may generate preventive actions and measures. Five-minute samplings are used to compare to **the prescribed maximum acceptable concentration (MAC)** that is mandatory for all parameters except microbiological. Sampling for microbiological levels is normally taken at two minutes into flushing.

- Only cold-water distribution systems shall be sampled.

- Only PoCs, such as water fountains, kitchen sinks, ice machines and coffee machines directly connected to the domestic water system, shall be sampled. Water fixtures, such as washroom faucets, wash basins, workshop or janitorial sinks, mixed or combined water outlets, are not considered PoCs and would only be sampled as part of health and safety investigations driven by a particular complaint.

- Daycare facilities shall conduct additional sampling for lead, as outlined in procedures identified in Ontario Regulation 243/07 of the *Safe Drinking Water Act*. It should be noted that this regulated sampling is completed independently from the University, and not part of the Potable Water Quality Management Program.

Parameters

- Table 1 outlines the parameters to be sampled from the PoE and LRT of each building:

Table 1: POE and LRT Testing Regime

IMMEDIATELY UPON OPENING TAP (T = 0 MIN)	2 MINUTES AFTER OPENING TAP (T = 2 MIN)	5 MINUTES AFTER OPENING TAP (T = 5 MIN)
Lead (Pb) – Lab Sample	Free Residual Chlorine – Field Measurement or Lab Sample	Turbidity – Field Measurement or Lab Sample
		pH, Nitrates and CaCO3 – Lab Sample
	E. coli – Lab Sample	Trihalomethanes (THMs)
Arsenic (As), Boron(B), Barium (Ba), Cadmium (Cd), Chromium (Cr), Iron (Fe), Manganese (Mn), Mercury (Hg), Selenium (Se), Uranium(U), Aluminum (Al), Copper (Cu), and Zinc (Zn) – Lab Sample	Total Coliforms – Lab Sample	Arsenic (As), Boron(B), Barium (Ba), Cadmium (Cd), Chromium (Cr), Iron (Fe), Lead (Pb), Manganese (Mn), Mercury (Hg), Selenium (Se), Uranium(U), Aluminum (Al), Copper (Cu), and Zinc (Zn)– Lab Sample

- Table 2 outlines the parameters that are sampled from all other regular points of consumption (that are not the PoE or LRT)

Table 2: Regular Testing Regime

IMMEDIATELY UPON OPENING TAP (T = 0 MIN)	2 MINUTES AFTER OPENING TAP (T = 2 MIN)
Lead (Pb) – Lab Sample	E. coli – Lab Sample
	Total Coliforms – Lab Sample

- Use the following procedure to collect all lead samples:
  - Collect one water sample in a 250 mL bottle at each consumption point.
  - Follow random daytime sampling methods to collect all lead samples.
  - Collect all samples at zero-minute flush time.
  - Compare the results against the 0.01 mg/L (10 µg/L) standard described in O. Reg 169/03.
  - Immediately notify the University of Ottawa, both verbally and electronically, of any results whose concentrations exceed the 0.01 mg/L (10 µg/L) standard.
    - Samples for lead will also be compared against the GCDWQ maximum allowable concentration (MAC) of 0.005 mg/L (5 µg/L). Any results above 0.005 mg/L (5 µg/L), but below the O. Reg 169/04 standard of 0.01 mg/L (10

µg/L) will be considered suitable for human consumption but will trigger actions that may include flushing or re-sampling.

- Collect all samples according to the **Procedures for Conducting Water Sampling in Federal Facilities** issued by the Interdepartmental Water Quality Training Board (IWQTB) (**Appendix E**), and the **Practices for the Collection and Handling of Drinking Water Samples** issued by the Laboratory Services Branch of the Ministry of Environment, with the most stringent standards prevailing.
    - Volume, preservative/chemical pre-treatment, labelling, packing, chain of custody, and shipping priority of sample bottles (i.e. maximum allowable travel time of a sample from collection point to laboratory for analysis) must be appropriate to the sample type, and must follow the applicable guidelines and regulations.

- All samples must be analyzed by a laboratory accredited by the Canadian Association for Environmental Analytical Laboratories (CAEAL).

- All samples must be shipped to the laboratory immediately after collection, and must arrive at the laboratory within 48 hours of the time of collection.

- All samples are to be kept cold and shipped cold (but not frozen) to ensure they arrive in their original state and viable for analysis. Packing and storage temperatures and conditions (e.g. dark) shall be as per the **Practices for the Collection and Handling of Drinking Water Samples** issued by the Laboratory Services Branch of the Ministry of Environment.

6.0 ADVERSE RESULTS (EXCEEDANCES)

General

- Results obtained during any potable water sampling program are to be compared against the Ontario Drinking Water Quality Standards (Ontario Regulation 169/03). The Health Canada document entitled “Guidelines for Canadian Drinking Water Quality (GCDWQ)” will be used as a warning level in instances where the maximum allowable concentrations are severe than the standards set out in O. Reg 169/03. Please see **Appendix A** for additional information regarding these values and their corresponding health effects.

- After adverse result detection, identification and signage installation, those responsible for sampling will contact Facilities, as soon as possible , to inform them of the adverse results, both verbally and in writing, and then inform the tenant (namely the facility manager) responsible for the specific areas/buildings. They will also make recommendations, including remedial actions to be taken for water consumption, to the tenant, Health and Safety, and the Office of Risk Management. Depending on the severity of the exceedances and the number of locations with adverse results (in one building or across multiple buildings), Facilities may defer to uOttawa Central Communication to issue a campus-wide communication.

Metals

Lead

- The following actions must be taken if an exceedance of lead is found at a PoC:
  - Immediately post signage at affected PoC "Date YYYY-MM-DD; Do not drink – under maintenance" (Example included as **Appendix D**) until appropriate measures have been taken and two results confirm that the water meets Ontario Regulation 169/03 standards.
  - If no other source of water is available nearby, alternative drinking water sources should be provided.
  - Flush the PoC for ten minutes.
  - Remove the aerator, check whether particulate material is trapped in the tap aerator (sign of corrosion), clean it and reinstall it.
  - Sample a second time at the PoC, as soon as possible, according to the 30-minute stagnation (30MS) sampling protocol which includes:
    - a five-minute flush
    - followed by a stagnation of 30 minutes
    - five x 250 ml water samples
    - The highest concentration of the five samples will be used to establish the result. If the result exceeds the limit, the five samples will be used to determine the source of the contamination.

- **If the second sampling result** (sample with the highest concentration) is **less** than the MAC, take **a third sample** (30MS sampling protocol - one x 250 ml sample) to confirm that the PoC can be put back online and signage can be removed.

- **If the second sampling result** (sample with the highest concentration) is **greater** than the MAC, an assessment is needed to determine the source of the exceedance using appropriate protocols, such as those in the Health Canada publication *Guidance on Controlling on Corrosion in Drinking Water Distribution Systems*.

- Given that lead in drinking water is primarily due to leaching from distribution and plumbing system components, drinking water treatment devices (such as carbon-based filters certified NSF 53, reverse osmosis, or distillation treatment devices) are effective in lowering exposure to lead from drinking water. **However, their use should not be considered a permanent solution since filters must be replaced regularly and such systems require ongoing maintenance.** Refer to manufacturer's instructions for frequency of maintenance and filter replacement, etc.

- Consequently, the best approach to minimize exposure to lead from drinking water is to remove the full lead-containing service line or the portion of the plumbing components involved and to control corrosion in the distribution systems. Brass fixtures also have lead impurities, which may leach into the water supply, and therefore should be avoided. However, cost implications should be compared against a lead in drinking water management program (i.e., more frequent sampling and communication).

Other Metals Exceeding their MAC

- The following actions must be taken when informed that a metal parameter other than lead exceeds the MAC at a PoC:
    - Immediately post signage at the affected PoC: "Date YYYY-MM-DD; Do not drink – under maintenance" until appropriate measures have been taken and two results confirm that the water meets the GCDWQ and Health Canada Lead guidelines.
    - If no other source of water is available nearby, provide alternative sources of drinking water.
    - Flush the PoC for 10 minutes.
    - Remove the aerator, check whether particulate material is trapped in the tap aerator (sign of corrosion), clean it and reinstall or replace it.
    - Sample a second time at the PoC, as soon as possible, at both a zero-minute and five-minute flush

- **If the second sampling result** is **less** than the MAC, the PoC can be put back online and signage can be removed.

- **If the second sampling result** is **greater** than the MAC, an assessment is needed to determine the source of the exceedance using appropriate protocols, such as those in the Health Canada publication *Guidance on Controlling on Corrosion in Drinking Water Distribution Systems*. These actions could include replacing fixtures or pipes, expanding sampling programs, or installing appropriate filters.

Microbial (Total Coliforms and E.coli)

- The following actions must be taken when informed of **Total Coliforms** present at a PoC, the following actions are to be implemented:
    - Immediately post signage at the affected PoC: "Date YYYY-MM-DD; Do not drink – under maintenance" until appropriate measures have been taken and two results confirm that the water meets Health Canada guidelines.
    - If no other source of water is available nearby, provide alternative sources of drinking water (we recommend large containers, such as water dispensers, to avoid single-use plastics/single-use bottled water).
    - Flush the PoC for 10 minutes.
    - Remove and/or replace the aerator, clean it with vinegar and water, and reinstall it.
    - Follow up any result between 1 and 10 coliforms per 100 mL by conducting an additional sample to confirm the total coliforms present.
    - If the second sample confirms that total coliforms are present, flush and super chlorinate the PoC to remedy the problem, and consult plumbers and/or water treatment specialists. Consult water chlorination experts to determine the most appropriate approach, based on the age/size of the building and associated piping systems.
    - If total coliforms are still observed after flushing and/or super-chlorination, the cause of the contamination should be investigated and corrected through appropriate actions. These actions could involve investigating and/or scoping the plumbing system, descaling pipes, or replacing fixtures/piping associated with the point of consumption.
    - If total coliforms exceed 10 per 100 mL, then the above corrective actions should be taken immediately before confirmation through resampling.

- Prior to declaring the water safe to drink, two consecutive tests should indicate the absence of coliforms. These tests should be completed no less than 24 hours apart.

- The following actions must be taken when informed of an exceedance of **E. coli** at a PoC:
  - Immediately post signage at the affected PoC: "Date YYYY-MM-DD; Do not drink – under maintenance" until appropriate measures have been taken and two results confirm that the water meets Health Canada guidelines.
  - If no other source of water is available nearby, provide alternative sources of drinking water (we recommend large containers, such as water dispensers, to avoid single-use plastics/single-use bottled water).
  - Flush the PoC for 10 minutes.
  - Remove and/or replace the aerator, clean it, and reinstall it.
  - Complete re-sampling for E. coli
  - If these actions do not remedy the problem, initiate an investigation to determine the cause. The investigation could involve assessing/scoping the plumbing system, descaling pipes, or replacing fixtures/piping associated with the point of consumption.
  - Prior to declaring the water safe to drink, a minimum of two consecutive tests should indicate the absence of E. coli. Tests should be completed no less than 24 hours apart.

