University of Toronto
Utilities and Building Operations

Water Maintenance Program (Legionella in Potable Water Systems)

Date: 06 April 2023

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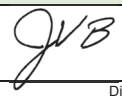
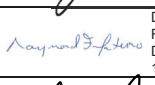
Author	**Jelena Vulovic-Basic**	**Senior Manager, Building Mechanical Services**		06/04/2023
Approver	**Raymond Monteiro**	**Dir. Utilities and Building Operations**	 Digitally signed by Raymond Monteiro Date: 2023.04.06 16:00:36 -04'00'	06/04/2023
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University of Toronto - Water Maintenance Program

Purpose

The purpose of this document is to describe the operation, treatment, and maintenance, including testing procedures for *Legionella* spp. (*Legionella* species, *Legionella pneumophila*, and *Legionella pneumophila* serogroup 1) in water, that will confirm the potable water system is functioning effectively during university regular operation.

Potable (drinking water) water systems function effectively when potable water is distributed to the point of use in a manner ensuring safety of the user by controlling the contaminants in the water below the standards (see Section 7).

For more information on Lead in Potable Water Systems, please see ehs.utoronto.ca/lead-in-potable-water-systems.

Legionella

1. Waterborne Pathogens

Legionella bacteria is ubiquitous to the environment – water, soil and sediment. Thus it is found in natural water environments (rivers, lakes, ponds, and reservoirs) and can be found in soils and mud. It can also be found within biofilm growing inside a building's plumbing and given a suitable condition, it can form biofilm from which the bacteria may be released from taps, showerheads and other points of discharge. There are several important factors that provide an environment for *Legionella* to multiply including, the water temperature, the presence of biofilm, water stagnation and the type of plumbing material and components present. Therefore, a water management program is needed to address potential amplification (growth) sites within the potable water systems.

2. Scope of Water Maintenance Program

This Water Maintenance Program is specific to the University of Toronto's potable hot and cold water only during university regular operation.

This program does not cover Re-Entry Maintenance Procedure - protocol to be followed if a low-flow or shutdown condition exists for 4 consecutive weeks within a specific building or across the campus. The historical re-entry procedure will be used as a reference point and updated as required – Appendix A.

The ongoing operational maintenance at the point of use such as drinking fountains and water refill stations is not included in this scope.

3. **Procedures within Maintenance Program**

The Water Maintenance Program is composed of three procedures, each of which is further described below:

1. Preventative Maintenance Procedure - ongoing maintenance on a fixed schedule
2. Predictive Maintenance Procedure - a risk-based predictive approach based on testing results
3. Reactive Maintenance Procedure – remedial actions based on predictive maintenance procedure results

4. **Reference documents**

Water testing for *legionella* and remedial activity in this document is guided by the following two sources:

- **Public works and Government Service Canada**

  MD15161-2013 Control of Legionella in Mechanical systems

- **Ontario Agency for Health Protection and Promotion (Public Health Ontario)**
  Legionella: Questions and Answers 2nd Edition Toronto ON; Queens Printer for Ontario: 2019

5. **Preventative Maintenance Procedure**

Ongoing, regular maintenance of the potable water system is required to ensure the integrity of the water. The specific tasks and frequency are outlined below:

Scheduled Preventative Maintenance Tasks	Frequency
Verify hot water storage maintained at 60°C (140°F)	Monthly
Drain, flush and clean domestic hot water tanks	Annual

6. **Predictive Maintenance Procedure**

The predictive maintenance procedure consists of scheduled testing (i.e., monitoring for presence of *Legionella)*. *Legionella* testing is performed at least **annually** using qPCR DNA *Legionella* Test method (ISO 11731-1998 and 150/TTS 11731-2-2004) and/or concentration of Colony Forming Units (CFM) to understand the presence of *Legionella* in potable water systems.

7. Reactive Maintenance Procedure

Remedial actions are based on testing results obtained during predictive maintenance procedure. The measurements are categorized into different levels based on the concentration of CFU found, as follows:

1. Green - (0 to 10 CFU per ML)
2. Orange - (11 to 100 CFU per ML)
3. Red - (101 to 1000+ CFU per ML)

Based on the categorization of results, remediation is required through response protocols described below.

Occupants will be advised of orange and red *Legionella* test results through Facilities and Services alerts. In addition, occupants are notified not to use the source for red results through signage at the testing location. All *legionella* testing results are posted on the EHS website and distributed to appropriate Joint Health & Safety Committee(s).

a) Green
- *Legionella* Bacterial Count less than 10 CFU per ML

Response Protocol

- Continue with standard operations and maintenance

b) Orange
- *Legionella* Bacterial Count 11 CFU to 100 CFU per ml

Response Protocol

- Continue with standard operations and maintenance
- Verify storage tank operating temperature minimum 60°C (140°F)
- Flush at point of use as soon as possible:
  - Increase the storage tank to at least 70 °C (158 °F)
  - Remove water mixing valve and faucet aerator at point of use. Place both mixing valve and aerator into container with solution of water and minimum of 2.25% hypochlorite, for one hour.
  - Flush hot water for at least 30 min each. Record temperatures at point of use.
  - After flush, reinstall mixing valve and faucet aerator then flush with cold water for 10 – 15 minutes to remove bleach from system.

