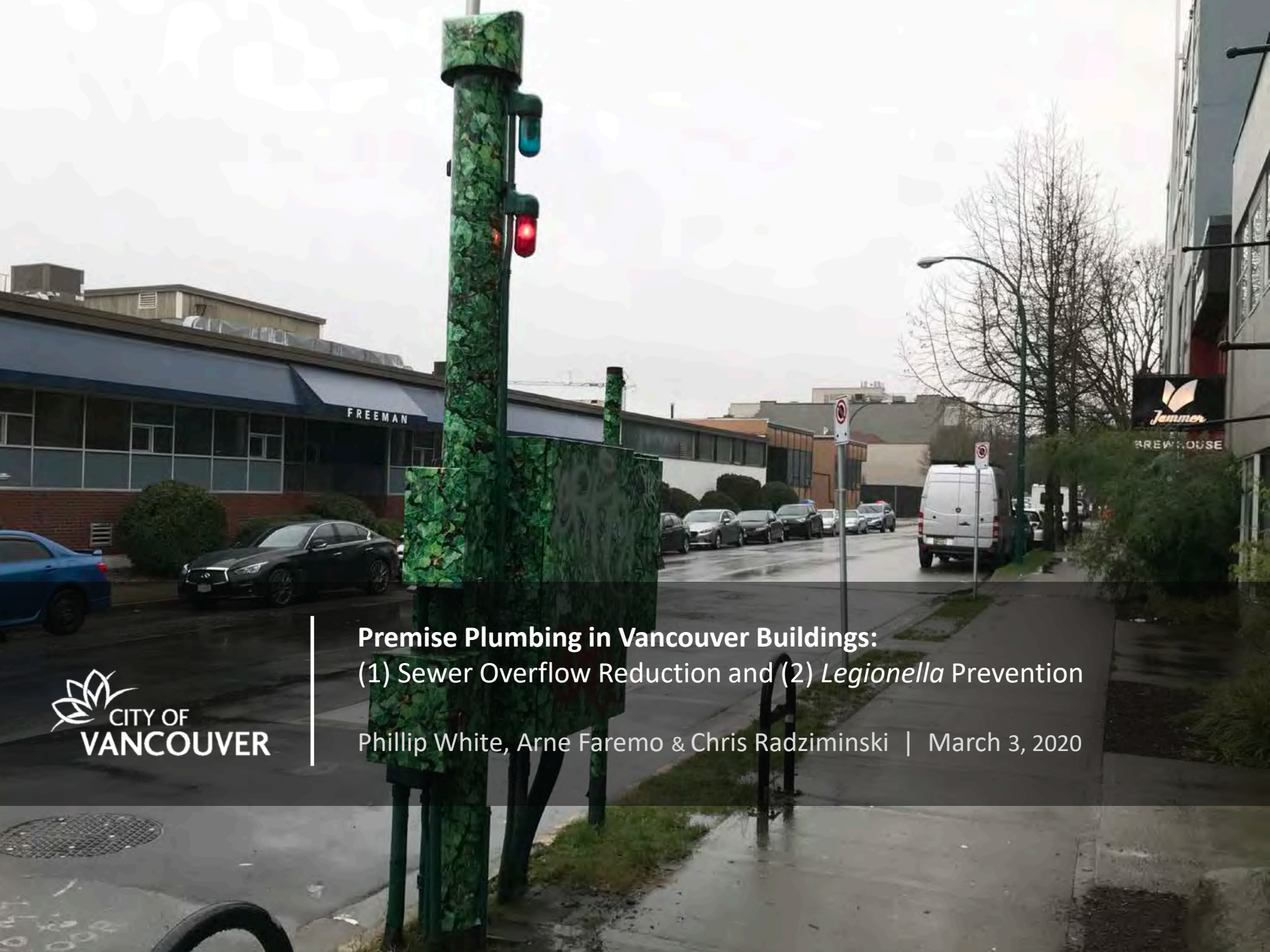
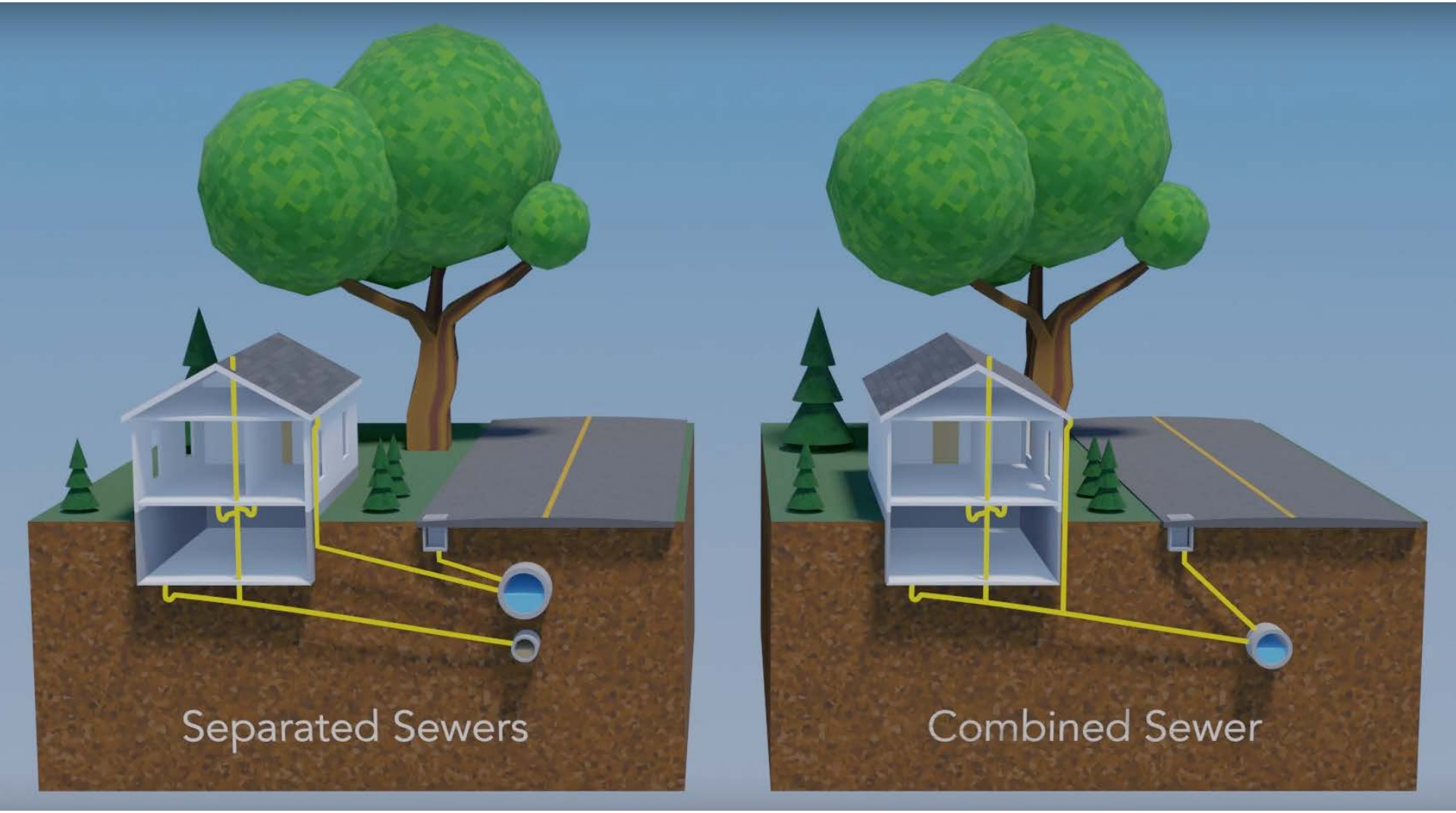


