Legionella: When risk becomes reality

Jessica Fullerton
The Ottawa Hospital

The Ottawa Hospital | L'Hôpital d'Ottawa

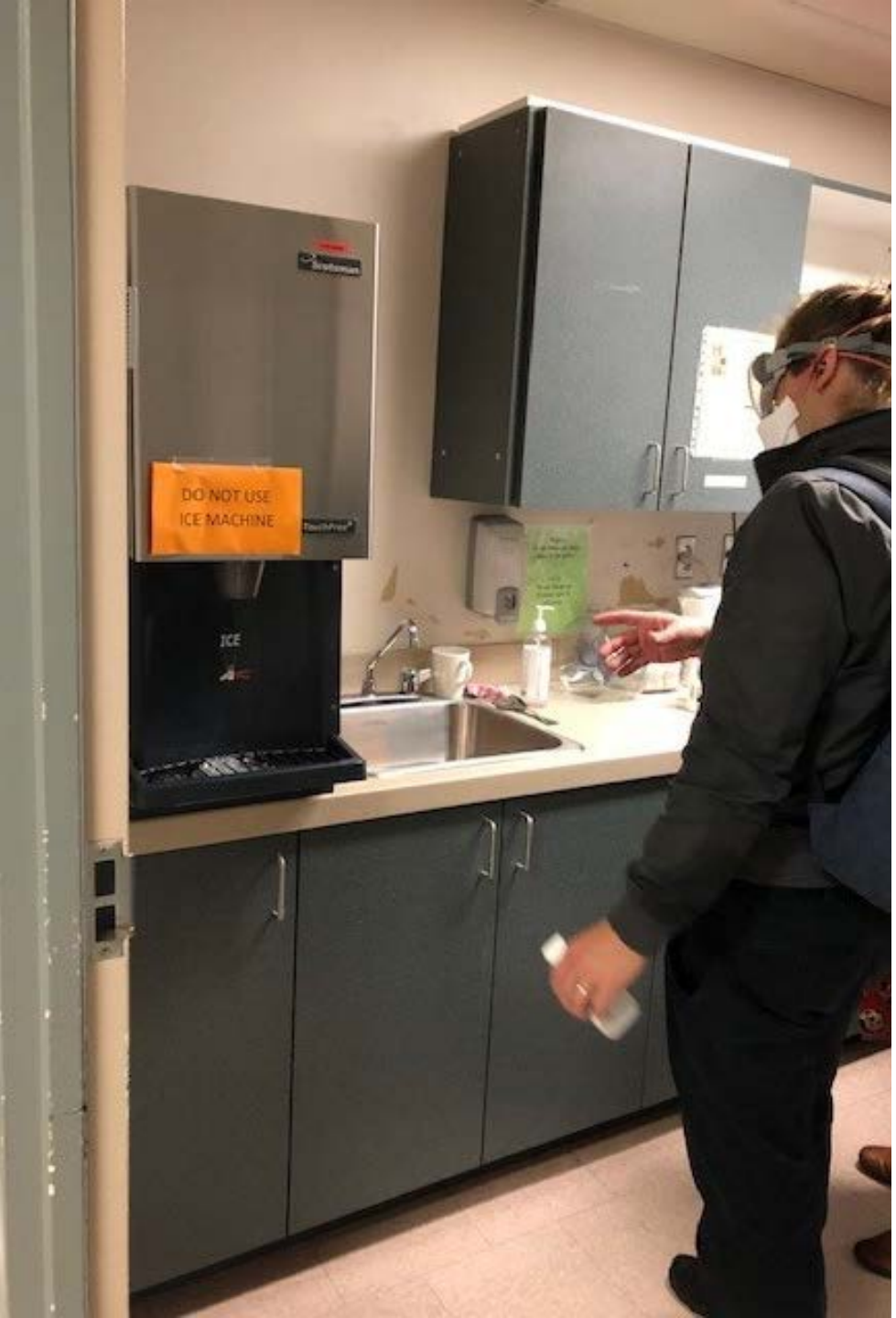
Inspired by research. **Inspiré** par la recherche.
Driven by compassion. **Guidé** par la compassion.