7.0 PRECAUTIONARY WATER SAMPLING

- Complaints regarding water are usually the result of disruptions or damage to the potable water distribution system or a faulty point of consumption. In such cases, the water's taste, odour and/or appearance may be objectionable. Complaints should be reported to Facilities by contacting their call centre at sdiprs@uottawa.ca or 613-562-5800, ext. 2222 (directly 2222 from a uOttawa phone).

- Although these disruptions or complaints often pose no health risk to the individual, they can decrease confidence in the drinking water supply and should be investigated and corrected. If individuals are worried about health effects, they can submit a complaint to the uOttawa's Health and Wellness section. Precautionary water sampling should be completed as soon as possible to determine if water quality has remained consistent.

- If a disruption has occurred or a complaint has been received, University representatives will create a sampling plan and the contracted environmental consultants will carry it out. During the initial assessment, University representatives will survey the area to identify any construction activities or other building operations that could be affecting water quality (i.e., due to damaged water lines). At a minimum, the water should be sampled at:
  - The location of the complaint;
  - At a PoC in proximity to the complaint area (for comparison purposes); and
  - At the PoC closest to the water main entry point into the building.

- The sample results of the location of the complaint shall be compared to GCDWQ limits (as indicated in **Appendix 3**), samples taken at different PoC locations, and previous analytical results completed within the building. The person(s) who launched the complaint should be kept informed of the sample results and any investigative or remedial action being taken. JHSC should also be informed of any analysis completed as a result of precautionary water sampling.

8.0 EXTENDED PERIODS OF WATER STAGNATION

- Temporary shutdowns or reduced operation in a building, and reductions in normal water use, can create hazards in potable water for returning occupants. These can include microbial contaminants (including Legionella bacteria), changes in water chemistry that lead to corrosion, leaching of metals (such as lead) into stagnant water, or elevated levels of disinfection by-products.

- Potable water should be sampled prior to re-occupying a building. Where possible, the annual sampling program should be scheduled to coincide with the re-occupancy.

Preventative Maintenance

- During temporary shutdowns or reduced operations, the University of Ottawa will regularly flush the potable water distribution system.

9.0 BACKFLOW PREVENTION

- Typically, drinking water flows from the City's distribution system into a property's private water system. Backflow is the undesired reversal of water flow between the City's distribution system and a private system due to changes in water pressure. This reversal, or "backflow", can cause contaminants to enter the drinking water distribution system.

- Backflow preventors have been installed between each building's potable water lines and the City's distribution system and should be installed on the suppression system line to prevent contamination.

APPENDIX A – SAMPLE PARAMETERS, LIMITS and POTENTIAL HEALTH EFFECTS

Parameter	O.Reg 169/03 (mg/L)	GCDWQ MAC (mg/L)	GCDWQ Other Value (mg/L)	Common sources of parameter	Health considerations	Applying the Guideline/ Comments
Aluminum (Al)	N/A		OG: < 0.1 (conventional treatment); < 0.2 (other treatment types)	Aluminum salts used as coagulants in drinking water treatment; naturally occurring	There is no consistent, convincing evidence that aluminum in drinking water causes adverse health effects in humans	The operational guideline applies to treatment plants using aluminum-based coagulants; it does not apply to naturally occurring aluminum found in groundwater. For treatment plants using aluminum-based coagulants, monthly samples should be taken of the water leaving the plant; the OGs are based on a running annual average of monthly samples.
Arsenic (As)	0.01	0.010 ALARA		Naturally occurring (erosion and weathering of soils, minerals, ores); releases from mining; industrial effluent	**Health basis of MAC:** Cancer (lung, bladder, liver, skin) (classified as human carcinogen) **Other:** Skin, vascular and neurological effects (numbness and tingling of extremities)	MAC based on treatment achievability; elevated levels associated with certain groundwaters; levels should be kept as low as reasonably achievable.
Barium (Ba)	1	1		Naturally occurring; releases or spills from industrial uses	**Health basis of MAC:** Increases in blood pressure, cardiovascular disease	MAC takes into consideration exposure estimates from food, water and air.
Boron(B)	5	5		Naturally occurring; leaching or runoff from industrial use	**Health basis of MAC:** Reproductive effects (testicular atrophy, spermatogenesis) **Other:** Limited evidence of reduced sexual function in men	MAC based on treatment achievability.
Cadmium (Cd)	0.005	0.005		Leaching from galvanized pipes, solders or black polyethylene pipes; industrial and municipal waste	Health basis of MAC: Kidney damage and softening of bone	MAC takes into consideration exposure estimates from food, water and air
Chromium (Cr)	0.05	0.05		Naturally occurring (erosion of minerals); releases or spills from industrial uses	**Health basis of MAC:** Hyperplasia of the small intestine from chromium (VI). **Other:** No definitive evidence of toxicity to Chromium (III).	MAC protects against both cancer and non-cancer effects from Chromium (VI) and is established for total chromium.
Copper (Cu)	N/A	1	AO: 1	Naturally occurring; leaching from copper piping	**Health basis of MAC:** Gastrointestinal effects (short-term), liver and kidney effects (long-term).	Water samples should be taken at the tap. MAC is for total copper and protects against both short term and long-term exposure. AO is based on taste and water discolouration (causing staining of laundry and plumbing fixtures).

E.coli	Not detectable	None detectable per 100 mL		Human and animal faeces	The presence of *E. coli* indicates recent faecal contamination and the potential presence of microorganisms capable of causing gastrointestinal illnesses; pathogens in human and animal faeces pose the most immediate danger to public health.	*E. coli* is used as an indicator of the microbiological safety of drinking water; if detected, enteric pathogens may also be present. *E. coli* monitoring should be used, in conjunction with other indicators, as part of a multi-barrier approach to producing drinking water of an acceptable quality.
Hardness ($CaCO_3$)	N/A	None Required		Naturally occurring (sedimentary rock erosion and seepage, runoff from soils); levels generally higher in groundwater	Although hardness may have significant aesthetic effects, a guideline has not been established because public acceptance of hardness may vary considerably according to the local conditions; major contributors to hardness (calcium and magnesium) are not of direct public health concern	Hardness levels between 80 and 100 mg/L (as CaCO3) provide acceptable balance between corrosion and incrustation; where a water softener is used, a separate unsoftened supply for cooking and drinking purposes is recommended.
Iron (Fe)	N/A		AO: ≤0.3	Naturally occurring (erosion and weathering of rocks and minerals); acidic mine water drainage, landfill leachates, sewage effluents and iron-related industries	No evidence exists of dietary iron toxicity in the general population.	Based on taste and staining of laundry and plumbing fixtures.
Lead (Pb)	0.010	0.005 ALARA		Leaching from plumbing (lead service lines, lead solder and brass fittings)	**Health basis of MAC:** Reduced intelligence in children measured as decreases in IQ is the most sensitive and well-established health effect of lead exposure. There is no known safe lead exposure level. **Other:** Possible effects include behavioral effects in children. Reduced cognition, increased blood pressure, and renal dysfunction in adults are also possible. Classified as probably carcinogenic to humans	Lead levels should be kept as low as reasonably achievable. Sampling should be done at the tap to reflect average exposure. The most significant contribution of lead in drinking water is generally from the lead service line that supplies drinking water to the home. The best approach to minimize exposure to lead from drinking water is to remove the full lead service line. Drinking water treatment devices are also an effective option.
Manganese (Mn)	N/A	0.12	AO: 0.02	Dissolution of naturally occurring minerals commonly found in soil and rock. Other sources include industrial discharge, mining activities and leaching from landfills.	**Health Basis of MAC:** Effects on neurological development and behaviour; deficits in memory, attention, and motor skills. **Other:** Formula-fed infants (where water containing manganese at levels above the MAC is used to prepare formula) may be especially at risk.	AO based on minimizing the occurrence of discoloured water, consumer complaints and staining of laundry.

Mercury (Hg)	0.001	0.001		Releases or spills from industrial effluents; waste disposal; irrigation or drainage of areas where agricultural pesticides are used	**Health basis of MAC:** Irreversible neurological symptoms	Applies to all forms of mercury; mercury is generally not found in drinking water, as it binds to sediments and soil.
Nitrates	10 (as nitrogen)	45 as nitrate; 10 as nitrate-nitrogen		Naturally occurring; leaching or runoff from agricultural fertilizer use, manure and domestic sewage; may be produced from excess ammonia or nitrification in the distribution system	**Health basis of MAC:** Methaemoglobinaemia (blue baby syndrome) and effects on thyroid gland function in bottle-fed infants **Other:** Classified as possible carcinogen under conditions that result in endogenous nitrosation	Systems using chloramine disinfection or that have naturally occurring ammonia should monitor the level of nitrate in the distribution system. Homeowners with a well should test nitrate concentrations in their water supply.
pH	N/A		7.0–10.5[4]	Not applicable	Not applicable	The control of pH is important to maximize treatment effectiveness, control corrosion, and reduce leaching from distribution system and plumbing components
Residual chlorine	N/A	None Required		Used as drinking water disinfectant	A guideline value is not necessary, due to low toxicity at concentrations found in drinking water	Free chlorine concentrations in most Canadian drinking water distribution systems range from 0.04 to 2.0 mg/L.
Selenium (Se)	0.05	0.05		Naturally occurring (erosion and weathering of rocks and soils) and release from coal ash from coal-fired power plants and mining, refining of copper and other metals.	**Health basis of MAC:** chronic selenosis symptoms in humans following exposure to high levels **Other:** Hair loss, tooth decay, weakened nails and nervous system disturbances at extremely high levels of exposure	Selenium is an essential nutrient. Most exposure is from food; little information on toxicity of selenium from drinking water. Selenium can be found in non-leaded brass alloy where it is added to replace lead.
Total coliforms	Not detectable	None detectable per 100 mL		Human and animal faeces; naturally occurring in water, soil and vegetation	Total coliforms are not used as indicators of potential health effects from pathogenic microorganisms; they are used as a tool to determine how well the drinking water treatment system is operating and to indicate water quality changes in the distribution system.	Total coliforms should be monitored in the distribution system because they are used to indicate changes in water quality. In water leaving a treatment plant, total coliforms should be measured in conjunction with other indicators to assess water quality; the presence of total coliforms indicates a serious breach in treatment. In a distribution and storage system, detection of total coliforms can indicate regrowth of the bacteria in biofilms or intrusion of untreated water. Detection of total coliforms from consecutive samples from the same site