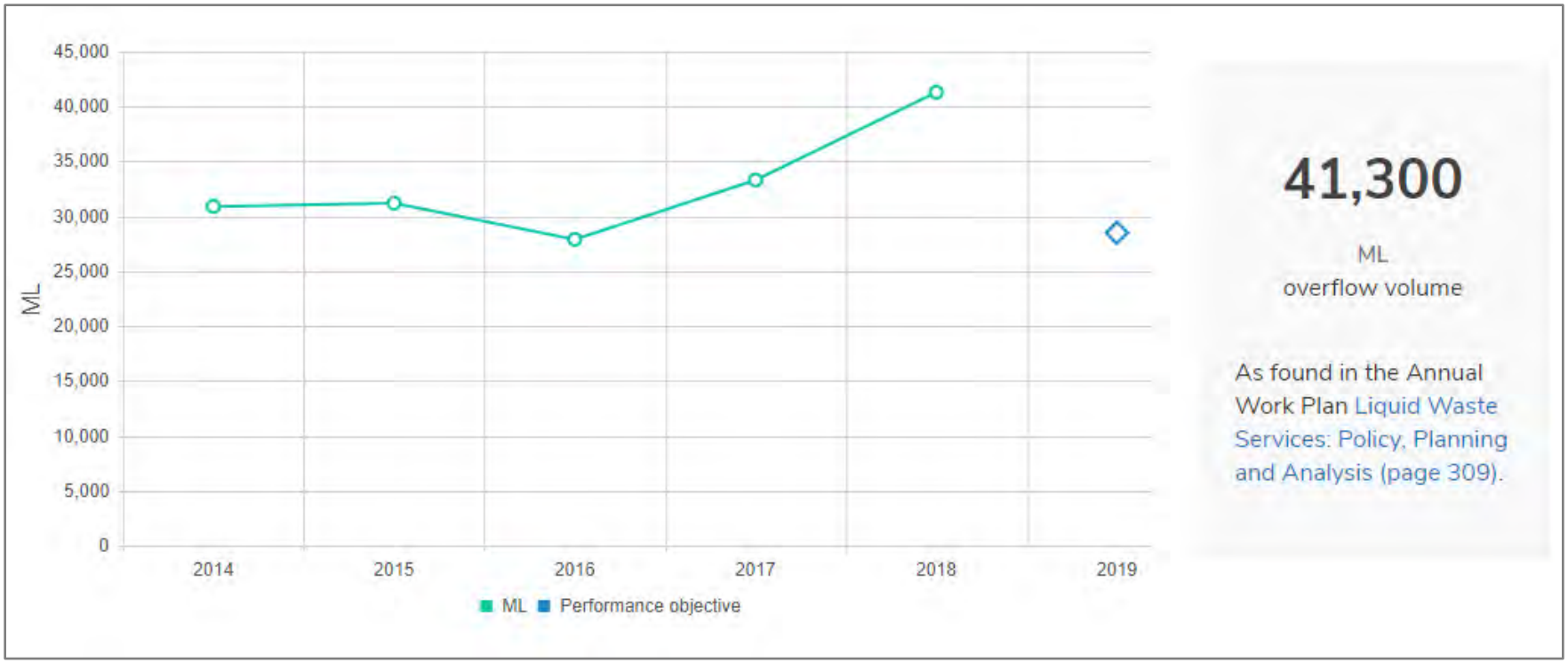
CITY OF VANCOUVER

Premise Plumbing in Vancouver Buildings:
(1) Sewer Overflow Reduction and (2) *Legionella* Prevention

Phillip White, Arne Faremo & Chris Radziminski | March 3, 2020

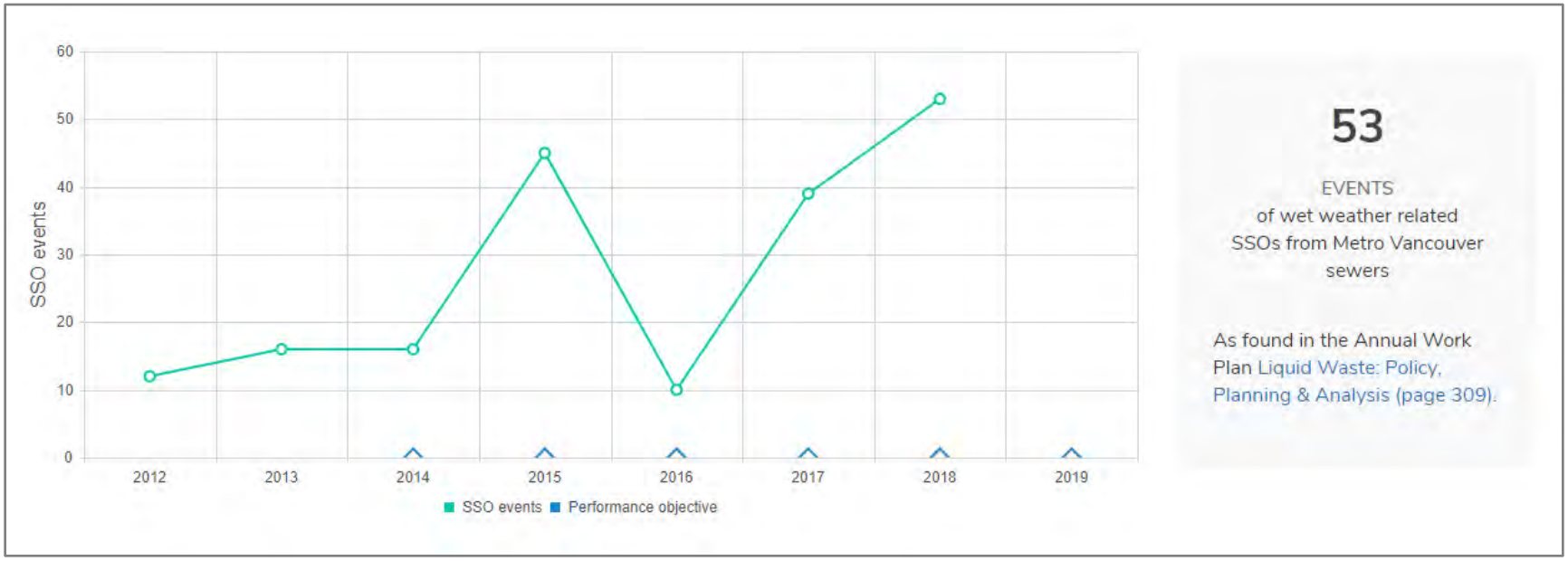


Source: City of Hamilton, ON
youtube.com/watch?v=iewH6iJMtS0



- **41,300,000,000 litres** of combined sewer overflows (CSO) in 2018.
- **Additional CSO** volumes from the City of Vancouver — but no data.
- "… British Columbia is responsible for the **highest volume** of untreated effluent discharged from CSO points (**38%**)."

Sources: Metro Vancouver (chart) and Environment and Climate Change Canada (quote),
metrovancouver.org/dashboards/services/liquid-waste/Pages/Annual-Combined-Sewer-Overflow-Volume.aspx
publications.gc.ca/site/eng/9.871652/publication.html

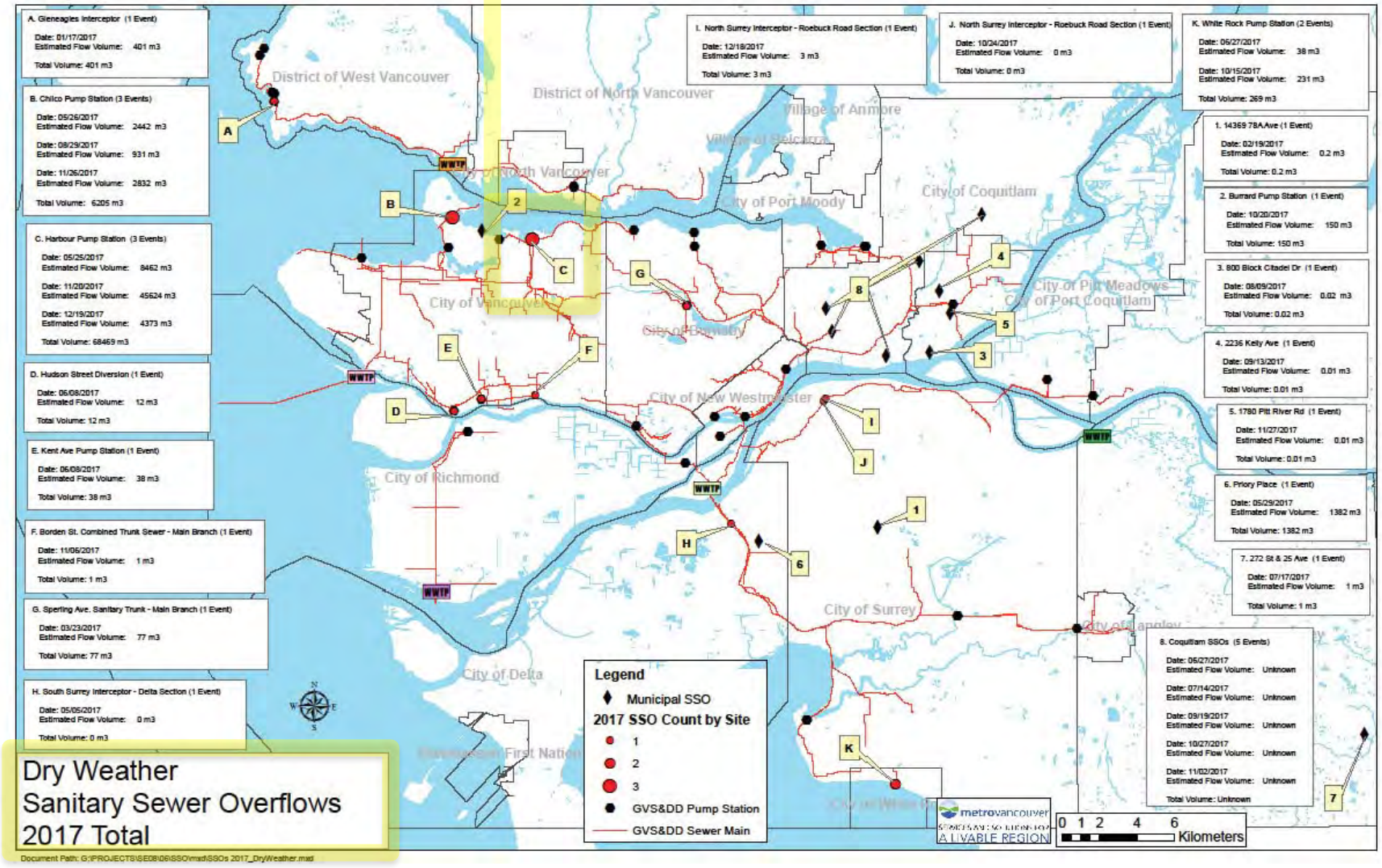


- "Wet weather sanitary sewer overflows **will continue to increase** in the near term, **partially** as a result of late delivery of several infrastructure expansions **needed to keep pace with growth**."