Signs and symptoms of an outbreak

- Single case of healthcare-associated Legionnaires disease should prompt immediate investigation
- Case definition: A clinically compatible case with confirmatory laboratory evidence of Legionella
- Incubation period 2-14 days (up to 16 days has been recorded in some outbreaks)
- Positive water samples or environmental swabs
- Link clinical isolates to environmental isolates

Case study

- One case of laboratory confirmed *Legionella pneumophilia* in an immunocompromised host
- Symptom onset Day 13 of admission
- Positive bronchoalveolar lavage Day 16
- Bed history – one room prior to symptom onset

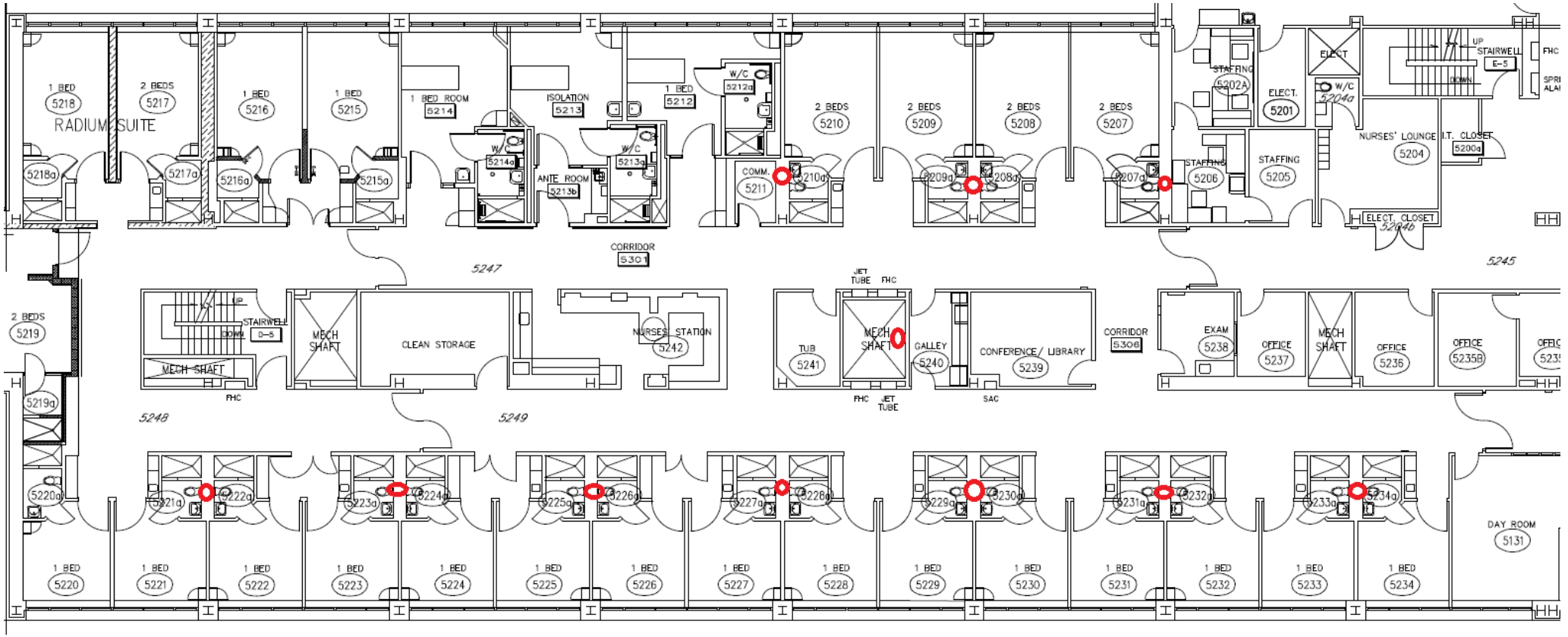


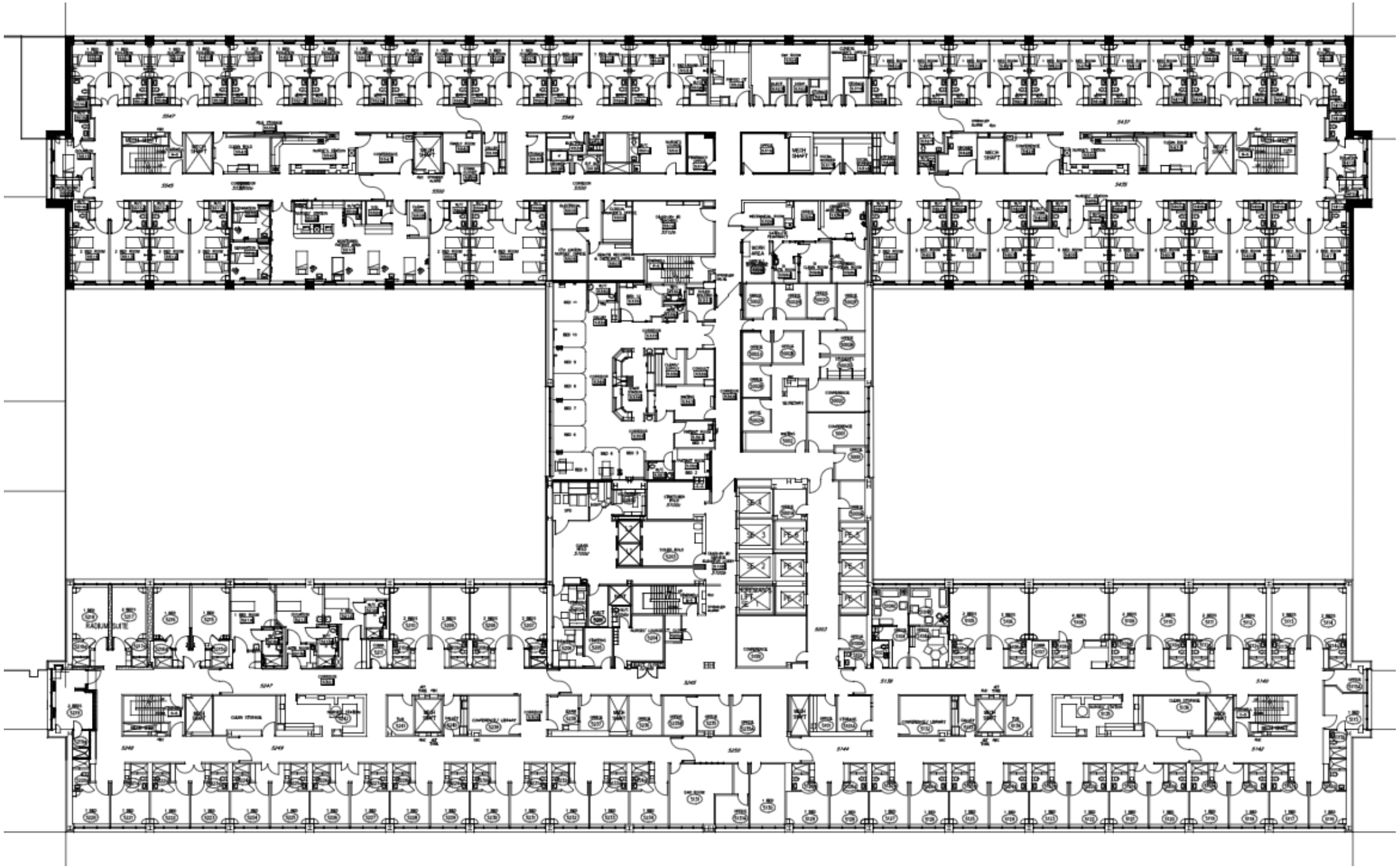
First steps

- Urine antigen testing performed on all patients on unit + prophylactic antibiotics initiated
- Access to potable water halted (bottled water only)
  - Point-of-use (POU) filters added to high-risk units
- Environmental audit conducted – no obvious sources
- Public Health Unit notified + sampling of domestic water
  - Several positive results on PCR – 9 of 10 samples, most with high CT values, no qPCR
  - Samples sent for culture – 2 of 9 culture positive
  - 2 culture positive L. pneumophilia Serogroup 1
- Retain Environmental Consultant