						or from more than 10% of the samples collected in a given sampling period should be investigated. In non-disinfected groundwater, the presence of total coliforms may indicate that the system is vulnerable to contamination, or it may be a sign of bacterial regrowth.
Trihalomethanes[5]	0.100	0.1		By-product of drinking water disinfection with chlorine; industrial effluents	**Health basis of MAC:** Liver effects (fatty cysts) (chloroform classified as possible carcinogen) **Other:** Kidney and colorectal cancers	Refers to the total of chlorodibromomethane, chloroform, bromodichloromethane and bromoform; MAC based on health effects of chloroform. MAC takes into consideration all exposures from drinking water, which include ingestion, as well as inhalation and dermal absorption during showering and bathing. Utilities should make every effort to maintain concentrations as low as reasonably achievable without compromising the effectiveness of disinfection. Recommended strategy is precursor removal. The separate MAC for BDCM was rescinded in April 2009.
Turbidity	N/A	Treatment limits for individual filters or units: - Conventional and direct filtration: ≤ 0.3 NTU[1] - slow sand and diatomaceous earth filtration: ≤ 1.0 NTU[2] - membrane filtration: ≤ 0.1 NTU[3]		Naturally occurring particles: *Inorganic*: clays, silts, metal precipitates *Organic*: decomposed plant & animal debris, microorganisms	Particles can harbour microorganisms, protecting them from disinfection, and can entrap heavy metals and biocides; elevated or fluctuating turbidity in filtered water can indicate a problem with the water treatment process and a potential increased risk of pathogens in treated water.	Guidelines apply to individual filter turbidity for systems using surface water or groundwater under the direct influence of surface water. The decision to exempt a waterworks from filtration should be made by the appropriate authority based on site-specific considerations, including historical and ongoing monitoring data. To ensure effectiveness of disinfection and for good operation of the distribution system, it is recommended that water entering the distribution system have turbidity levels of 1.0 NTU or less. For systems that use groundwater, turbidity should generally be below 1.0 NTU. Filtration systems should be designed and operated to reduce turbidity levels as low as reasonably achievable and strive to achieve a treated water turbidity target from individual filters of less than 0.1 NTU.

Uranium(U)	0.02	0.02		Naturally occurring (erosion and weathering of rocks and soils); mill tailings; emissions from nuclear industry and combustion of coal and other fuels; phosphate fertilizers	**Health basis of MAC:** Kidney effects (various lesions); may be rapidly reversible after exposure ceases	Based on treatment achievability; MAC based on chemical effects, as uranium is only weakly radioactive; uranium is rapidly eliminated from the body.
Zinc (Zn)	N/A		AO: ≤5.0	Naturally occurring; industrial and domestic emissions; leaching may occur from galvanized pipes, hot water tanks and brass fittings	Zinc is an essential element and is generally considered to be non-toxic, however levels above the AO in water would render it unpalatable.	AO based on taste; water with zinc levels above the AO tends to be opalescent and develops a greasy film when boiled; plumbing should be thoroughly flushed before water is consumed.

[1] in at least 95% of measurements either per filter cycle or per month; never to exceed 1.0 NTU.

[2] in at least 95% of measurements either per filter cycle or per month; never to exceed 3.0 NTU.

[3] in at least 99% of measurements per operational filter period or per month. Measurements greater than 0.1 NTU for a period greater than 15 minutes from an individual membrane unit should immediately trigger an investigation of the membrane unit integrity.

[4] No units.

[5] Expressed as a locational running annual average of quarterly samples.

APPENDIX B – INVENTORY OF POINTS OF CONSUMPTION

APPENDIX C – BUILDINGS TO BE SAMPLED SEMI-ANNUALLY

Appendix C

SEMI-ANNUAL LEAD SAMPLING			
Building Abbrev	**Building Code**	**BUILDING by ADDRESS (Name/Description)**	**Year Built**
KED	211	538-540 King Edward	1920
	212	542 King Edward	1920
	215	554 King Edward	1920
	216	555 King Edward	1920
	217	556 King Edward	1920
	218	558 King Edward	1920
	219	559 King Edward	1920
	220	562 King Edward	1920
	224	598 King Edward	1920
	227	615 King Edward	1920
	228	621 King Edward	1920
	228	631 King Edward	1920
	236	190 Laurier	
STT	242	34-36 Stewart	1918
	243	38 Stewart	1900
	244	40 Stewart	1900
ATK	260	Alex Trebek Alumni Hall	1884
	060	200 Lees	1963 - 1980

APPENDIX D – ADVERSE RESULTS SIGNAGE

EAU TEMPORAIREMENT NON POTABLE

WATER TEMPORARILY NOT POTABLE

Nous travaillons à régler le problème dans les prochains jours – Merci de votre compréhension

We are working to address the issue in the coming days – Thank you for your comprehension

Immeubles / Facilities

uOttawa

APPENDIX E – Health Canada Procedures for Conducting Water Sampling in Federal Facilities

PWGSC
DRINKING WATER
SAMPLING PROCEDURES MANUAL

Release Version 3.0
August 13, 2004

TABLE of CONTENTS

What's New?

The most immediate and visible change is the renaming of "Potable Water Sampling Procedures Manual" to the more accurate "Drinking Water Sampling Procedures Manual". This is a correct revision because both Treasury Board and the Canada Labour Code Part II require federal occupancies to base any sampling on the Guidelines for Canadian Drinking Water Quality published under the authority of Health Canada. This change is for clarification only and shall not be considered as meaning the water is non-potable or unfit for bathing and food preparation.

As this is the first major rewrite for the PWGSC Drinking (formerly Potable) Water Sampling Procedures Manual it is strongly hoped you will find this a much-improved document. These improvements come about from known successes and frustrations over the last two years.

Administrative issues that have been raised include:

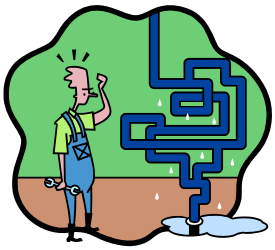
- Inconsistent application of differing regulations by regulatory bodies, subject matter experts, and consultants;
- Ignorance and misinformation on sampling procedures, perceived versus actual health concerns, and varied "appropriate" responses;
- To follow a reporting system and not to arbitrarily shutdown/close the building water supply and supply bottled water without proper consultations; and
- Confusion regarding potable water, domestic hot water and drinking water.

Technical issues that have been raised and merit identifcation are:

- The Guidelines for Canadian Drinking Water Quality (GCDWQ) and its sampling parameters are intended for **adequately flushed, cold drinking water only**;
- Washroom faucets are NOT to be used for drinking water because of their design and intended usage;
- Domestic Hot Water (DHW) is NOT to be used as drinking water;
- Domestic Hot Water (DHW) is NOT to be sampled against or compared to the GCDWQ because the design of hot water tanks and associated piping leaches metals and creates metal parameters that are higher than acceptable for human ingestion;
-
-
- Acknowledgement that when bottled water is supplied there is a corresponding stagnation of water in the building drinking water supply system that artificially creates a) elevated metals readings and b) complaints of water poor tasting drinking water quality.

PREAMBLE

What is a Drinking Water Sampling Procedures Manual?



It is an Operations and Maintenance Regimen for drinking water quality sampling. The information that must be included in the Drinking Water Sampling Procedures Manual is information that PWGSC must have up-to-date and available to pass on to clients or regulatory authorities.

Purpose

The goal of this work is to inform PWGSC property/asset and maintenance/facility managers, AFD providers, and other operational staff, on factors involved in drinking water issues and to guide them through the development of a drinking water quality management strategy tailored to their facility.

Please Note: Other parties using this information are responsible for their own regulatory compliance and verifying the accuracy/currency of the material contained herein.

Scope

This Drinking Water Sampling Procedures Manual provides information on PWGSC responsibilities and duties with regard to water sampling parameters of drinking water; a protocol for notification and communication of concerns; and the provision of an alternate drinking water source, should drinking water quality issues occur.

SECTION 1: INTRODUCTION

PWGSC can anticipate accountability for our occupants who are consuming, or believe themselves to be consuming, contaminated water from our building water supply or distribution system. This water contaminant might not be delivered from the municipal water source and could occur from our property line and building water distribution system. PWGSC is required to act with recorded due diligence of our providing "drinking water" to our occupants. *This evidence must be best collected by a qualified person and must be analysed by an accredited laboratory or, in special circumstances by a qualified person using properly calibrated equipment. PWGSC has a responsibility to monitor for and correct any risk(s) to demonstrate due diligence. Most importantly PWGSC must keep verifiable records. Therefore, in summary, PWGSC* must perform, demonstrate and record due diligence.

There is no such thing as naturally pure water. We often think of drinking water quality as a matter of taste, clarity and odour, and in terms of other properties, which determine whether water is fit for drinking. Pure water is tasteless and odourless. Both groundwater and surface water may contain many constituents, including microorganisms, gases, inorganic and organic materials.

Water contamination can occur from the building water line connections, such as lead soldered lines, defective back-flow preventors, chillers and reservoirs. These are in addition to impaired drinking water quality from agricultural, chemicals, industrial pollution, cross connections, and the leaching of chemicals from landfills.

There are two basic sources of water for our properties, surface-water (lakes/rivers) and ground-water (wells) that provide the two basic suppliers of water; namely private and public. All sources must be sampled and records kept.

Concerns over water contaminants fall into 4 groups; these are,

- **Physical Contaminants and Aesthetic Objectives**
- **Chemical Contaminants**
- **Microbiological Contaminants**
- **Radionuclides/Radiological Contaminants**

SECTION 1: INTRODUCTION

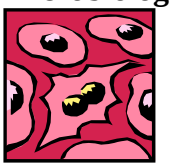
Accepted Criteria

Aesthetic Objectives are water's physical aspects: Taste, Odour, Colour, Temperature and Clarity.

Physical Contaminants/Aesthetic Objectives are normally pertinent to our senses. Our senses cannot normally detect bacteriological, metals, and chemical content of drinking water. In the past having water from a municipal public water source was viewed as all that was necessary to ensure acceptable criteria before the water was used for human consumption.

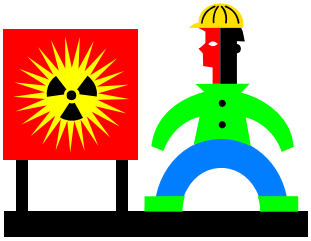
Chemical contaminants: Inorganic or organic compounds are naturally present in water in either a dissolved or suspended form. They can also be present as a result of human activity (i.e. spills, etc.). A general chemical analysis will usually include parameters such as: Alkalinity, Nitrate/Nitrites, Magnesium, Manganese, Fluoride, Potassium, Chlorine, Iron, Sodium, Lead, and pH, etc.