Source: Metro Vancouver, metrovancouver.org/dashboards/services/liquid-waste/Pages/Wet-weather-related-sanitary-sewer-overflow-events.aspx and metrovancouver.org/boards/GVRD/RD_2019-Oct-23_AGE.pdf (PDF page 290).

Source: Metro Vancouver, metrovancouver.org/dashboards/services/liquid-waste/Pages/Reported-events-of-sanitary-sewer-overflows-non-weather-related.aspx

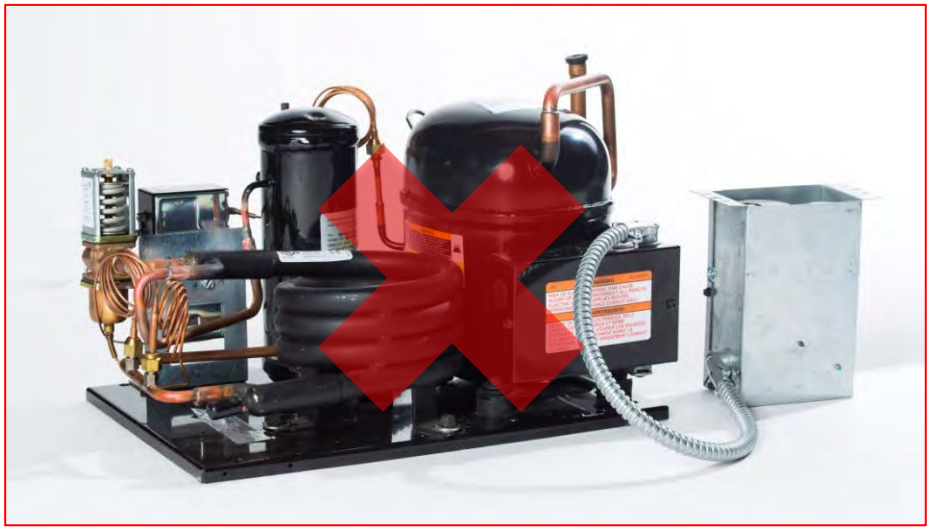
68,469,000 L



Source: Metro Vancouver, metrovancouver.org/services/liquid-waste/LiquidWastePublications/BiennialReport2019-Volume-1.pdf

1) Single Pass Systems

Water cooled (once through)
condensing unit



Air cooled
condensing unit

All **new** and **existing** systems prohibited

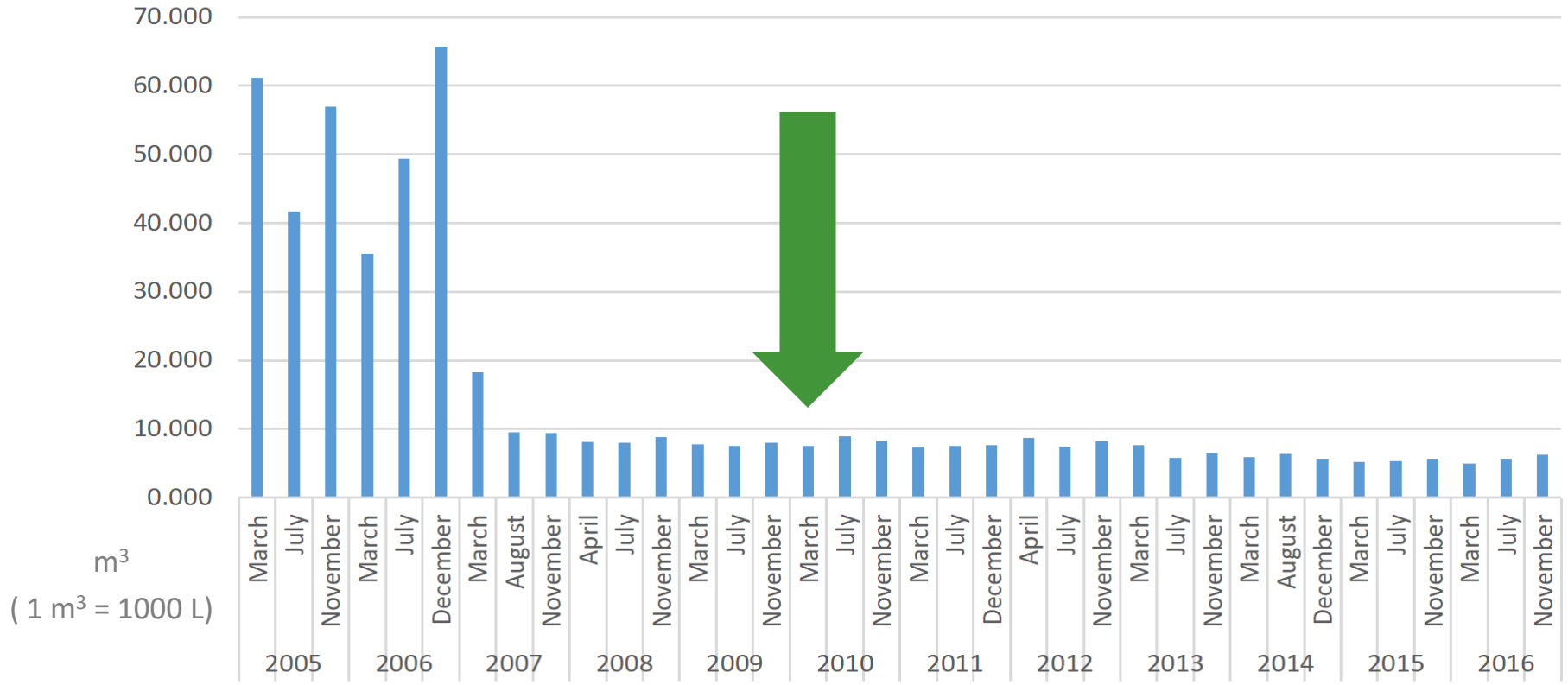
Bulletin 2018-003-PL
bulletins.vancouver.ca

Photographs courtesy of the Capital Regional District, British Columbia
Photo Credits: Derek Ford Studios

1) Single Pass Systems

Billing Data: Restaurant

Pre- and post-retrofit of once through cooling



Courtesy of the Capital Regional District, British Columbia

1) Single Pass Systems

CITY OF VANCOUVER

Once-Through Cooling Identification Guide

November 2019

vancouver.ca/operating-permit

Ice Machines

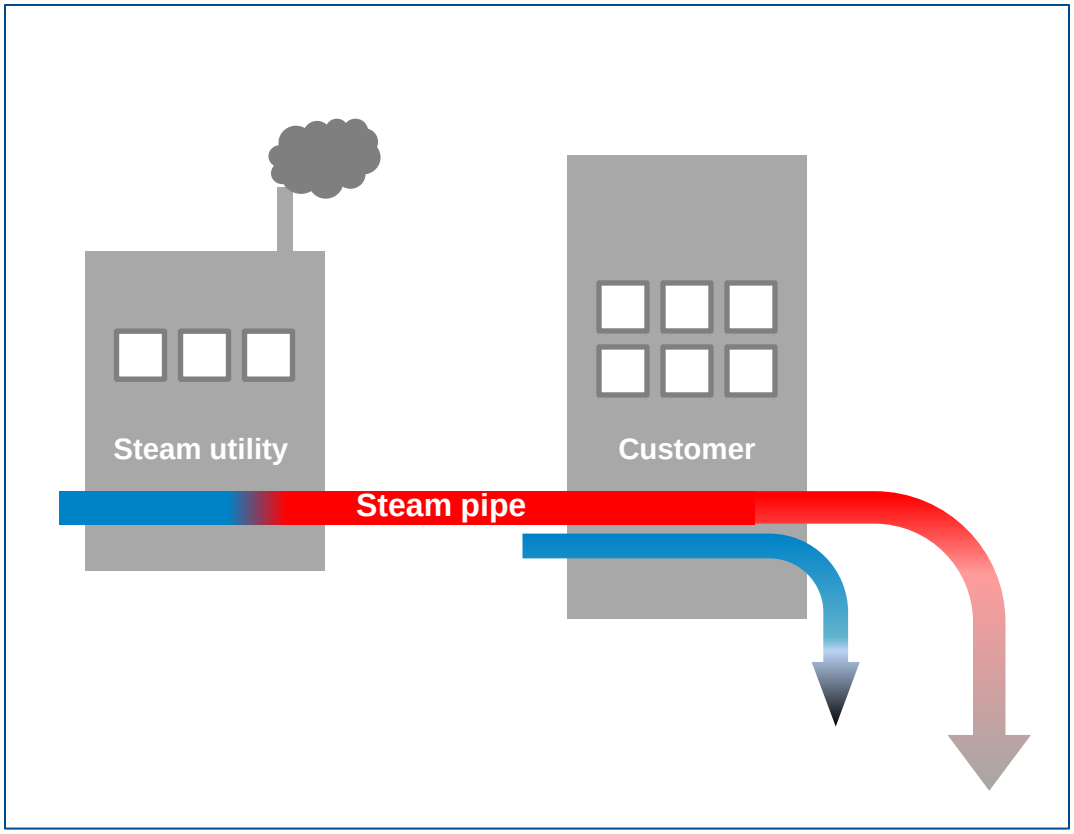
Water-cooled ice machines are wasteful of treated drinking water. These and other once-through cooled (OTC) systems are being phased out in the City of Vancouver. No new OTC systems may be installed. All existing OTC systems must be disconnected by January 1, 2020.