Case study

- Plumbing distribution based on vertical risers



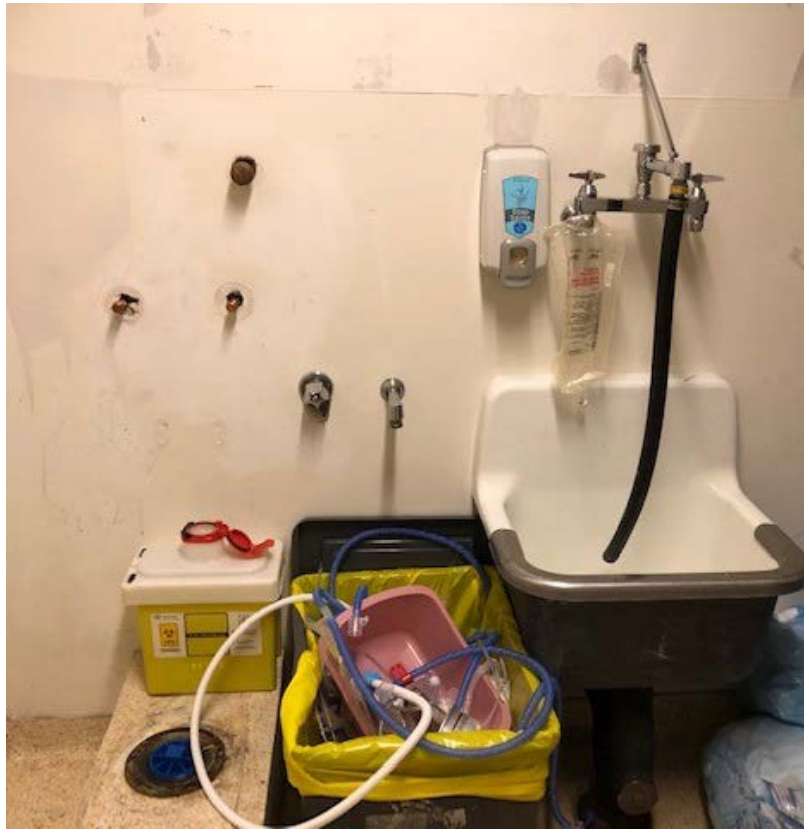


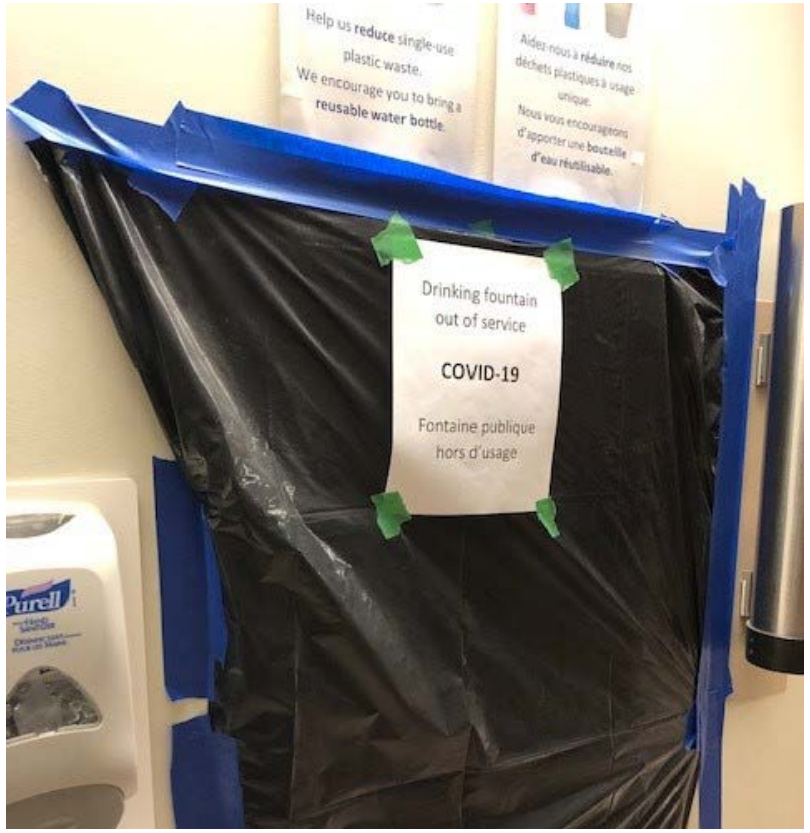
System disinfection

- System-wide hyperchlorination of entire inpatient tower
  - Manifold installed on incoming water line + chlorine pump
  - Hyperchlorination 20-40 ppm, >24 hour contact time
  - ~1000 fixtures flushed
  - Team of 50
- All shower heads and laminar-flow devices removed and disinfected
- Chlorine off-gassing could be a concern for vulnerable populations (NICU, Respirology)



The Team





Plumbing dead-legs

Incident Management System (IMS)

- Essential to success
- Need Leadership support
- Multi-disciplinary team
  - Emergency Preparedness
  - IPAC
  - Occupational Health and Safety
  - Clinical
  - Facilities
  - Environmental Services
  - Communications

Resampling

Resample ~10% of fixtures + environmental swabbing of piping

- qPCR + culture

Very unlikely to eradicate

- When do you resume water use?