Microbiological contaminants may be present in groundwater as a result of septic systems,



infiltration from grazing fields, unprotected wellheads, and unsecured monitoring wells. Microbiological contaminants including pathogenic bacteria, protozoa, viruses, and parasites are the most serious threat to drinking water and the most common and widespread health risk associated with drinking water. Examples of orally transmitted waterborne pathogens include; *E. coli* and *Salmonella*. Examples of orally transmitted waterborne viruses include; hepatitis A and Rotavirus. Giardia and cryptosporidium are orally transmitted waterborne protozoa.

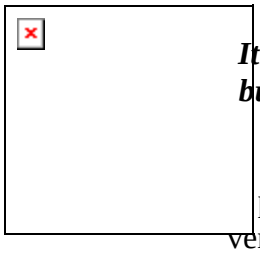
Radiological contaminants may be man-made or naturally (radon) occurring within the earth. The risk of radiological contamination of the source water is increased by certain human activities.



SECTION 1: INTRODUCTION

Drinking water sampling is divided into frequency and location. The *frequency* of performing drinking water sampling shall be at least annually but can be more frequent if desired. The *location* of these drinking water samplings shall be rotational to include water outlets intended for human consumption, namely, drinking, food preparation, and washing/bathing. However, PWGSC requires one sample to be taken at the nearest property outlet from the intake of supplied water into the building and another sample taken at the most remote point on the drinking water system, every time we do drinking water sampling. The amount and type of sampling is covered in SECTION 3.

The next question may be "What to test for?" Educated decisions are needed to select what tests are required. The best way to have accurate water sampling/testing is to *know your area and your water source*. Your local health authority and municipal water treatment utility is required to have and make available records on the chemical characteristics of water in your area, this can assist you to narrow your search. Additionally, most provincial/municipal authorities require at least annual publication of local drinking water quality reports, which identify contaminants in our drinking water and the levels at which they were found.



It is recommended that a general chemical analysis be performed at each building to begin assessing what must be tested/sampled for.

If you are concerned about specific types of metals, bacteria, chemicals and/or pesticides, then indicate those concerns to the persons doing your water tests and verify these are tested for. Simple tests such as a bacteriological or a chemical analysis only cover certain aspects of water. As well, each test may require different methodology or equipment to complete the analysis.

This entire process needs to be performed and recorded systematically at all PWGSC owned, managed and leased properties.

SECTION 2: REGULATORY REQUIREMENTS

Regulatory Requirements (Appendix 8 has excerpts of below noted regulatory requirements.) Provinces and territories have the general responsibility for the provision of drinking water. However, there are federal laws that are applicable for provision of drinking water at owned, leased or otherwise managed properties; these are:

1 The ***Canada Labour Code Part II – Section 125.(1) Specific Duties Of Employer*** states, "Without restricting the generality of section 124, every employer shall, in respect of every work place controlled by the employer and, in respect of every work activity carried out by an employee in a work place that is not controlled by the employer, to the extent that the employer controls the activity, …(j) provide, in accordance with prescribed standards, potable water;"

2 ***Part 9.24 of the Canada Occupational Safety & Health Regulations of the Canada Labour Code Part II*** reads as follows, "Potable Water 9.24 Every employer shall provide potable water for drinking, personal washing and food preparation that meets the standards set out in the Guidelines for Canadian Drinking Water Quality 1978, published by authority of the Minister of National Health and Welfare."

3 Readers of the Canada Labour Code must remember that *anything* prescribed by the Canada Occupational Safety & Health Regulations is a legal/regulatory requirement for federal occupancies. This is irrespective of the title of what is prescribed/referenced, such as the prescribed ***Guideline for Canadian Drinking Water Quality (GCDWQ)***, authored by Health Canada, ***which is mandatory for our usage because it is prescribed in 9.24***. This document is required reading for anyone associated with PWGSC's Drinking Water Sampling Procedures Manual. An additional document, with more frequent updates of the **GCDWQ** is entitled the ***Summary of Guidelines for Canadian Drinking Water Quality, March 2001***. Health Canada's former Occupational Safety & Health Agency had created the ***OSHA National Drinking Water Sampling Procedures,*** which PWGSC - MM has modified for PWGSC usage.

The **G**uideline for **C**anadian **D**rinking **W**ater **Q**uality (**GCDWQ**) process of developing drinking water guidelines for microbiological, chemical, physical, and radiological parameters is based on Health Canada's risk management concepts. These risk management concepts require PWGSC to have a drinking water quality management program that identifies, assesses, evaluates, and keeps records of drinking water quality for our owned, leased or managed properties. Close co-operation is necessary between PWGSC and the municipalities supplying water to our occupants. By logical extension this includes PWGSC's contractual agreements with Landlord's and Other Service Providers.

4 Additionally PWGSC must comply with ***Treasury Board – 2.18 Sanitation Directive - POTABLE WATER***, which states, "44. Water for drinking, personal washing and food preparation shall be potable and meet the standards set out in the Guidelines for Canadian Drinking Water Quality 1987, published by authority of the Minister of Health and Welfare. Treasury Board's Sanitation Directive."

SECTION 3: WATER SAMPLING PARAMETERS

Which Properties/Facilities Require Sampling?
Any property or facility where PWGSC is responsible for providing drinking water, including PWGSC- owned, leased, PWGSC-managed or managed by other service providers.

Frequency of Sampling
Sampling should be conducted at least annually but it is recommended that sampling be divided throughout the year, e.g. semi-annually or quarterly. The frequency of sampling is dependent upon the water source. Buildings that receive municipal treated water shall collect samples at least annually. Buildings that receive non treated (i.e. well or surface) water that is treated within the building, shall be sampled more frequently in conformance with provincial or territorial requirements. The intent is that all applicable drinking water locations be sampled at least annually.

Sampling Locations
Wherever water is supplied for human ingestion it should be sampled at least annually. This specifically includes fountains and cold-water supplies for kitchenettes. Hot water supplied for a kitchenette is not to be sampled under the GCDWQ parameters as supplied hot water is not intended for human ingestion.

Explanation of the Rationale for Sampling at Zero and Five Minutes
An interesting point, is that Health Canada's **G**uideline for **C**anadian **D**rinking **W**ater **Q**uality (**GCDWQ**) does not state a time period for flushing of drinking water fountains prior to sampling; however, there is reference to flushing and cold water, in addition to establishing the Maximum Acceptable Concentrations (**MAC**) for microbiological, chemical, physical, and radiological parameters.
Apart from authoring the **GCDWQ** Health Canada's - Occupational Safety & Health Agency has promulgated Water Sampling Guidelines which PWGSC has adopted as being based on good engineering practices.
For this context, Health Canada's Water Sampling Guidelines establish

a) The zero minute sampling is for ***informative purposes*** which may necessitate preventive actions and preventive measures on the part of PWGSC; and
b) The 5 minutes sampling is for ***comparison to the prescribed and mandatory MAC level*** for all parameters but microbiological; and,
c) Microbiological sampling is normally taken at 2 minutes into flushing.

SECTION 3: WATER SAMPLING PARAMETERS

Types of Sampling
Each facility and each region shall have varied requirements based on their regional environment. The following are suggested standard/general parameters that could be included for your regional needs.

Note: A <u>General Water Chemistry Analysis</u> shall be done at least annually.

Suggested SCHEDULED:

Metals (Scheduled)

Arsenic (As)	Boron (B)	Barium (Ba)	Cadmium (Cd)	Chromium (Cr)	Copper (Cu)

Iron (Fe)	Lead (Pb)	Manganese (Mn)	Mercury (Hg)	Selenium (Se)	Uranium (U)	Zinc (Zn)

Microbiological (Scheduled)

Escherichia Coli	Total Coliform

Note: Heterotrophic Plate Count & Background Colonies are no longer required for microbiological sampling under the GCDWQ

Informative (Scheduled) *only 2 samples normally requested for each parameter

Chlorine (Cl)	Corrosive or Acidic (pH),

NON-SCHEDULED:

Aesthetic (Complaint Driven)

Colour	Odour	Taste	Turbidity

SECTION 4: WATER SAMPLING - BASIC PROCEDURES

Step 1: Verification

Decide what must be sampled for and where sampling shall be done. . See **APPENDIX 9:**
Part 2.2 Sample Collection Methodology- *Microbiological (Bacteriological) Parameters*
Part 2.4 Sample Collection Methodology - *Metal (Chemical) Parameters*

Step 2: Preparation

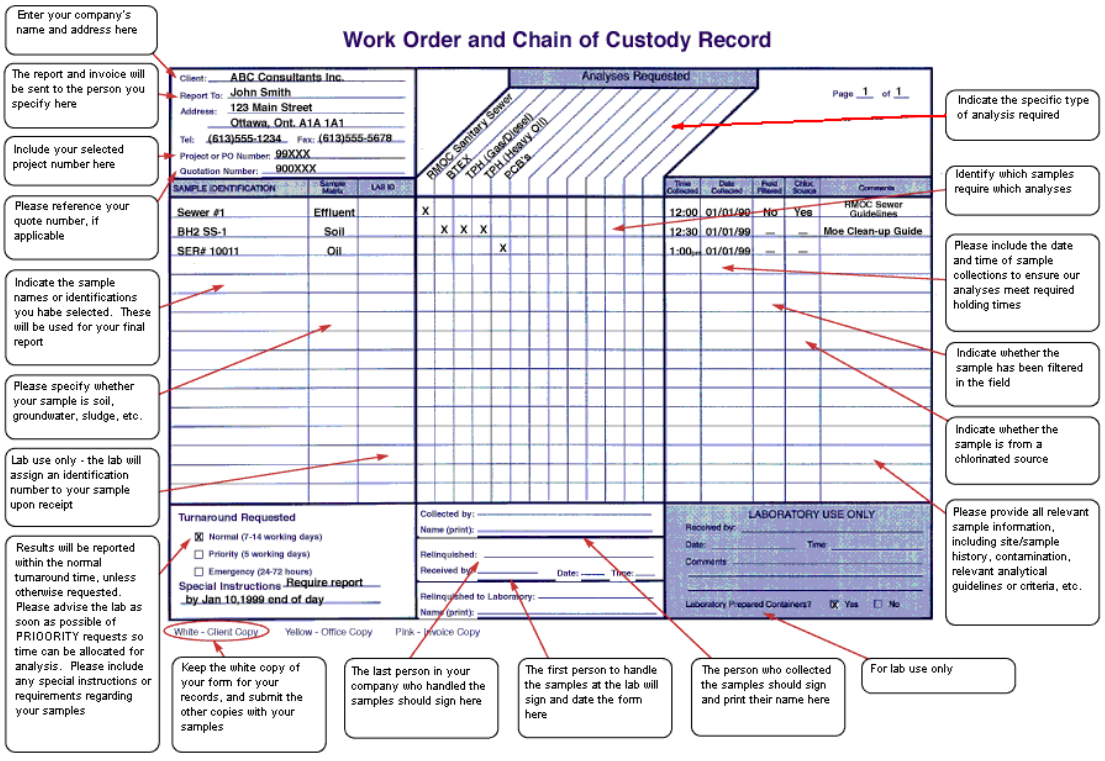
Remember to take Informative Samples (at first draw or zero minutes of flushing) and prescribed Maximum Acceptable Concentrations (MAC's) (at 2 or 5 minutes of flushing).
Verify the drinking water system, either from as-built drawings or having traced the pipe run, to locate loop systems, reservoirs, chillers, etc.