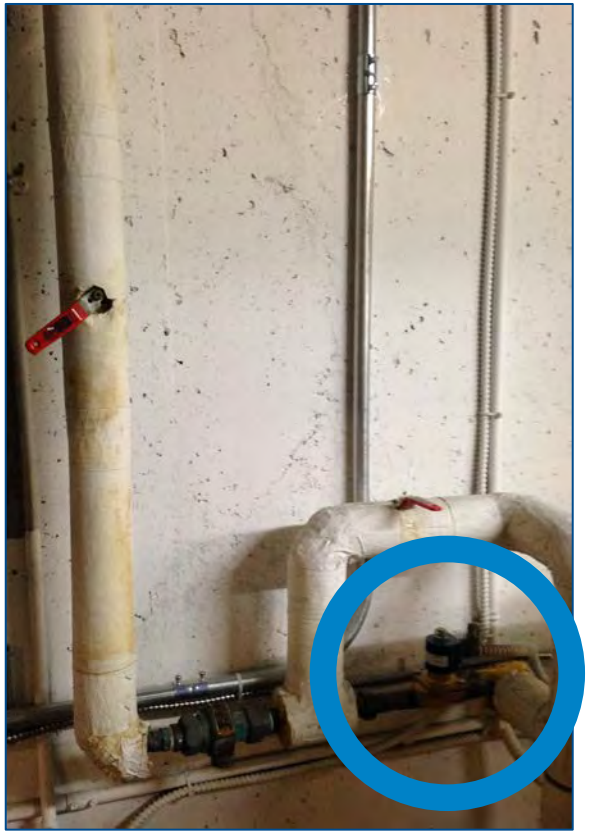
How to tell if your ice machine is once-through cooled (OTC) or air-cooled:

- If your ice machine is Energy Star® qualified, then it is air-cooled. No action is necessary.
- Model numbers are the most reliable means of identifying the type of cooling system. The table below summarizes model numbering conventions for major brands.

Brand	Model Numbering Structure	Letter	Condenser Type
Manitowoc	ID-0302W • ID is the Model Line • 0302 is the Size • W is the Condenser Type	A	Air-Cooled Condenser
		S	**Water-Cooled Condenser (OTC)**
		N, C, DC, YC	Remote Condenser
Hoshizaki	F-1002-MWJ • F is the Model Line • 1002 is the Size • W is the Condenser Type	A	Air-Cooled Condenser
		T	**Water-Cooled Condenser (OTC)**
		R	Remote Air-Cooled Condenser
		L	Remote Condenser (Serenity Series)
Scotsman	C0322MW • C is the Model Line • 0322 is the Size • W is the Condenser Type	A	Air-Cooled Condenser
		U	**Water-Cooled Condenser (OTC)**
		V	Remote Air-Cooled Condenser
		W	Air-Cooled Remote Low Side
Ice-O-Matic	ICE0500W • ICE is the Model Line • 0500 is the Size • W is the Condenser Type	A	Air-Cooled Condenser
		T	Top Air-Cooled Condenser
		X	**Water-Cooled Condenser (OTC)**
		R	Remote Air-Cooled Condenser
Follet	MCD425WBS • MCD is the Model Line • 425 is the Size • W is the Condenser Type	A	Air-Cooled Condenser
		Y	**Water-Cooled Condenser (OTC)**
Kold-Draft	GB1064LHK • GB is the Model Line • 1064 is the Size • L is the Condenser Type	A	Air-Cooled Condenser
		Z	**Liquid (Water) Cooled Condenser (OTC)**
		R	Remote Air-Cooled Condenser

1) Single Pass Systems

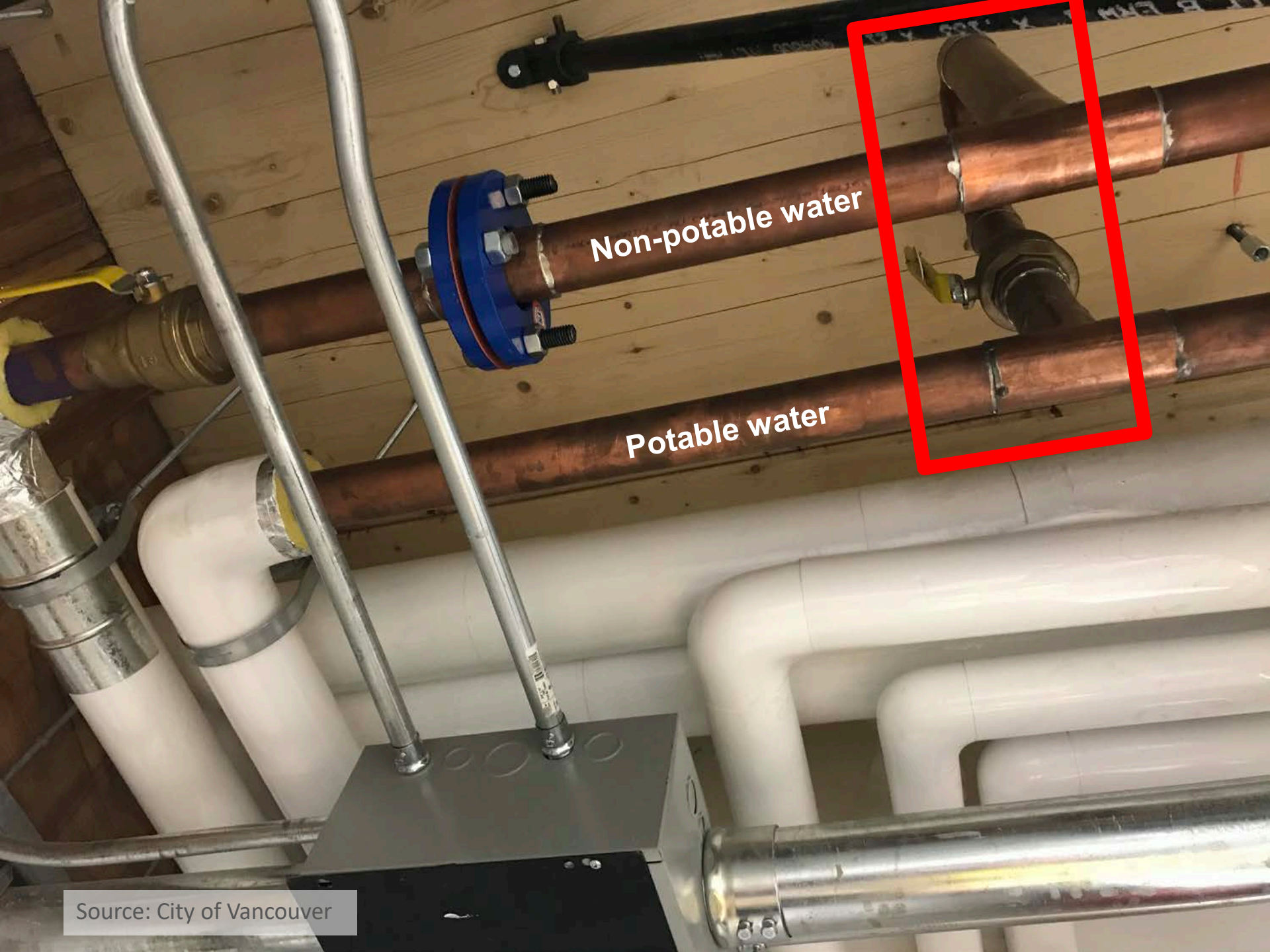




- **630,000,000 litres** into sewer (2017).
- This is **1.5x** the Metro Vancouver CSO into False Creek.