- After flush at point(s) of use verify storage tank operating temperature minimum 60°C (140°F)
- Retest 36 hours later

c) Red

- *Legionella* Bacterial Count 101 CFU to 1000+ CFU per ML

Response Protocol

- Isolate the point of use location from public usage as soon as possible. Place signage and caution tape.
- Flush the point of use location using the described level orange procedures as soon as possible.
- If potable water source is suspected as a source of *Legionella* bacteria flush the point of use location using orange procedure after disinfecting the system
- Following flushing verify storage tank operating temperature minimum 60° C (140°F)
- Retest 36 hours later

d) Disinfection of the system

Follow this procedure if it is deemed that the whole system needs to be disinfected based on the results (e.g., red results in frequently used fixtures and/or reoccurring red results perform disinfection of the system).

Thermal shock treatment is the preferred method. The process is outlined as follows:

- Increase Storage Tank Temperature to at least 70°C (158°F) prior to treatment and keep it at that temperature minimum for 24 hours.
- Once the tank temperature is increased to at least 70°C (158°F), progressively flush each outlet in the system while maintaining the tank temperature as follows:
  - Remove water mixing valve and faucet aerator at point of use. Place both mixing valve and aerator into container with solution of water and minimum of 2.25% hypochlorite, for one hour.
  - Flush hot water for at least 30 min . Record temperatures at the point of use.
  - After flush, reinstall mixing valve and faucet aerator then flush with cold water for 10 – 15 minutes to remove bleach from system.
- Retest system 36 hours later.

If thermal shock disinfection method is not successful, a building specific plan will be developed that could include other methods for water distribution system disinfection such as but not limited to: hyperchlorination, inspection of dead legs and/or infrequently used fixtures and their subsequent removal; replacement of mixing valves & associated branch piping; installation of domestic hot water recirculation; replacement of domestic hot water heater; etc.

APPENDIX A – Reference WMP September 22, 2022

1. Re-Entry Maintenance Procedure

The City of Toronto Water service is continually in use, as such not considered stagnant. The immediate building feed from the city water main to the building is continuously moving as illustrated by monthly City Water Billings. The location of possible water stagnation is internal to the individual buildings, and accordingly flushing will focus on that aspect.

The procedure is to prepare the University of Toronto potable water systems serving the campus buildings for re-entry after a prolonged shutdown or low-flow situation that exceeds four weeks.

Facilities to apply Flushing Procedure

Since the main pathway for exposure to *Legionella* is breathing aerosols, the risk arises from activities creating small droplets (aerosols) inhaled by the individual. As such, the areas of flushing to remove or minimize the legionella risk are as follows.

1. Sinks or hand/face wash facilities, custodial sinks, ice machines, hose bibs, generally all outlets creating mist. (Spray from taps and steam)
2. Food Preparation
   a. Serveries (Spray from taps, coffee machine)
   b. Kitchenettes (Spray from taps, coffee machines)
3. Showers or bath areas due to creation of steam / mist
4. Toilet or Urinal facilities (swirling action of flushing)
5. Drinking Fountains

Flushing Procedure:

Step 1 - Identify all risk locations as described that have not been used in the last four weeks (PPE requirements identified further in the document)

Step 2 – Remove all components from the fixtures that create the risk.

a. Shower Heads
b. Faucet Aerators

Place the removed components in solution containing 2.25% sodium hypochlorite solution during the step 3 activities to remove any contaminants.

Step 3 - Commence flushing depending on specific facilities as follows:

a. Sinks or Hand/Face wash Facilities/Food Preparation Areas*

1. Cold Water
   Flush cold water until the water is clear, and once clear, for a further 10 minutes. If water becomes turbid (discoloured) during flushing, continue flushing until it becomes clear again, and for a further
   10 minutes once clear. To minimize splashing place a cloth or shroud over the faucet enabling the water to drop to the drain contained in the shroud.

2. Hot water
   After cold water flush, flush hot water at 50°C (122°F) for 15 minutes. If the water becomes turbid, flush until water becomes clear, and for a further 15 minutes once clear. To minimize splashing place a cloth or shroud over the faucet enabling the water to drop to the drain contained in the shroud.

   *Food preparation areas as described above to be flushed using the same methodology as 'Sinks or Hand / Face Wash Facilities". Any equipment left undrained during last 4 weeks must be drained then cleaned in accordance with the original manufacturer's instructions.

b. Showers and Bathing Areas:

1. Remove the showerhead and the faucet aerator, then place them in a 2.25% sodium hypochlorite solution. Affix a hose over the shower pipe to empty directly to the floor drain. Place a towel over the hose at the floor drain to eliminate the possibility of spray or splash back. Flush the faucet at the same time as the shower; ensure splashing is minimized by using a shroud.