Follow-up testing

- Every 2 weeks for 3 months and then every 3 months thereafter (Ontario MOH)

Point-of-use (POU) filters

Fixture types

Type of fixture/Location	Number of fixtures	Type of connector
Single lever faucets in patient washrooms	24	Faucet quick connect
Single lever faucets in alcoves	4	Faucet quick connect
Old gooseneck with aerators in patient rooms	5	Faucet quick connect
Utility kitchen/pantry sink	1	Faucet quick connect
Utility soiled room sink	1	Faucet quick connect
Old gooseneck with aerator in staff washroom	1	Faucet quick connect
Electronic eye faucets in patient washrooms in day unit clinic	4	Faucet quick connect
Sink in room proper in 5219	1	Faucet quick connect
	Total: 41 Faucet quick connect	
New thread-less gooseneck faucets in alcoves	9 + 4 in 3B construction site	Universal connector
	Total: 13 Universal connector	
Showers	27	Shower connector
	Total: 27 shower connector	

Laboratory testing

- Capabilities of your Public Health Unit vs. Third Party testing
- PCR vs. qPCR vs. culture (quantifiable)
- Know your test kit
  - Some PCR tests only detects *L. pneumophilia* serogroup 1
- Legionella rapid antigen testing
  - Limited sensitivity
- Whole genome sequencing or sequence-based typing
  - Compare clinical isolate to environmental isolate
    - Clinical isolate Sequence Type (ST) 8
    - Environmental isolate Sequence Type (ST) 1 x 2

Legionella concentration vs. risk

Thresholds or actionable limits

Mitigation strategies

Response time

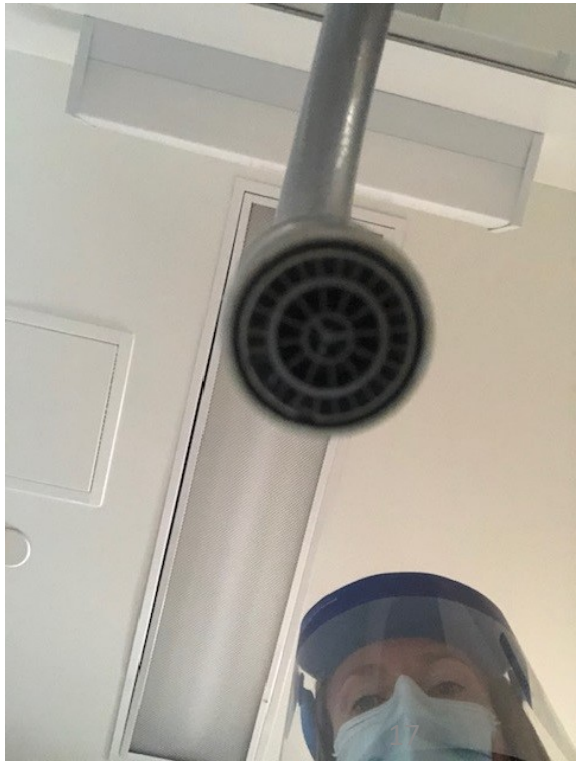
Table 3: Actions to be taken following *Legionella* sampling in hot and cold water systems in health care institutions with susceptible individuals

Legionella Count (cfu/L)	Recommended actions for health care institutions
Not detected or <100 cfu/L	• In a healthcare institution, the primary concern is protecting susceptible individuals, so any detection of *Legionella* should be investigated and, if necessary, the water system should be re-sampled to aid interpretation of the results, and ensure it is in line with the monitoring strategy and risk assessment.
>100 cfu/L and up to 1000 cfu/L	• If the minority of samples are positive, the water system should be re-sampled. If a similar count is found again, a review of the control measures and risk assessment should be carried out to identify any remedial actions to be taken. • If the majority of samples are positive, the water system may be colonized with a low level of *Legionella*. An immediate review of control measures and risk assessment should be carried out to identify any other remedial action required, which may include disinfection of the water system.
>1000 cfu/L	• An immediate review of the control measures and risk assessment should be carried out to identify any remedial actions, including possible disinfection of the water system. • The water system should be re-sampled, and retesting should take place a few days after disinfection and at frequent intervals thereafter, until a satisfactory level of control is achieved.

SOURCE: Ontario Ministry of Health and Long-Term Care (2016).