2) Rainwater Harvesting

Source: City of Vancouver



Source: City of Vancouver

Source: City of Vancouver

2) Rainwater Harvesting

As of **January 1, 2019**, all new & existing systems:

- Require:
  - An *operating permit* **vancouver.ca/operating-permit**
  - Water quality testing & reporting (sampling guidelines: see City website)
- Must meet water quality standards:
  - *E. coli* < 100 CFU or MPN / 100 mL (accredited laboratory list: see City website)
  - Turbidity < 10 NTU
  - Temperature < 20 °C
- Exceedance: Switch to potable water and notify the City.
- **Exempt**: single/dual family homes, triplexes, fourplexes, and rain barrels < 500 L cumulative capacity.
- Reference: 2019 Vancouver Plumbing By-law, Division B, Section 2.7
  bccodes.ca/vancouver-bylaws.html

Chain of Custody (COC) / Analytical Request Form

L2237761-COFC

COC Number: 17 - 664044

Page of

Report To	Contact and company name below will appear on the final report	Report Format
Company:		Select Report Format: PDF EDD (DIGITAL)
Contact:		Quality Control (QC) Report with Report YES NO
Phone:		Compare Results to Criteria on Report - provide details below if box checked
	Company address below will appear on the final report	Select Distribution: EMAIL MAIL FAX
Street:		Email 1 or Fax
City/Province:		Email 2
Postal Code:		Email 3
Invoice To	Same as Report To	Invoice Distribution
	Copy of Invoice with Report	Select Invoice Distribution: EMAIL MAIL FAX
Company:		Email 1 or Fax
Contact:		
Job #:		
PO / AFE:		
LSD:		

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?

☐ YES ☑ NO

Are samples for human consumption/ use?

☐ YES ☑ NO

Non-potable sample

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ | Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

SAMPLES ON HOLD | Sample is hazardous (please provide further details) | NUMBER OF CONTAINERS

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☑ NO

Are samples for human consumption/ use? ☐ YES ☑ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No	☐
Ice Packs ☐	Ice Cubes ☐	Custody seal intact	Yes ☐	No	☐
Cooling Initiated	☐				

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:

2) Rainwater Harvesting

MICROBIOLOGY (WATER)

	UNITS	SAMPLE #1	RDL	QC Batch
Microbiological Param.				
E. coli	CFU/100mL	< 1	1	9780053
RDL = Reportable Detection Limit				

RESULTS OF CHEMICAL ANALYSES OF WATER

	UNITS	SAMPLE #1	RDL	QC Batch
Physical Properties				
Turbidity	NTU	1.2	0.10	9780029
RDL = Reportable Detection Limit				

Proposals for January 1, 2021

- Expand the list of optional uses (example: clothes washers).
- **Require** both *Legionella pneumophila* and *E. coli* testing and reporting (every two months).
- **Require** a new Building Water System Operator certification (Environmental Operators Certification Program).
  - Launching fall 2020
  - 2 day course + exam (water quality, sampling, treatment)
  - Ongoing continuing education requirement

EOCP
Environmental Operators Certification Program

3) Building Water Treatment Systems

Source: City of Vancouver

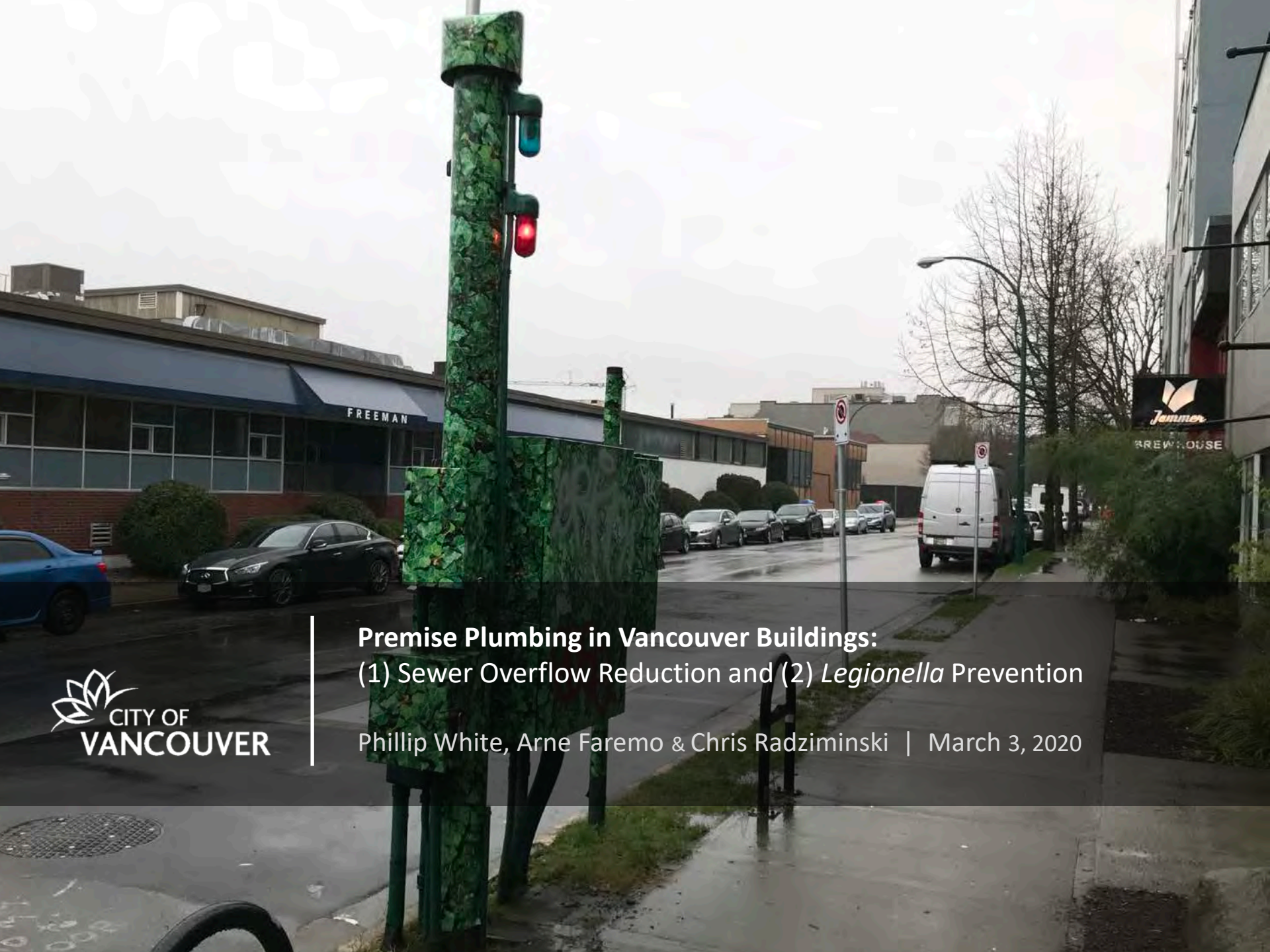
3) Building Water Treatment Systems

Source: City of Vancouver

3) Building Water Treatment Systems

As of **June 3, 2019**, all new & existing building water treatment systems (for **potable water** only) require an *operating permit.*

- **vancouver.ca/operating-permit**
- Subject to regular inspection.
- *Operating permit* number to be affixed.
- *Chief Building Official* to be notified within 30 days of changes.
- **Exempt:** single/dual family homes, triplexes, fourplexes.



CITY OF VANCOUVER

Premise Plumbing in Vancouver Buildings:
(1) Sewer Overflow Reduction and (2) *Legionella* Prevention

Phillip White, Arne Faremo & Chris Radziminski | March 3, 2020

CBC news

British Columbia

Surrey Walmart reopens after legionnaires' disease outbreak

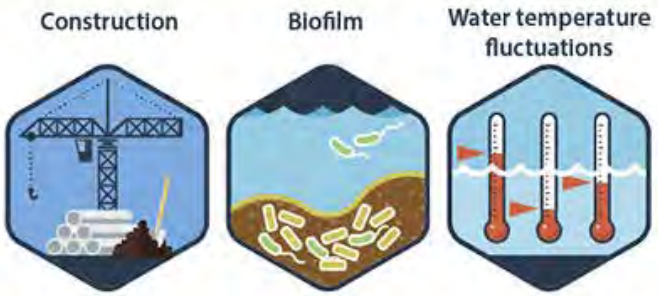
Fraser Health Authority confirms 7 cases under investigation; no health risk inside mall, says owner

CBC News · Posted: Sep 07, 2018 2:50 PM PT | Last Updated: September 8, 2018

Source: cbc.ca/news/canada/british-columbia/legionnaires-disease-outbreak-surrey-walmart-1.4815437

How *Legionella* affects building water systems and people

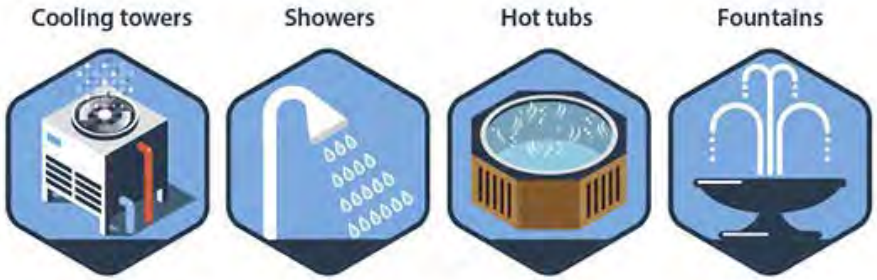
1. Internal and external factors can lead to *Legionella* growth in building water systems.