Step: 3 Sampler's Record-keeping

Once you know where to Sample and what to Sample for, you must use a form to record the Sampling Activity. This shall include

1. Record Sample Locations	2. Methodology
3. Storage/shipping	4. Any time delay between collection and analysis.

Accredited Laboratories commonly use a generic form as shown below.



SECTION 4: WATER SAMPLING - BASIC PROCEDURES

Step 4: Pre-Plan for Transportation of Samples to Accredited Laboratories.

This needs to be done under appropriate conditions, often in a dark cooler with ice packs. Ask the Accredited Laboratory BEFORE beginning Sampling. Prior to a water sampling survey, arrangements should be made for rapid transportation to the accredited laboratory. Rapid transportation is desirable for all tests, however is essential for others such as microbiological samples. Ideally the Accredited Laboratory should receive the Sample within 24 hours of collection. Remote locations must pre-plan and be more diligent in storing the samples for delivery to accredited laboratory within 30-48 hours, otherwise Sampling must be redone.

Step 5: Sanitize - Wash Your Hands

Water sampling can be very easily contaminated and ***using the proper sampling protocol is vital for accurate results.*** Exercise care that you or your sampling technique does not contaminate sampling. Samples collected for microbiological analysis are perishable and easily contaminated. Prior to collecting the water samples, the person who will be collecting them should wash his/her hands and wear appropriate gloves (rubber, nitrile or other). It may be necessary to wash hands or change gloves, more than once if they become contaminated during or between sampling locations.

Step 6: Acquire Sanitized Water Sample Containers.

Relevant to your request for water analysis, appropriate test kits or accredited laboratory personnel must prepare and shipped to you the appropriate sterile Sample containers. These may have preservatives or additives for specific sampling requirements.

Step 7: General Water Sampling Instructions.

PWGSC Water Sampling Guidelines establish the -0- minute sampling is for ***informative purposes*** that may necessitate preventive actions and preventive measures from PWGSC and the 2 & 5 minutes sampling is for ***comparison to the prescribed and mandatory MAC level***.

- Sampling for different contaminants means different procedural steps, therefore, *read the instructions provided with the sanitized containers before sampling*. Collect the samples as per the laboratory or test kit provided instructions.
- DO NOT Rinse Sample Bottles Prior To Filling. Regulate pressure to avoid flushing out chemicals inside sample container.
- DO NOT remove the cap from more than one bottle at a time.
- After filling that bottle, re-cap it before proceeding to the next bottle in the set.
- After filling the bottles, cap tightly, and with a pen containing permanent ink fill out the requested information on the sample bottle label.
- Retain a copy of the water analysis request and collection report for your records and return the original and the samples to the laboratory for analysis.

- All paperwork sent with the samples shall be placed in a waterproof storage bag to protect the paperwork from water damage if a sample container should leak in transit.

SECTION 4: WATER SAMPLING - BASIC PROCEDURES

Step 8: Temperature and Time

Promptly deliver the sample to an accredited laboratory. Once Sampling is complete Temperature and Time can work against you. Water Samples will be inaccurate if exposed to temperature extremes or if not evaluated within a specified/recorded time period.

Step 9: Processing the Water Sample

Test Kits: Such as Hach, will require a clean location and qualified person doing the processing. Calibration of equipment, staffing, and training are concerns, however, and most importantly, the impartial third party analysis is not available with in-house sampling.

Accredited Laboratory: The laboratory needs to have quality control/assurance procedures in place so their analytical values aren't compromised. Assurance is needed that water samples will be analyzed in a "clean" fashion. Analytical instruments dedicated for drinking water quality analyses work at lower concentration levels than instruments that are used on every incoming sample. Therefore, when procedures and instruments are subjected to wide ranges of different compounds, the detection of low levels may not be as accurate.

Accredited Water Testing Laboratories are normally only certified for testing a limited number of compounds and you must verify they are accredited to perform the specific water testing you require. The use of an Accredited Water Testing Laboratory is the best and most consistent means presently available for validation that our water is “drinking”. One way to determine the accuracy of the work carried out is to include double blind samples where you send several samples of the same water to two or more Accredited Water Testing Laboratories.

Excluding Test Kits or similar “in-house” sampling equipment, PWGSC requires only Accredited Water Testing Laboratories be used for drinking water analysis.

Choosing a laboratory accredited and proficient for all the parameters to be tested is critical to ensure quality assurance and control. For a current list of laboratories that have acquired accreditation by the **Canadian Association of Environmental Analytical Laboratories (CAEAL)**, visit the following web site. **http://www.scc.ca/certific/labs.html**

Step 10: Interpretation.

This is where competence and training in water quality is required. For most compounds, if all the steps have been carried out well, believable numbers can be generated and an accurate report issued by and interpreted by the Accredited Water Testing Laboratory.

An Executive Summary Report shall be requested as part of the Analysis Contract.

Note: Health specialists from PWGSC-AES, Environmental Services, and/or Corporate Environment Health & Safety, and/or Health Canada are available to interpret these Executive Summary Reports and assist your decisions on any remedial actions.

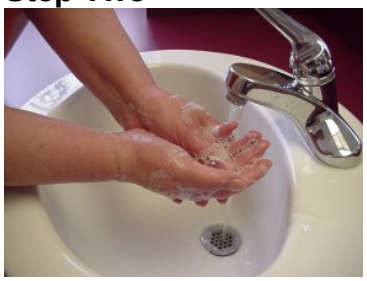
SECTION 4: WATER SAMPLING - BASIC PROCEDURES

Step 11: Taking a Routine Total Coliform Sample Properly

Step One

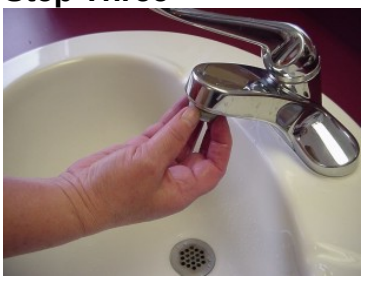
Do Not Rinse The Bottle
The powder in the bottle is meant to be there and will not contaminate your sample.

Step Two



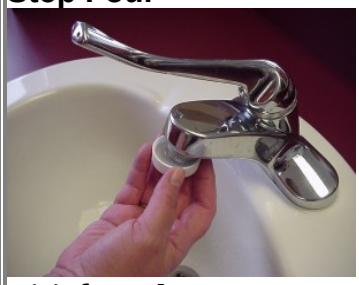
Wash Your Hands
Prior to taking the sample. Then remove the sterile strip from the bottle.

Step Three



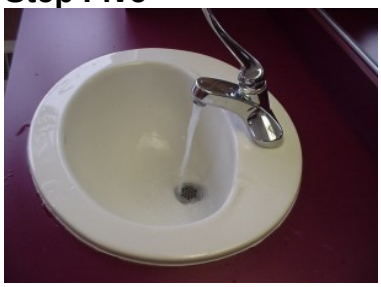
Remove Faucet Screen
hoses and aerators from the end of the faucet. If possible avoid using a swivel faucet.

Step Four



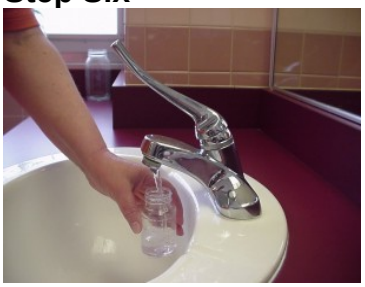
Disinfect The Faucet
By dipping the end in a cap full of bleach if "flaming" is not preferred.

Step Five



Run Cold Water 5 Minutes
to remove residue bleach solution.

Step Six

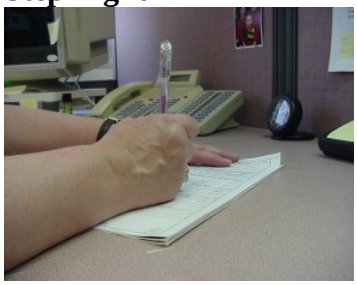


Turn The Water Down
Do not flush out the powder. Allow 1" head space. **Do not breath towards sample.**

Step Seven

Screw Cap On Tightly
Take special care not to touch the inside of the cap or bottle. Otherwise redo sampling.

Step Eight



Fill Out Paperwork
Send It In Keep a copy for your files. Pack samples provided containers.

If positive results come back see Follow-Up Sampling After A Positive Routine Total Coliform Sample.

Single-usage Sanitary Gloves are to be worn as this further reduces the risk of external contamination of the water sample.

SECTION 4: WATER SAMPLING - BASIC PROCEDURES

Step 12: Complaint-Driven Sampling

Complaints with regard to water are usually the result of objectionable taste, odour or appearance, and while they often pose no health risk to the individual, they can decrease the confidence and acceptance of the drinking water supply and should be investigated and corrected if feasible.

If a complaint has been received then a water sample shall be collected at the following locations:

1. **The location of the complaint;**
2. **In the proximity of the complaint area (for comparison purposes); and**
3. **At the tap nearest to the water main entry point to the building**

The results of the analysis shall be compared to GCDWQ limits, samples taken at different locations and previous routine maintenance results. The person(s) who launched the complaint should be keep informed of sample results and any investigative or remedial action that is being taken.

Common Complaints and their Possible Sources

Complaint	**Possible Sources**
Colour	Iron Manganese Zinc
Odour	Chromium Iron Manganese
Taste	Aluminum Chromium Copper Manganese Sodium Zinc
Turbidity	Iron

SECTION 4: WATER SAMPLING - BASIC PROCEDURES

Step 13: On-Site Record-Keeping

The property/asset manager must keep all records on-site for a minimum of 5 years. Some of the documents that shall be included in a drinking water management file are:

Checklist of Documents to be Kept On-File

On file (Check)	Document Description
	Analytical accredited laboratory reports
	Copies of communications sent to employers/tenants, occupants, management, and their Workplace Health & Safety Committees
	Drinking water quality analysis reports
	Records of drinking water quality complaints
	Facility specific information sheet
	Municipality drinking water quality reports
	Records of any maintenance or repairs done on the drinking water distribution system
	Records of remedial actions to solve drinking water quality problems
	Copy of the applicable provincial or territorial drinking water quality regulations / standards / acts and the GCDWQ
	Facility specific contingency plan
	Facility specific drinking water Sampling Procedures Manual
	Any other water quality related documentation
	PWGSC Drinking Water Sampling Procedures
	Drawings of the water distribution system showing any treatment system within the distribution system
	Copy of the Contract for Accredited Laboratory analysis and related information/analysis supplied by them.