Responding to positive *Legionella* samples

- **Expect some positives**
  - % positives ranges for culture (5-33%) and qPCR (28-100%) in water systems
- **Interpret as per building specific 'acceptable' levels (or regulations)**
  - Thresholds adapted the building users and features
    - Showers vs faucets vs toilets
    - Absence in a transplant unit versus low levels in public building faucets
  - COVID-19 Legionella monitoring may force the definition of 'acceptable' levels
- **Refer to Water Management Plan**
  - Implement corrective actions if needed
  - Business case for infrastructure upgrades
  - Develop reference levels for your system
  - Communicate with users and regulators



Follow-up – localized action

- Replacement of all shower heads and hoses
- Replacement of old faucets
- Audit of unused fixtures and plumbing dead-legs
- Flushing protocol for unused fixtures - Twice weekly for ~10 minutes
- Check valve inspection/installation

Follow-up – plumbing infrastructure

- Installation of tempering valves on hot water tanks to increase the hot water tank temperature
- Installation of temperature sensors within the distribution and return hot water system to ensure minimum temperatures are being maintained
- Feasibility study on secondary disinfection methods
  - UV
  - Increased chlorine
  - Copper silver ionization
- Installation of copper silver ionization system

CSA Z317.1 - Table 1 Hot water temperatures

Table 1
Hot water temperatures, °C
(See Clauses 6.3.3.1, 6.3.3.3, 6.3.3.5, 6.3.3.9, 6.3.3.16, 6.3.3.17, 6.3.3.20, and 6.3.3.22.)

Site	Normal operation	Maximum
Hot water storage tanks	70 ± 10	80*
Piping distribution system	60 ± 5	65
Patient/public-use outlets	43	49
General-use outlets, food preparation areas, and central supply rooms	49	60
Automatic washer(s)	77† (minimum)	82†
Laundry	77† (minimum)	82†
Other uses	43	65

Lessons Learned

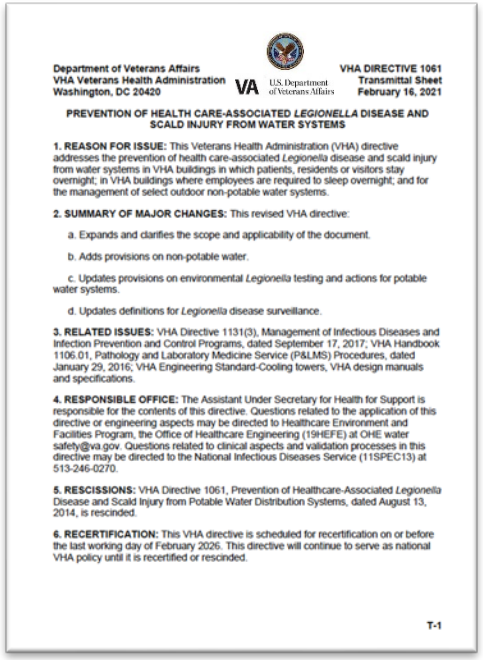
- Never take your plumbing system for granted
- Be informed on the process in advance
  - Do you know who your stakeholders are?
- Have supply of POU filters on hand – make sure you have the right accessories for your faucets!
- Testing techniques
  - Quantitative PCR (qPCR) is a helpful tool
- Audit of unused fixtures and plumbing dead-legs
- Flushing protocol for unused fixtures
- Importance of upgrading plumbing infrastructure
- WATER MANAGEMENT PLAN
  - How would you perform a system-wide disinfection if you needed to?
  - Injection points for riser disinfection

Conclusion

- **A detailed Water Management Plan/Water Safety Plan is imperative**
- Map the entire domestic water system
- Identify areas of risk
- Establish monitoring program and action limits
- Specific buildings require specific measures
  - Patient populations
  - Services provided
  - Age/complexity/limitations of plumbing infrastructure
- Mock code grey (loss of water)
- CSA Z317.1 standard can assist
  - Design and maintenance requirements that minimize the development and proliferation of pathogens
  - Annexes B to D – useful references

Important documents on water quality in HCFs

NASEM 2019
Management of *Legionella* in water systems


Department of Veterans Affairs
VHA Veterans Health Administration
Washington, DC 20420

VHA DIRECTIVE 1061
Transmittal Sheet
February 16, 2021

PREVENTION OF HEALTH CARE-ASSOCIATED *LEGIONELLA* DISEASE AND SCALD INJURY FROM WATER SYSTEMS

1. REASON FOR ISSUE: This Veterans Health Administration (VHA) directive addresses the prevention of health care-associated *Legionella* disease and scald injury from water systems in VHA buildings in which patients, residents or visitors stay overnight; in VHA buildings where employees are required to sleep overnight; and for the management of select outdoor non-potable water systems.