2. *Legionella* grows best in large, complex water systems that are not adequately maintained.

Source: Centers for Disease Control and Prevention (cdc.gov/legionella)

3. Water containing *Legionella* is aerosolized through devices.



4. People can get Legionnaires' disease when they breathe in mist or accidentally swallow water into the lungs containing *Legionella*. Those at increased risk are adults 50 years or older, current or former smokers, and people with a weakened immune system or chronic disease.

CDC

www.cdc.gov/legionella

01/12/2018

Source: Centers for Disease Control and Prevention (cdc.gov/legionella)

WORKSAFE BC

Risk Advisory

Legionnaires' disease exposure from contaminated water vapour

What is the potential risk?

Workers exposed to water vapour containing Legionella bacteria may be at risk of developing Legionnaires' disease. Legionnella bacteria multiply in warm water and may be found in swimming pools, hot tubs, water tanks or cooling towers used in residential or commercial buildings. If the water containing the bacteria becomes airborne, such as via mist or vapours from water jets, showers, faucets, or air conditioning and ventilation systems, it may be inhaled by workers or members of the public.

Legionnaires' disease cannot be transmitted from human to human. People with the disease have symptoms similar to pneumonia and can be effectively treated with antibiotics.

Scientific literature shows that the incidence of Legionnaires' disease in North America is increasing. People with decreased immune function or chronic lung problems are at an increased risk of developing Legionnaires' disease if they are exposed to the bacteria.

Workers at risk of developing Legionnaires' disease may include those who work in recreational (swimming pool) facilities or in buildings using water tanks or cooling towers.

What industries may be at risk?

- Pool cleaning
- Pool equipment service and repair
- Pool installation or structural repair
- Pool maintenance
- Pool, spa, or hot tub installation or structural repair
- Pool, spa, or hot tub service
- Services
- Swimming pool

How can I reduce the risk in my workplace?

As an employer, you need to know if there is the potential for the risk identified in this advisory to be present in your workplace. It's your responsibility to regularly inspect your workplace, and to ensure that your safety procedures and practices control the risk. The following information highlights some of the sections of the Occupational Health and Safety (OHS) Regulation and Guidelines that are most relevant to this risk.

Section 4.78 of the OHS Regulation requires employers to maintain acceptable air quality. This includes inspecting for conditions that would promote the growth of micro-organisms, such as water leaks or stagnant water pools, and ensuring there is adequate treatment of open-water systems associated with ventilation equipment, such as cooling towers and humidifiers, to control biological growth.

Under section 4.79 of the Regulation, the employer must ensure that the indoor air quality is investigated when complaints are reported. The investigation may include sampling for airborne

WORKSAFE

Legionnaires disease

Preventing Legionnaires' disease from cooling towers and evaporative condensers

Legionella bacteria can infect humans and cause legionellosis and Legionnaires' disease. The bacteria can grow on the wet surfaces of cooling towers, evaporative condensers (cooling plant) and scrubbers. Poorly positioned air intakes for air conditioning units can also capture the bacterial plume and draw it into buildings.

We have produced guidance for PCBUs that have cooling towers or evaporative condensers (cooling plant) on how to minimise or eliminate the risk of Legionella bacteria growing in their workplace.

Preventing Legionnaires' disease from cooling towers and evaporative condensers provides advice on the roles, duties and extent of influence/control held by different PCBUs and guidance for installing a new cooling plant or maintaining an existing plant.

This fact sheet provides advice to persons conducting a business or undertaking (PCBUs) who have cooling towers or evaporative condensers (cooling plant). This includes (but is not limited to) cooling plant that is part of: any building air conditioning system, commercial premises with refrigeration plant (eg bulk storage of chilled or frozen food), or industrial process.

> Legionella bacteria grow on the wet surfaces of cooling towers, evaporative condensers (cooling plant) and scrubbers, and can cause a pneumonia called Legionnaires' disease. Legionnaires' disease is often severe and can be fatal. Those at higher risk of becoming infected are adults over 50, males, smokers, people with lung disease or low immunity.
>
> Legionella become airborne when fine water droplets (aerosols) carrying the Legionella bacteria are expelled from the exhaust fans of this equipment and may be inhaled by those nearby. Poorly positioned air intakes for air conditioning units can also capture the bacterial plume and draw it into buildings.

PCBUs whose work involves buildings, industrial or commercial premises that operate one or more cooling towers or evaporative condensers (cooling plant) must eliminate the risks from Legionella colonisation and dissemination so far as is reasonably practicable. If a risk can't be eliminated, it must be minimised, so far as is reasonably practicable.

In relation to cooling plant, there will be different PCBUs with overlapping health and safety duties. When this happens, PCBUs must, so far as is reasonably practicable, consult, co-operate and co-ordinate activities. The extent of the duty to manage risks depends on the ability of each PCBU to influence and control the matter. Table 1 describes the different types of PCBUs that may be involved, their duties and likely extent of their influence or control.

Sources: WorkSafeBC, RA 2015-26 (published 2015/11), WorkSafe New Zealand, worksafe.govt.nz/topic-and-industry/legionnaires-disease/legionnaires-disease-cooling-towers-and-evaporative-condensers/

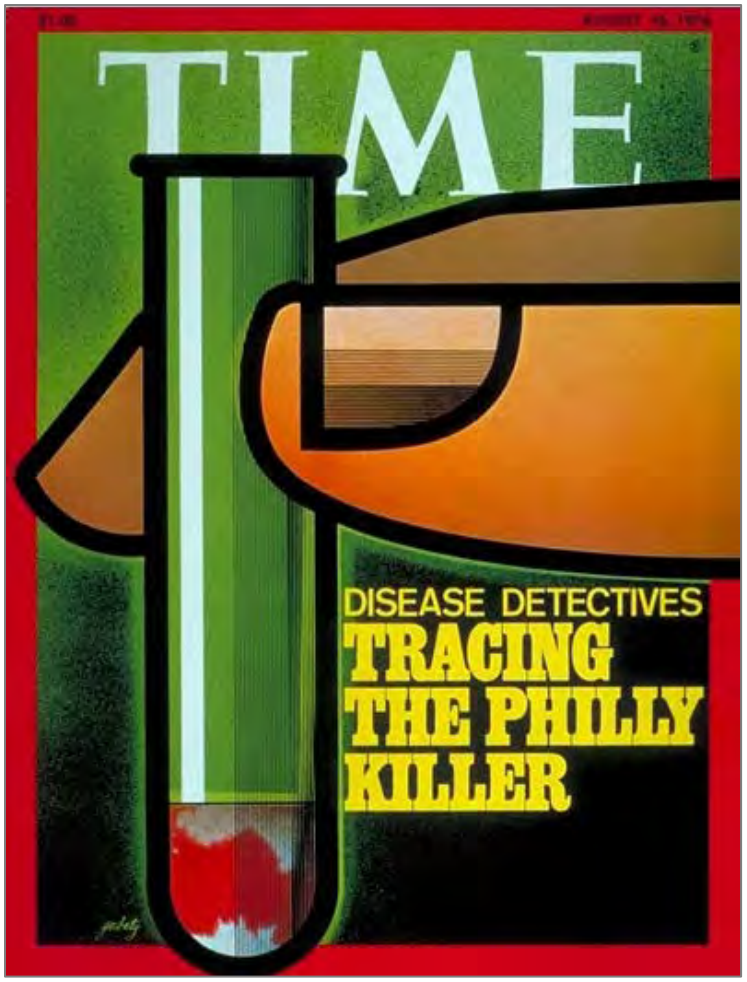
THE STAR

By **Antonia Zerbisias** Special to the Star
Fri., Feb. 21, 2014 | 2 min. read

135 cases, 23 fatalities

In this 2005 file photo, medical workers at Rouge Valley Centenary Hospital treat a patient from Seven Oaks Home for the Aged, where there was an outbreak of legionnaires disease. **RON BULL / TORONTO STAR FILE PHOTO**