SECTION 4A: REMEDIAL ACTIONS

Remedial Corrective Maintenance Actions For Commonly Exceeded Water Parameters

Parameter	Possible Remedial Action(s)
Aluminum	• Aluminum may be a result of processes at the treatment facility. • Residual aluminum concentrations can be effectively removed through filtration systems, ion exchange units • Implementing a flushing routine can often solve high aluminum concentrations as a result of corrosion.
Cadmium	• Try flushing for five minutes and if there is no improvement then the entire distribution system should be flushed. Develop a regular maintenance plan to include flushing the drinking water distribution system. • Ion exchange • Reverse osmosis
Colour	• Once possible cause is determined, refer to remedial action for that specific parameter • Chemical - high concentrations of iron, manganese, or zinc • Physical – decay of organic matter, turbidity
Chromium	• Try flushing for five minutes and if there is no improvement then the entire distribution system should be flushed. Develop a regular maintenance plan to include flushing the drinking water distribution system. • Ion exchange unit • Replace pipes and solder that leaches chromium
Copper	• If the copper concentration exceeds the aesthetic objectives after five minutes of flushing then the entire distribution system should be flushed. Develop a regular maintenance plan to include flushing the drinking water distribution system. • Ion exchange units • pH (alkalinity) adjustments
E. coli and/or faecal coliforms	• If sample results indicate that the contamination is at the point of use (i.e. tap, fountain) then *this may be the result of contact with a person with poor personal hygiene and not widespread contamination of the distribution system*. If this is suspected, all points of water use should be disinfected and re-sampled for confirmation. A regular disinfection routine may prevent further problems. • If these actions do not remedy the problem then an investigation should be initiated to determine the cause. • Ultra violet (UV) treatment within the distribution system can provide an additional measure of protection and confidence in drinking water quality

SECTION 4A: REMEDIAL ACTIONS

Remedial Corrective Maintenance Actions For Commonly Exceeded Water Parameters

Iron	• Try flushing for five minutes and if there is no improvement then the entire distribution system should be flushed. Develop a regular maintenance plan to include flushing the drinking water distribution system. • Insoluble iron can be removed using a filtration system • Soluble iron need to be oxidized to their insoluble form prior to filtration • Greensand can be used for iron removal, within the distribution system, through a combination of sorption and oxidation processes [15]

Lead	• The following corrective actions may alleviate the problem:
	  • Implement distribution system flushing as part of regular maintenance;
	  • Replace lead-containing taps and compression components within the distribution system with lead-free components; or
	  • Replace lead-containing piping and/or solder

Manganese	• Insoluble manganese can be removed using a filtration system • Soluble manganese need to be oxidized to their insoluble form prior to filtration • Greensand can be used for manganese removal, within the distribution system, through a combination of sorption and oxidation processes [15]
Odour	Once possible cause is known, refer to remedial action for that specific parameter. • Chemical - may be high concentrations of iron, manganese, chromium, phenols, and hydrogen cyanide • Physical – humic/humus related substances, algae growth in surface water • Microbiological – nuisance organisms (i.e. “iron bacteria”)
Residual Chlorine	• Distribution lines should be flushed and resampled until residual chlorine concentrations return. • If flushing does not result in an acceptable residual chlorine concentration then superchlorination should be performed. • If the superchlorination is not effective then an investigation should be initiated to determine the source of contamination.
Silver	• Silver can be removed during the treatment SECTION by lime-softening techniques and coagulation.
Sodium	• Remove ion exchange unit from within the distribution system, if applicable. • Sources of sodium are likely the result of the use of sodium-containing chemicals used in the treatment of drinking water.
Taste	Once possible cause is known, refer to remedial action for that specific parameter. • Chemical - may be high concentrations of total dissolved solids, sodium, iron, manganese, aluminum, zinc, copper, calcium and magnesium • Physical – turbidity, algae growth in surface water • Microbiological – nuisance organisms (i.e. “iron bacteria”)

SECTION 4A: REMEDIAL ACTIONS

Remedial Corrective Maintenance Actions For Commonly Exceeded Water Parameters

Total Coliform	• The presence of total coliforms does not necessarily mean that faecal matter has contaminated the water. Their presence does indicate that treatment may be inadequate, or that re-growth and/or infiltration may be occurring in the distribution system. A result of 1 - 10 coliforms per 100 mL must be followed up with an additional sample to confirm total coliforms were present. If the resample confirms that total coliforms are present then flushing and super-chlorination are often used to remedy the problem. If total coliforms are still observed after flushing and/or super-chlorination the cause of the contamination should be investigated and corrected through appropriate actions. If total coliforms exceed 10 per 100 mL then the above corrective actions should be taken immediately prior to confirmation through resampling. • Additional tests such as HPC, chlorine residual and turbidity may assist in determining the source of contamination. • Prior to declaring the water safe to drink, a minimum of two consecutive tests should indicate the absence of total coliforms.
Turbidity	• Flush distribution lines and superchlorinate • Filtration units can be installed for persistent problems
Trihalomethanes	• Try flushing for five minutes and if there is no improvement then the entire distribution system should be flushed. • Develop a regular maintenance plan to include flushing the drinking water distribution system.
Zinc	• Flush the distribution system

SECTION 4B: ADDITIONAL REMEDIAL ACTIONS

Exceeding Aesthetic Objectives
The taste and odour of water may be affected by a variety of substances. All possible sources should be investigated to determine whether the water has become contaminated. Remedial actions should be focused on the remediation of the offending substance rather than taste/odour improvement. While the exceeding of aesthetic parameters often does not represent an immediate health risk, their source must be investigated and corrective actions taken to ensure occupant confidence in the water source.

Routine "flushing" of drinking water fountains or related water distribution systems must be an integral and recorded part of PWGSC's regular maintenance program. Flushing of water lines for about 5 minutes shall be scheduled every 6 to 8 weeks *in all inactive areas* (such as dead-ended lines or unoccupied sections of the building) and *a flush of the entire water system, to remove sedimentary build-up, shall be performed at least once per year.*

Flushing is one of the simplest and common steps to get rid of contaminants. Care must be taken when sampling after regular flushing so as not to acquire a false sense of security. Regular flushing can rid the system of a contaminant (this is especially the case when dealing with bacteria and lead, which tend to accumulate during periods of stagnation) that may return when flushing ceases or decreases. When bacteriological problems arise or lead is a concern a worse case scenario must be applied, that is, the system should be left to sit over a period of 3 days to simulate a long weekend without occupants using the water.

Continuous "flushing" of water in drinking water fountains is an alternative and long-term method to routinely flush of drinking water fountains. One way to achieve this is with the installation of a needle valve that is set to regulate a constant water flow. Ideally this valve should be installed after the drinking water fountain's reservoir to promote constant turnover of the water. Unfortunately this does nothing for environmental concerns for water conservation and therefore, needs to be considered only where no other option remains.

Permanent removal of water fountains or taps shall also be considered. This will also reduce stagnation problems. Dead-end lines or poorly located/designed fountains shall be considered first. An accepted travel distance between water fountains (Chapter 49 of the ASHRAE 1994 Handbook recommends a 60 metre spacing or travel distance for fountains; therefore, 2 fountains would be able to cover 180 metres travel distance.

SECTION 4B: ADDITIONAL REMEDIAL ACTIONS

Superchlorination is sometimes necessary when the chlorine residual may not be able to meet the demand needed to kill all of the organisms. Introducing a large quantity of chlorine, known as superchlorinating, may reduce the bacteria to a level at which the normal chlorine residual can maintain good bacteriological water quality. This shall be done at the direction of a health specialist or a well-trained and knowledgeable individual.

Replacing all or sections of the water line shall also be considered for those extreme circumstances where no other solution is apparent.

Rerouting a new and contaminant-free water line shall also be considered for those extreme circumstances where no other solution is apparent.

Stabilization of Water, by adjusting pH (alkalinity/acidity).

SECTION 5: SAMPLING THAT INDICATES A PROBLEM

Re-sampling Without Delay
When an initial problem is discovered, one of the first steps is to resample (at the same sites as previously tested). A sample from the closest tap, on our buildings water service, to the city main (or immediately following whatever treatment system is in place) will provide information on whether the problem is originating from outside the building. If this sample is free from contaminants then the source of the problem is within the building's distribution system. Strategic sampling can prove very helpful in determining the affected areas and narrowing down where the source of the problem is.

Dirty hands could be the cause of this problem or it could be something more serious. Re-sampling must be done without delay.

When re-sampling verifies that there is indeed a problem

a) Consult with PWGSC – Environmental Services, PWGSC Environment Health & Safety and, as necessary Health Canada or Other Subject Matter Experts to determine the best course of action to take, and,

b) This information must be disclosed to PWGSC Regional Management and the client representative, in a timely manner.

Communication and Notification to Occupants of Unsafe Drinking Water
When an analysis of a water sample from a water distribution system within a facility indicates that a parameter exceeds GCDWQ MAC notification must be immediate and effective. Notification is not only important in the protection of health but also in maintaining occupant confidence; therefore, the PWGSC Property Manager must establish a notification and communication protocol.

When water has been pronounced **Unsafe for Consumption**, such as the presence of E. coli, the source of contamination must be isolated from the occupants, an alternative drinking water source must be provided and notification to occupants must be immediate. Posted signs must be easily visible and clearly warn occupants not to drink the water.

Communication shall be sent to the employer(s) of the occupants within the workplace; it is their responsibility to notify their workplace health and safety committee representatives, detailing the nature of the contamination, what is being done to fix the problem, and information on the availability of an alternative water supply. PWGSC property and maintenance management shall act in a resource/advisory capacity for these employer(s). All records, reports, and results shall be made available to employer(s) for their respective workplace health and safety committees or representatives.

SECTION 5: SAMPLING THAT INDICATES A PROBLEM

Notification must consist of, but is not limited to,

1. Immediately advising PWGSC Regional Management, this will include
   - Asset/Property Managers (PWGSC & AFD)
   - PWGSC, Environmental Services
   - PWGSC, Environmental, Safety & Health, and
   - Where building water service cessation is required, contact Corporate Communications

2. Isolating the contaminant from the occupants

3. Posting of signs at points of water use

4. Providing alternate source of water, (Bottled Water within personal 1 litre or less bottles is highly recommended over the 18 litre Bottled Water Coolers as *the 18 litre Bottled Water Coolers require rigorous maintenance to prevent the spread of bacteria*)

5. Discussions with employer(s) who will inform client workplace health and safety representatives. PWGSC may act as a resource/advisory capacity for the employer(s) and provide information sessions, where required, for the occupants.