2. SUMMARY OF MAJOR CHANGES: This revised VHA directive:

a. Expands and clarifies the scope and applicability of the document.

b. Adds provisions on non-potable water.

c. Updates provisions on environmental *Legionella* testing and actions for potable water systems.

d. Updates definitions for *Legionella* disease surveillance.

3. RELATED ISSUES: VHA Directive 1131(3), Management of Infectious Diseases and Infection Prevention and Control Programs, dated September 17, 2017; VHA Handbook 1106.01, Pathology and Laboratory Medicine Service (P&LMS) Procedures, dated January 29, 2016; VHA Engineering Standard-Cooling towers, VHA design manuals and specifications.

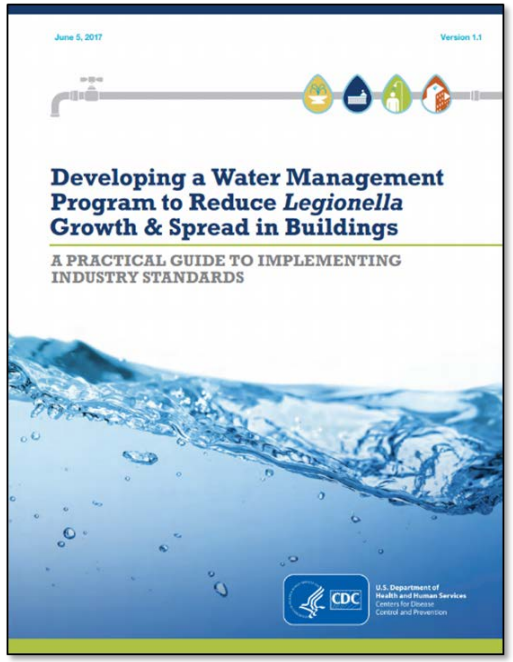
4. RESPONSIBLE OFFICE: The Assistant Under Secretary for Health for Support is responsible for the contents of this directive. Questions related to the application of this directive or engineering aspects may be directed to Healthcare Environment and Facilities Program, the Office of Healthcare Engineering (19HEFE) at OHE water safety@va.gov. Questions related to clinical aspects and validation processes in this directive may be directed to the National Infectious Diseases Service (11SPEC13) at 513-246-0270.

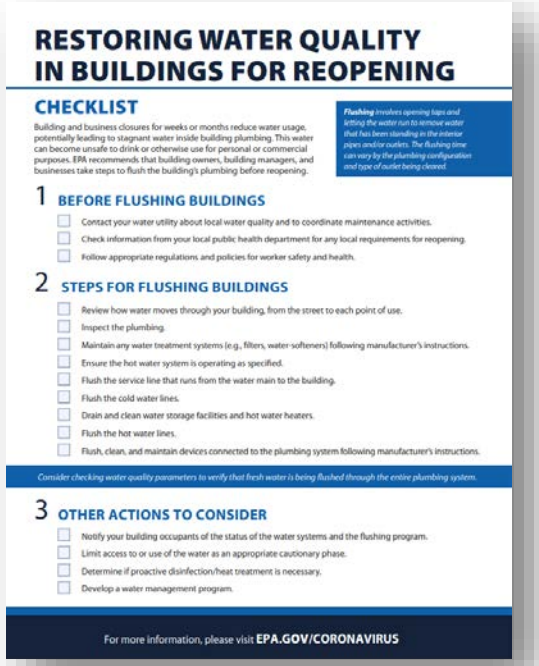
5. RESCISSIONS: VHA Directive 1061, Prevention of Healthcare-Associated *Legionella* Disease and Scald Injury from Potable Water Distribution Systems, dated August 13, 2014, is rescinded.

6. RECERTIFICATION: This VHA directive is scheduled for recertification on or before the last working day of February 2026. This directive will continue to serve as national VHA policy until it is recertified or rescinded.

T-1

VHA 1061 - 2021
Prevention of HCA Legionella disease and scald injury from water systems





Questions?

Thank you!