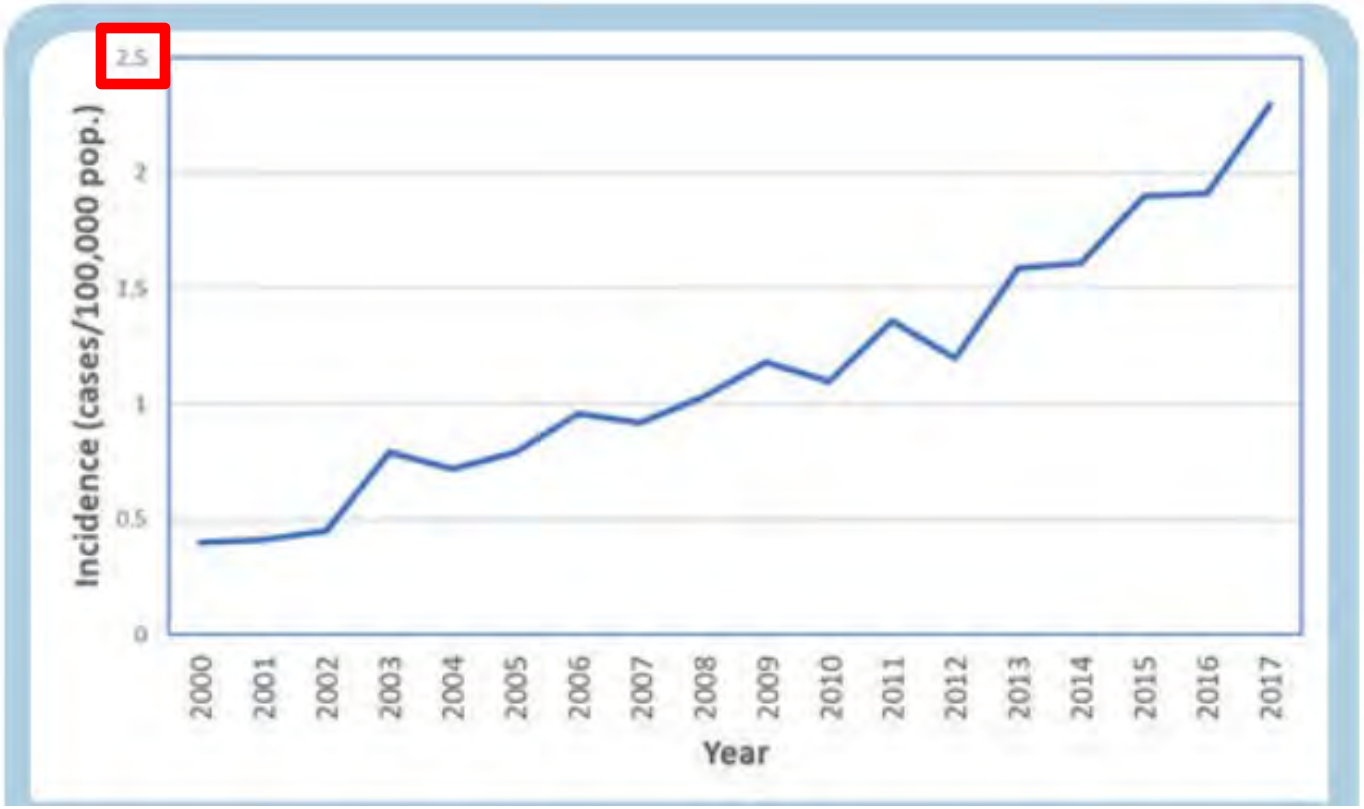
Source: thestar.com/news/gta/2014/02/21/seven_oaks_home_for_the_aged_class_action_suit_reaches_12_million_settlement.html



221 cases, 34 fatalities

181 cases, 14 fatalities

Sources: August 16, 1976 cover of TIME, time.com/3994453/legionnaires-disease-name-history-1976 and September 20, 2012 leading page of Le Soleil newspaper.



The report's authoring committee estimates that the number of persons with Legionnaires' disease in the United States ranges from 52,000 to 70,000 each year (or a rate of 20.5 to 27.4/100,000). This estimate is felt to be conservative

Source: nap.edu/resource/25474/Legionella%204-pager.pdf

River District
Sawmill Crescent, Vancouver, BC
Source: Bolld Real Estate Management, bolldpm.com/properties/river-district-1103-3557-sawmill-crescent-vancouver-bc/111

Source: Google Street View

Source: City of Vancouver

4) Cooling Towers

As of **January 1, 2020**, all new & existing cooling towers and evaporative condensers require an *operating permit*.

- **vancouver.ca/operating-permit**
- Published on the public VanMap (GIS-based).
- *Chief Building Official* to be notified within 30 days of changes.

5 CHICAGO Home News Weather Investigations Entertainment ••• LIVE TV 64° Connect

Third Person Dead From Legionnaires' Outbreak in Chicago Hotel

Officials tie outbreak to main fountain in lobby of JW Marriott hotel

Published Aug 31, 2012 at 5:46 PM | Updated at 8:41 PM CDT on Sep 1, 2012

114 cases, 3 fatalities

Source: NBC Chicago, nbcchicago.com/news/health/legionnaires-disease-outbreak-chicago-hotel-marriot-168210636.html

Design

Office of Facilities Planning — Facilities Standards Service

Department of Veterans Affairs — Office of Construction & Facilities Management

CFM

ALERT

INDOOR WATER FEATURES, DECORATIVE FOUNTAINS: RECOMMEND NON - USE

ISSUE:
Incidents of healthcare-associated infection by *Legionella* bacteria, the causative agent of Legionnaires' disease, have been linked to contaminated interior water features. Patients, visitors, and staff who are immunocompromised are particularly vulnerable and, if infected, can have a high mortality rate

DISCUSSION:
Recently published articles highlight the risk of indoor water features in healthcare facilities. In one report, an indoor water feature in the lobby of a mid-west US hospital was linked to 8 cases of Legionnaires' disease; none of the 8 cases were inpatients at the facility at the time of exposure and some were visitors that likely just passed by the water feature on their way through the lobby. In another report, 2 immunocompromised inpatients developed Legionnaires' disease after exposure to a contaminated water feature in a radiation oncology suite. The fountain had been shut down for 5 months and then operational for 4 months prior to the disease cluster. In both situations, routine maintenance, cleaning and disinfection procedures did not prevent *Legionella* contamination or growth.

CONCLUSION:
Indoor fountains and other water features present a risk in healthcare facilities and should not be included in new VA healthcare interior design solutions. Where these features are currently installed, adaptive reuse of the space for another form of positive healing environment reinforcement should be considered.

ACKNOWLEDGEMENTS:
This Design Alert was developed by a mutual collaborative effort which included the following Participants:

- CFM-Office of Facilities Planning,-Facilities Standards Service
- National Infectious Diseases Service (NIDS).
- National Center for Patient Safety

FOR ADDITIONAL INFORMATION:
Contact Zoltan John Nagy, AIA-NCARB-AAH, Facilities Standards Service at Zoltan.Nagy@va.gov.

(continued)

April 19, 2012
003C2B-DA-138

O'Loughlin *et al.* (2007)
BMC Infect Dis **7**: 93

18 cases

Haupt *et al.* (2012)
Infect Control Hosp Epidemiol **33**: 185

8 cases

Sources: fm.va.gov/TIL/dAlert/dAlert138.pdf; images from papers cited.

Source: City of Vancouver

5) Decorative Features

As of **July 1, 2020**, all new & existing decorative water features require an *operating permit*.

- **vancouver.ca/operating-permit**
- **Includes**: indoor and outdoor features.
- *Chief Building Official* to be notified within 30 days of changes.
- **Exempt**: single/dual family homes, triplexes, fourplexes and systems with an operating permit under the *BC Pool Regulation.*


Mail
12:34 PM
linkedin.com
Search
Damian Stathonikos, CAE
President at BOMA BC
4d
An important reminder -- our members are happy to work with the City of Vancouver to protect public safety and prevent public health outbreaks such as Legionella.
BOMA BC
869 followers
DYK: As of Jan 1, 2020, you need to register any cooling towers or water treatment systems with the City of Vancouver and apply fo ...more
CITY OF VANCOUVER

Operating Permits vancouver.ca/operating-permit

Proposals for January 1, 2021

- **Require** a one year maintenance contract for new cooling towers.
- **Require** on site maintenance logs.
- **Require** a new Building Water System Operator certification (Environmental Operators Certification Program).
  - Launching fall 2020
  - 2 day course + exam (water quality, sampling, treatment)
  - Ongoing continuing education requirement