6. Correcting the source of contamination may require the contacting of any of the following:
   - Health Canada - Environmental Health Officer
   - Municipally - Medical Officer of Health, and
   - HRDC - Labour Programs – Health & Safety Officer

Note: Do not physically shut off the building water supply or post signage throughout the building stating “Do Not Drink the Water” when adverse Lead results are discovered. As an interim measure an individual fountain, when possible, may be shut-off. It is agreed remedial action must be considered/performed, however full consultation must occur with the subject matter experts and they must review all sampling protocols, sampling results, piping construction and layout before offering remedial measures.

SECTION 5: SAMPLING THAT INDICATES A PROBLEM

WATER NOTIFICATION SAMPLE SIGNAGE

PUBLIC NOTICE:

DO NOT DRINK THIS WATER.

To the Occupants of _XYZ__building. Please do not drink the water in the fountains, taps and other outlets. Routine drinking water sampling showed elevated levels of (contaminant X) and additional tests are being conducted to ensure that drinking water meets the Guidelines for Canadian Drinking Water Quality. Bottled water (or other alternative source of water is available at (location).

Date: _____

Signed: _____

For Additional Information Please Contact:

Name:
Position:
Telephone:
Location:

Summary Wrap-Up in General

Public Works and Government Services Canada is required to be knowledgeable and to demonstrate due-diligence on matters related to drinking water. This is the required information that PWGSC must have and make available for occupants/clients and regulatory authorities, concerning water for human consumption.

This document supersedes the original Public Works and Government Services Canada compilation of a Potable Water Sampling Procedures Manual, as promulgated by the Public Works and Government Services Canada - Potable Water Quality Management Committee. While every effort has been made for accuracy, readability and practicality, the department requests all readers to verify the accuracy and applicability of this material with their respective authorities having jurisdiction and subject matter experts.

There are many different solutions to drinking water quality problems, however, at present, there is no practicable single solution to every drinking water quality problem. Regional Public Works and Government Services Canada employees should read this Drinking Water Sampling Procedures Manual in its entirety for satisfactory implementation. Additional electronic information packages are also available to assist said readers.

This Manual was written with an understanding that it is a living document that requires continual maintenance and revision; therefore, please verify that your version is the most current version by referring to the AFMS Intranet Site, located at http://source.pwgsc.gc.ca/rps/afms and follow the links to the document.

APPENDIX 1: ACCREDITED LABORATORIES

Canadian Association of Environmental Analytical Laboratories (CAEAL)

It is ***required*** that each Region has an Accredited Laboratory perform analysis of drinking water. It is not uncommon for one laboratory to sub-contract their analysis work because of workload or lack of analytical devices. Ask the laboratories if they perform this practice and request them not to do so without your expressed written permission.

On occasion laboratories lose their accreditation or other laboratories become accredited, therefore, routinely visit their website at http://www.scc.ca/certific/labs.html **to verify any changes that apply to your Region. Many of these laboratories also perform the actual sample taking.**

APPENDIX 2: HYPERLINKS – Websites & Publications

Website	URL	Description
Sanitation Directive	http://www.tbs-sct.gc.ca/pubs_pol/hrpubs/tbm_119/chap2_18_e.html	Treasury Board Directive
What's In Your Well?	http://www.hc-sc.gc.ca/ehp/ehd/catalogue/general/iyh/well_water.htm	Health Canada Publication; A guide to Well Water Treatment and Maintenance
Guidelines for Drinking Water Quality	http://www.who.int/water_sanitation_health/GDWQ/GWDWQindex.htm	A World Health Organization publication
Giardia and Cryptosporidium in Drinking Water	http://www.hc-sc.gc.ca/ehp/ehd/catalogue/general/iyh/giardia.htm	Health Canada Fact Sheet
Questions and Answers on Bottled Water	http://www.hc-sc.gc.ca/food-aliment/english/organization/microbial_hazards/faqs_bottle_water_eng.html	Health Canada publication
Canadian Bottled Water Association	http://www.cbwa-bottledwater.org/ and http://www.cbwa-bottledwater.org/en/brands.htm	CBWA Questions & Answers CBWA Current Members who Supply Bottled Water
Lead and Human Health	http://www.hc-sc.gc.ca/ehp/ehd/catalogue/general/iyh/leadhum.htm	Health Canada publication
Agriculture & Agri-Foods Canada	http://www.agr.ca//food/industryasso/mandates/bottledwater_e.html	Sub-Sector Profile
Health Canada – Water Quality	http://www.hc-sc.gc.ca/ehp/ehd/catalogue/bch_pubs/dwgsup_doc/dwgsup_doc.htm and http://www.hc-sc.gc.ca/ehp/ehd/bch/water_quality.htm	Guidelines for Canadian Drinking Water Quality - Supporting Documents
Canadian Association of Environmental Analytical Laboratories (CAEAL)	**http://www.scc.ca/certific/labs.html**	Current Listing of CAEAL **Accredited Laboratories**

*This is "under construction" and by no means a complete reference source. Your input is welcomed and appreciated; dan.strickland@pwgsc.gc.ca.

APPENDIX 3: BOTTLED WATER COOLER MAINTENANCE 18 litre

Cleaning your water cooler *after every refill*:

1. Unplug cord from electrical outlet of cooler.
2. Remove empty bottle.
3. Drain water from stainless steel reservoir(s) through faucet(s). Prepare a disinfecting solution by adding one-tablespoon (15 mL) household bleach to one Imperial gallon (4.5 L) of water solution. This solution should contain over 100 ppm of chlorine. Other disinfecting solutions may be suitable. Some companies suggest using one part vinegar to three parts water solution to clean the reservoir of scale before cleaning with bleach. Consult your water cooler manufacturer and water cooler supplier.
4. Wash reservoir thoroughly with bleach solution and let stand for not less than two minutes (to be effective) and not more than five minutes (to prevent corrosion).
5. Drain bleach solution from reservoir through faucet(s).
6. Rinse reservoir thoroughly with clean tap water, draining water through faucets, to remove traces of the bleach solution.

Drip Tray/Screen and Faucets:

1. Remove the screen and wash tray/screen in mild detergent.
2. Rinse well in clean tap water and replace on cooler.
3. Clean exterior of faucets with a mild detergent and rinse with a damp cloth. Sanitize with an alcohol swab.

Replacing Bottle:

1. Wash hands with soap and warm water before handling. If you choose to use clean protective gloves (ex. latex), discard or disinfect after each use and prior to reuse.
2. Wipe the top and neck of the new bottle with a paper towel dipped in household bleach solution (1 tablespoon (15 mL) of bleach, 1 gallon (4.5 L) of water). Rubbing alcohol may also be used, but must be completely evaporated before placing the bottle in the cooler.
3. Remove cap from new bottle.
4. Place new bottle on cooler.

Bottled Water Sources

Currently bottled water does not have to meet the Guidelines for Canadian Drinking Water Quality (GCDWQ). In Canada, Bottled Water is considered a “food” and is therefore governed by the Canadian Food and Drugs Act; therefore, jurisdiction is with the Canadian Food Inspection Agency (CFIA) of Agriculture Canada. Bottled Water recalls are found at their website, **http://www.cfia-acia.agr.ca/english/corpaffr/foodrecalls.html**

Agriculture Canada currently has an excellent link on bottled water at http://www.agr.ca//food/industryasso/mandates/bottledwater_e.html

Reference can also be made to the Canadian Bottled Water Association at their website: www.cbwa-bottledwater.org

APPENDIX 4:

LISTED CANADIAN BOTTLED WATER ASSOCIATION SUPPLIERS

As the information on the listed suppliers changes frequently you are strongly advised to visit the Website provided at page bottom. The bottled water produced by members of the CBWA has met any applicable government and CBWA standards.

List of brands (as of November 29, 2002):	Avalon	Avena	Big 8
Blue Water	Canada's Choice	Canada's Original Iceberg Water	Canadian Springs (Kamloops)
Canadian Springs (Prince George)	Canadian Springs (Richmond)	Canadian Springs (Victoria)	Cedar Springs
Columbia Ice	Cool Spring Water	Crystal Springs	Culligan Brampton)
Culligan (Kapuskasing)	Culligan (Saskatoon)	Culligan (Surrey)	Culligan (Winnipeg)
Culligan (Woodstock)	Danone (Mississauga)	Echo Springs	Esker
Evian	Glacier's Eagle	Icewater	Iroquois (Revelstoke)
Labrador (Chicoutimi)	Misty Mountain	Mountain Spring Water	Muskoka Springs
Naya	Neva Springs	Oak Hills Artesian Water	Ontario Gold Beverage
Polaris	Rocky Mountain (Calgary)	Sparkling Springs	Sparta (Alberta)
Sparta (Edmonton)	Spirit	Sugarloaf Spring Rain	Sun Mountain
Viking	Whistler		

http://www.agr.ca//food/industryasso/mandates/bottledwater_e.html

APPENDIX 7: COMMON CONTAMINANTS AND THEIR SOURCES

Common Contaminants and their Sources within a Building Water Distribution System

Parameter	**Possible Source(s)**
Aluminum	Addition of aluminum salts in the coagulation stage of water treatment (disinfection byproduct), also through contact with piping and solder in the distribution system
Arsenic	Contact with copper pipes and solder
Cadmium	Contact with copper pipes and solder Impurities in the zinc that occur as a result of the corrosion of galvanized pipes
Copper	Contact with copper or brass piping and solder Elevated copper levels enhance the leaching of aluminum and zinc
E. coli and/or faecal coliforms	Ineffective disinfection, cross connections, dead-ends or areas with stagnant water, breakaway contamination from secondary treatment
Iron	Contact with copper, steel, cast or ductile iron, or galvanized iron High iron concentrations may result from the use of iron salts for coagulation during water treatment processes
Lead	Contact with lead pipes and/or lead solder combined with low pH (leaching occurs) Contact with copper and copper alloy or brass fittings and solder joints
Residual Chlorine	Low concentrations may indicate ineffective disinfection during treatment, stagnant water or contamination within the distribution system
Silver	May be found in high concentrations if silver is used in devices for anti-microbial treatment
Sodium	Result of ion exchange either during the treatment stage or a result of ion exchange units within the distribution system
Tin	Contact with copper piping or solder in the distribution system
Total Coliform	Contact with microbiological contaminant (i.e. unhygienic person, dirty dish cloth), cross connections, dead-ends or areas with stagnant water, breakaway contamination from secondary treatment
Trihalomethanes	Reactions between chlorine residuals and organic substances (increase with larger residence times)
Zinc	Corrosion of galvanized pipes

Guideline for Lead in Drinking Water

Health Canada

The maximum acceptable concentration (MAC) for lead in drinking water is 0.010 mg/L as legislated by Heatlh Canada. The relationship written below shows how the MAC is calculated based on a number of determining factors. It is primarily important to note that the World Health Organization uses a consumption of 2 liters by a person weighing 60 kg to establish guidelines, however, where it has been found that infants/children are at a particular higher risk from exposure to a chemical the guideline was derived on the basis of a 13.6 kg child consuming 0.6 litres of water per day. Health Canada has applied this reasoning to establish guidelines for lead, and has employed the formula listed below to help determine MAC. By the same token this formula can also be used to calculate the daily water consumption that is required to exceed the Average Daily Intake (ADI) of Lead.