   Cold Water

2. Flush cold water until the water is clear, and once clear, for a further 10 minutes. If water becomes turbid (discolored) during flushing, continue flushing until it becomes clear again, and for a further 10 minutes once clear. To minimize splashing place a cloth or shroud over the faucet enabling the water to drop to the drain contained in the shroud.

Hot water

3. After cold water flush, flush hot water at 50°C (122°F) for 15 minutes. If the water becomes turbid, flush until water becomes clear, and for a further 15 minutes once clear. To minimize splashing place a cloth or shroud over the faucet enabling the water to drop to the drain contained in the shroud.

4. Remove towel and or shroud and place it in the bleach solution. Remove hose and place it in the bleach solution to remove possible contaminants.

5. Replace the showerhead and aerator; turn on water to ensure it is not leaking.

c. Toilets and urinals:

1. The toilets and urinals operate using cold water provided by the City of Toronto at approximately 8°C (46°F). Legionella is considered a low risk in water colder than 20°C (75°F). If the facilities have not been used or cleaned in the past four weeks, the facilities to be flushed twice to remove line debris.

d. Drinking Fountains:

1. Drinking fountains are operated using cold water, less than 20°C (75°F), and therefore legionella is considered a low risk. Fountains should be flushed for 10 minutes to clear the system including any accumulated debris that might exist. The ongoing operational maintenance at the point of use such as drinking fountains and water refill stations is not included in this scope.

Required Personal Protective Equipment (PPE):

The individuals performing the described flushing (except water fountains) are required to use the following PPE.

1. Gloves (Green Nitrile Examination Gloves – powder free & latex free)
2. Fit tested respirator with P100 filtration.

Verification of procedure effectiveness:

Buildings that have been subject to the above procedure will be randomly tested using an appropriate sampling system using a legionella quick test methodology performed by a competent trained individual, overseen by the University EHS Department. The preferred testing in accordance with ISO 11731-1998 and 150/TTS 11731-2-2004 uses the qualitative polymerase chain reaction (q-PCR DNA) methodology.

Document Change Control

This document is change controlled by the signatory committee identified on the title page. All changes to this document must be justified and approved by Director Utilities and Building Operations, Director Research Safety & Compliance and Exec. Director Occupational Health. The changes/revisions will be documented in the following table.

This document will be reviewed and edited as required using Change Control every five years.

Document Section Revision	Revision Description	Date
Scope of Water Maintenance Program	Addition – The ongoing operational maintenance at the point of use such as drinking fountains and water refill stations is not included in this scope.	14 September 2022
(2) Preventative Maintenance Program (PM) (Risk Based PM Indicators) (9) Hot Water	Addition – (Excluding emergency showers)	14 September 2022
(2) Preventative Maintenance Program (PM) (Risk Based PM Indicators) (F) Cold water	Remove – Shower facilities eye wash stations are flushed weekly) - High	14 September 2022
(3) Re-entry Maintenance Procedure (Drinking Fountains)	Addition – The ongoing operational maintenance at the point of use such as drinking fountains and water refill stations is not included in this scope.	14 September 2022
(3) Re-entry Maintenance Procedure (Required personal protective equipment (PPE) (Results of verification testing (Response Protocol)	Correction – 150/TTS 11731-2-2004 to ISO/TTS 11731-2-2004	14 September 2022
(3) Re-entry Maintenance Procedure (Remedial Action Based on Categorization (Red) (Communication)	Correction – Occupants will be advised of orange and red *Legionella* test results. Notifications will occur through existing facilities management notification processes. Signage will be posted at point of source location for red level test results.	14 September 2022

	To Occupants will be advised of orange and red results through Facilities and Services alerts. Identification will be placed at point of source for red results only using signage and caution tape.	
Document Change Control	Correction – All changes to this document must be justified and approved by Director Utilities and Building Operations, Director Research Safety and Compliance, Director Occupational Health and Safety, Chemical & Laboratory Safety Specialist, and site Senior Bio-Safety Officer. To All changes to this document must be justified and approved by Director Utilities and Building Operations, Director Research Safety and Compliance and Exec Director Occupational Health and Safety	14 September 2022
Purpose of Maintenance Program	Purpose, Lead and Lead surveillance replaced with Purpose section.	5-Apr-23
Legionella	Sections (Scope, Procedures and Waterborne Pathogen) rearranged & formatted #4 Reference document: Added Preventative Maintenance Procedure: Scheduled Preventative Verification (monitoring for presence of *Legionella*) removed Predictive Maintenance Procedure: Risk Based Predictive Maintenance Indicators, Building Prioritization Categorization removed Reactive Maintenance Procedure: Added	5-Apr-23
Re-Entry Maintenance Procedure	Re-Entry Maintenance Procedure moved to Appendix A for reference	5-Apr-23
Results of Verification testing (Response Protocol):	Results of Verification testing (Response Protocol) section removed	5-Apr-23