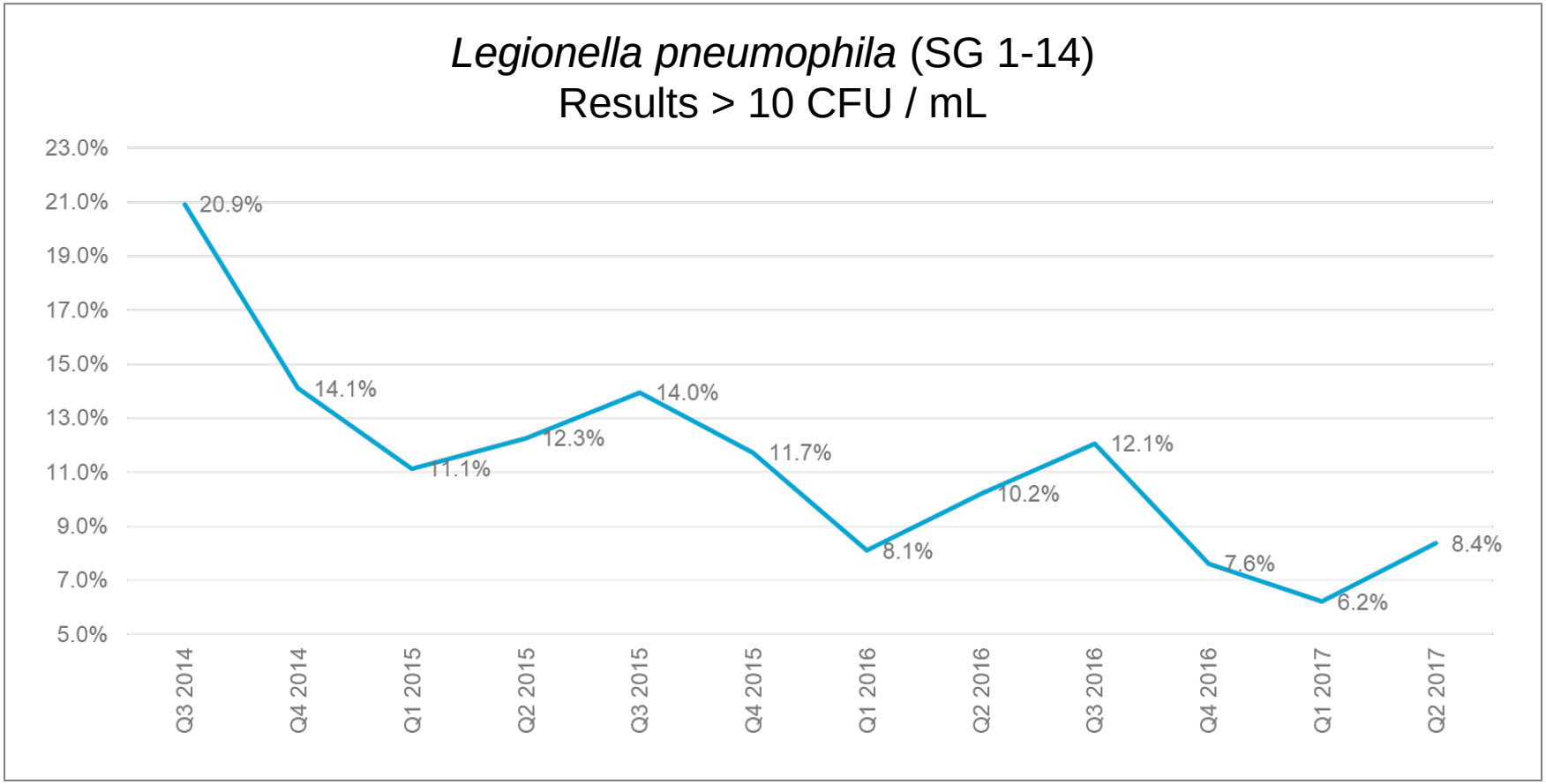
EOCP
Environmental Operators Certification Program

- **Require** *Legionella pneumophila* testing and reporting.
  - Monthly for cooling towers.
  - Every two months for decorative water features and non-potable water systems.
  - Prescribed corrective actions (based on the federal MD 15161 - 2013 standard).

Proposals for January 1, 2021

Analysis	Accr. *	Internal Method	Results	Units
Legionella spp. Count	Yes	ILME-037		
Legionella pneumophila (total)			<5000	CFU/L
L. pneumophila - Serogroup 1			<5000	CFU/L
L. pneumophila - Serogroup 2-14			<5000	CFU/L
Legionella spp. (total)			<5000	CFU/L
Legionella species			<5000	CFU/L
Detection limit			<5000	CFU/L

Note: 5000 CFU / L = 5 CFU / mL



"[t]he authors assert that one of the **key driving forces to the improvement** … was the mandate to sample for *Legionella*.

"The awareness of these results combined with the regulatory requirement to react to such results was the catalyst for systems improvement."

Racine *et al.* (2019) ASHRAE Conference Proceeding, AT-19-C042
Racine (2019) *Cooling Technology Institute* paper TP19-06 (emphasis added)

Proposals for January 1, 2021

Table 2.2.11.6.
Required Response to Failure to Meet *Legionella* Standards
Forming part of Sentence 2.2.11.6.(7)

Test Type	Test Result	Required Response
Legionella Culture Test	Greater than or equal to 10 CFU (colony forming units) / mL and less than or equal to 1,000 CFU / mL	1. The owner shall give notice to the *Chief Building Official* within 24 hours. 2. The owner shall, within 24 hours, either a) shut down the *cooling tower* system and perform offline cleaning and disinfection, or b) perform online remedial treatment(1) and within 7 days shut down the *cooling tower* system and perform offline cleaning and disinfection. 3. The owner shall wait 24 hours after cleaning and disinfection and then perform a *Legionella* culture test.

Reference for “online remedial treatment” and “offline emergency disinfection”:
ASHRAE Guideline 12-2000R Public Review **Draft** (First Public Review, July 2017), 8.2.9 Managing the Risk of Legionellosis Associated with Building Water Systems

Davis Event Center
Western North Carolina Agricultural Center
Source: wncagcenter.org/p/getinvolved/246

NC DEPARTMENT OF HEALTH AND HUMAN SERVICES

ROY COOPER • Governor
MANDY COHEN, MD, MPH • Secretary
BETH LOVETTE, MPH, BSN, RN• Acting Director
Division of Public Health

Interim Report: Outbreak of Legionnaires' disease associated with the NC Mountain State Fair, September – October, 2019

Case Characteristics	
Male	77 (57%)*
Female	58 (43%)*
Median age in years (range)	61 (24-91)
Hospitalizations	96 (71%)*
Deaths	4
Legionnaires' Disease	135 (99%)
Pontiac Fever	1 (1%)

Source: epi.dph.ncdhhs.gov/cd/legionellosis/outbreak.html

NC DEPARTMENT OF
HEALTH AND
HUMAN SERVICES

Legionellosis Risk Mitigation for Temporary Event Vendors

Certain activities at outdoor temporary events may pose a risk for Legionnaire's disease, a potentially serious respiratory illness caused by inhaling tiny water droplets contaminated with *Legionella* bacteria. As a vendor, there are precautions that can be taken to help reduce the risk of exposure to *Legionella* bacteria. Please contact the local health department for questions regarding Legionnaire's disease and *Legionella* exposure risk.

Hot Tub and Whirlpool Vendors

To minimize the risk of exposure to *Legionella*, please follow these recommendations when setting up whirlpool or hot tub displays containing water at temporary events, **even if the hot tub or whirlpool is for display only**. Full cleaning protocol is included in the CDC reference below.

1. Fill and hyperchlorinate using 20 ppm free chlorine. Keep the hydrotherapy jets off and let the hyperchlorinated water circulate for one hour in all components of the hot tub including the compensation/surge tank, filter housing, and piping. Turn on the hydrotherapy jets to circulate the hyperchlorinated water for nine additional hours. Maintain 20 ppm of free chlorine in the system for the entire 10 hours.
2. Flush the system before refilling with water and maintain at least two ppm free chlorine during display. Maintain records of free chlorine and pH of water as well as disinfection and cleaning records.
3. Between vendor events, drain the hot tub or whirlpool, removing as much stagnant water in the system as possible. Filters should be removed and left to dry and cleaned before reuse. The hot tub or whirlpool should be kept as dry as possible between events.

Outdoor Misters and other Spray Cooling Equipment

Cooling equipment such as misters or other spray devices are used at events when outdoor temperatures are high. Follow these recommendations to keep this equipment clean and minimize the risk of exposure to *Legionella*.

1. Water sprayed in a mister should be drinking water quality.
2. Never allow the water in the sprayer system to be stagnant for more than six hours.
3. Water reservoirs should be drained at least once every 24 hours.
4. Cleaning of misting systems should include soaking all aerators and sprayers in a chlorinated solution for 10 minutes. Chlorine disinfectant can be made by mixing 1/3 cup of household bleach with one gallon of water (1,000 ppm chlorine). Hoses should also be flushed, dismantled and kept clean.
5. Misters and cooling equipment should be stored dry and cleaned as described above before reuse.

Display Fountains, Small Water Features or Other Display Products with Water Spray

1. It is recommended that display fountains, small water features or other spray reservoirs be drained and cleaned weekly and disinfected with 3-5 ppm free chlorine (or equivalent) for one hour each day. Free chlorine concentration should be verified with pool and spa water test strips.
2. Between displays, or when water features have been inactive for more than three days, thoroughly scrub and disinfect water features or display fountains with 3-5 ppm free chlorine. Ensure fountains are stored completely dry.
3. If water becomes cloudy, the display fountain or water feature should be drained, scrubbed and disinfected.
4. Maintain cleaning and disinfection records for any display fountain or small water feature.

Sources:
https://www.cdc.gov/legionella/downloads/hot-tub-disinfection.pdf
https://www.specialpathogenslab.com/perch/resources/2014finallegionelleguidelinesforwesternpa.pdf
https://www.condair.com/m/0/water-misting-system-for-adiabatic-outdoor-cooling-in-hot-and-dry-areas-general.pdf

Source: epi.dph.ncdhhs.gov/cd/docs/LegionellaTemporaryFactSheet25Sep19.pdf

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