(1) $$MAC = \left(\frac{ADI \times BW \times 0.098}{WC} \right) = 0.008 \text{ mg/L (round to } 0.010 \text{ mg/L)}$$

Where: MAC = Maximum Allowable Concentration (0.010 mg/L)
ADI = Acceptable Daily Intake (0.0035mg/kg bw per day for a child)
BW = 13.6 kg, the average Body Weight of a 2 year old child.
0.098 = The proportion of total daily intake allocated to drinking water.
WC = 0.6L/day, the average daily Water Consumption for a two-year old child.

Rearranging this formula will yield the average daily water consumption by an individual (adult or child) to meet or exceed the ADI. Officials will then be able to monitor the amount of water intake that once exceeded will lead to over consumption of lead.

(2) $$WC = \left(\frac{ADI \times 0.098 \times BW}{MAC} \right)$$

Again, the 0.098, MAC, and ADI remained constant, to faciliate the higher risk case of a child.

World Health Orgonization

The method adopted by Health Canada is closely related to the method used by the World Health Orgonization (WHO). The WHO derives the guideline values (GV) for tolerable daily intake of lead as follows:

(3) $$GV = \left(\frac{TDI \times bw \times P}{C}\right)$$

Where: bw = body weight (60 kg for adults, 10 kg for children, 5kg for infants)
P = fraction of the TDI allocated to drinking-water (0.113 for adults and 0.098 for children)
C = daily drinking-water consumption (2 litres for adults, 1 litre for children, 0.75 litre for infants).
TDI = Tolerable daily intake, an estimate of the amount of lead, that can be ingested daily over a lifetime without appreciable health risk. (0.00714 for adults, 0.0035 for children)
GV = Guideline value for lead in drinking water is 0.010 mg/litre.

To illustrate how these regulations imposed by World Health Organization and Health Canada are to be used within PWGSC buidings, some examples follow.

Example 1. Adult Daily Water Consumption using World Health Organization

GV = 0.010mg/L
TDI (adult) = 0.00714 mg/L
Bw (adult) = 60 kg
P = 0.0113

The daily drinking-water consumption to exceed the TDI is

$$C = \left(\frac{0.00714 mg/kg \text{ bw per day} \times 60 kg \times 0.113}{0.010 mg/L}\right) = 4.8 \text{ L/day}$$

Example 2. Child Daily Water Consumption using World Health Organization

GV = 0.010 mg/L
TDI (child) = 0.0035 mg/kg bw per day
Bw (child) 13.6 kg
P = 0.0098

The daily drinking-water consumption to exceed the TDI is:

$$C = \left(\frac{0.0035 \text{mg/kg bw per day} \times 13.6 \text{kg} \times 0.098}{0.010 mg/L} \right) = 0.47 \text{ L/day}$$

Example 3. Adult Daily Water Consumption using Health Canada

MAC = 0.010 mg/L
ADI = 0.0035 mg/kg bw per day
Bw = 50 kg

$$WC = \left(\frac{0.0035 mg/kg \text{ bw per day} \times 0.098 \times 50 kg}{0.010 mg/L} \right) = 1.72 \text{L/day}$$

WHY IS BOTTLED WATER BEING USED?

A. **SUSPECT WATER QUALITY**

1. Perception
2. Lack of water quality awareness (ignorance of issues)
3. Media hype
4. Ignorance of water quality reading and analysis
5. Conflicting regulatory requirements
6. Bottled Water Marketing - fashionableness of bottled water
7. BW is treated as a beverage with great marketing, while municipally supplied water is not advertised and is perceived as inferior quality

B. Non-potable water

1. Multiple regulatory requirements
2. Aged/deteriorated building systems
3. Stagnation of water in building systems
4. Inconsistent Sampling protocols
5. Historical Construction techniques (i.e. Lead solder)
6. Groundwater contamination
7. Regimen and statistics not in place for potable water quality inspections
   a. Policy
   b. PWGSC does not know the number of or incidence of BW coolers used within our facilities;
   c. The national costs to PWGSC or GOC in providing BW is unknown for either emergency usage or non-emergency usage;

d. BW usage means less usage of building water fountains and therefore stagnation which leads few remaining water fountain users to complain about water fountain quality causing the belief that BW is a safe alternative;

WHO?

A. Under Canada Labour Code and Treasury Board, PWGSC is required to provide Potable Water

B. Ownership of BW Coolers is often client specific, therefore, individual water supply contracts exist which may be external to PWGSC/Client Agreements

C. Treasury Board, PWGSC and Clients, share responsibility for potable water in facilities.

What Are The Issues With Bottled Water (BW)?

A. **Hygiene**

1. Lack of hygienic procedures/cleaning each time a cooler/jug is replaced
2. Unsanitary handling can be transmitted to the consumer

i. some clients have contracted monthly/annual cleaning from suppliers

ii. suppliers have recalled/replaced dispensers for clients

iii. suppliers have begun replacing exposed dispenser spigots/taps with recessed flow taps, however, the risk of bacteria contact still exists

B. **Maintenance**

1. In most instances, there is no maintenance program for coolers
2. Electrical outlet required for cooler operation
3. Minor but potential fire risk
4. Possible electrical hazard
5. Unknown electrical consumption which is considerable when we begin adding all these coolers within a building such as 90+ at Place du Portage Phase IV;
6. Stagnation occurs within building water distribution system (fountains) when water coolers are used

i. Stagnation causes Aesthetic Complaints, and worse, it can cause excessive lead levels

C. **Associated Risks:**

1. Health Canada's Food & Drug Act - Div 12, applies to BW and the general population is ill-informed when they view BW as having greater quality control than municipal waterworks
2. Contaminated transfer of BW or contaminated at-the-tap usage of BW is a significant hygiene risk
3. Small overflow tray and sloppy transfer of jugs causes spills which can be a mould hazard
4. Danger for back-injury lifting a 23+kg water cooler jug
5. Violation of Canada Labour Code Part II - COSH Regulation Part XIV for Materials Handling 14.48 requires instruction and training of employees when they are required to lift or carry more than 10kgs, and associated record-keeping is also required
6. Chlorine or bleach used if/should clients sanitize coolers with each 18 litre replacement
7. Small overflow tray and sloppy transfer of jugs causes spills which can be a slipping hazard
8. Someone can tamper with a jug and thereby, harm a number of persons without exposing themselves to security
9.

WHERE

A. **PWGSC owned, leased and managed facilities.**

WHEN DO WE USE BW

A. **What Should be happening**

1. A formal water quality inspection regime should be implemented.
2. After negative sampling results are confirmed by secondary sampling then temporary provision of BW
3. Remedial action to building water supply, resupply of building water supply and then removal of BW

B. **What is Happening**

1. Clients are unilaterally supplying their own water; thereby stagnation occurs of building water system
2. Clients and other users are misinterpretting results and responding with good faith but erroneous actions, that include shutdown of building water supply system and provision of BW
3. PWGSC is caught between disperate regulatory requirements and differing implementation by various authorities having jurisdiction

-END-

At Issue: In an effort to reduce the perceived health risk of exposure to Legionella bacteria, there has been an increase in building hot water systems temperature to 50 degrees C or higher. While being as limiting, as possible, to Legionella growth PWGSC building hot water systems must be made safe from scalding to users.

Quick Facts:

- There are no known or recorded instances of Legionella at federal government occupancies.
- Legionellosis occurs in nature and is a bacteria of the species Legionella; it is not a communicable disease/illness with 2 distinct forms, Legionnaire's Disease, a pneumonia illness and Pontiac Fever, which is a flu-like illness, without pneumonia.
- Legionella pneumonia develops after inhalation of asperated droplets or mists, by a susceptible host; ie, a person with a compromised immune system, such as organ transplanted persons or cancer patients taking a shower.
- Exposure to Legionella may occur anywhere, from our homes, workplaces and public places visited during routine daily activities or during travel.
- Only if Legionella bacteria are quantitatively detected by subject matter experts is it advised to *briefly* elevate hot water temperatures.
- Most existing PWGSC water systems do not have tempering devices and are equipped with one "Hot" and one "Cold" water faucet, therefore, costs associated with providing a single necked hot-cold faucet, and tempering devices or allowing for manual mixing of water does not remove risk of scalding.
- Additionally fresh cold water can re-introduce Legionella to the heated water supply, thereby, defeating the purpose of elevated hot water temperatures.
- Costs associated with the legal and liability implications from scalding victims suing PWGSC, or clients, could be significant.
- Costs associated with heating all PWGSC hot water systems (nationally) to these higher temperatures and maintaining it there, are considerable, with an impact on Sustainable Development and non-renewable energy

What Regulations exist?

Canada Labour Code Part II, Canada Occupational Safety & Health Regulations, Part IX for Sanitation, 9.18 states "Hot water provided for personal washing shall be maintained at a temperature of not less than 35C and not more than 43C; and
shall not be heated by mixing with steam."
Treasury Board Guideline, Chapter 2-18, Sanitation Directive #30 states "Where hot water is provided for washing purposes, it shall be maintained at a temperature of not less than 35C and not more than 43C and in no case shall water be heated by mixing with steam."

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. ASHRAE Guideline No. 12-2000, entitled "Minimizing the Risk of Legionellosis Associated with Building Water Systems". This guideline provides information and guidance in order to minimize Legionella contamination in building water systems.

- Clarity is needed when reading "4.1.6 Recommended Treatment" as it applies to high-risk locations, meaning hospitals and nursing homes and only for those instances *AFTER discovery of Legionella*, does it advise short-term raising of hot water temperatures.

- This guideline does generalize for storage temperature and states "Where practical in other situations, hot water should be stored at temperatures of 49C." Most PWGSC buildings fall into this "*other situations"* category.
- It must be understood that technical aspects, such as heat loss calculations and the run/length of piping, are required to be done before determining hot water tanks storage temperature.

Conclusions

- PWGSC must comply with the Canada Labour Code Part II, Canada Occupational Safety & Health Regulations, Part IX for Sanitation, 9.18 and the Treasury Board Guideline, Chapter 2-18, Sanitation Directive; therefore, our hot water point of use (faucet) need to normally be maintained at a temperature between 35-43C.
- Annual monitoring for Legionella by culturing of samples from the building water system, is recommended, with associated record-keeping
- When Legionella is discovered within the building water system, immediate consultation with A&ES, Environmental Services and GOS-Environmental, Health & Safety is required and it is recommended PWGSC utilize ASHRAE Guideline No. 12-2000 for a limited time period, such as 1-3 days.

-End-