

# Legionella Risk Management Strategies

CHES Manitoba April 24, 2018

# Who Is Chem-Aqua?

Chem-Aqua has been in the water treatment industry for almost 100 years.

- Over 400 Field Representatives and Technicians in US and Canada
- Service in over 50 countries in 33 different languages.
- In Canada our plant and head office is in Brampton.
- Provide service and programs for over 200 Healthcare Facilities across Canada



# Who is EPI Enrich Products?

- Sole manufacturer of EPI copper silver ionization systems for Legionella control. The EPI controller is the most advanced controller available.
- Providing Legionella control equipment and service in premise plumbing systems for over 20 years
- US EPA Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), NSF/ANSI 61 and 372 Certified

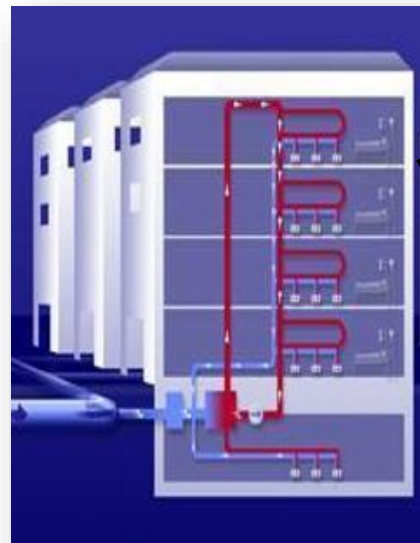


# Legionella Bacteria

- *Most common waterborne bacterium*
- Low levels present in almost all natural water sources
- Survives typical chlorine disinfection of potable water
- Can cause Legionnaires Disease or Pontiac Fever in exposed individuals



# From Water to Humans?



Host



# Legionnaires Disease?



- Fatal if not diagnosed and treated correctly
- Not contagious
- 34 known species and 50 serotypes
- Greatest risk with Legionella pneumophila, Serotype 1
- Immunocompromised people are more likely to contract disease

# Healthcare's Highest Risk Area

Potable water, in hospitals and senior buildings are considered to be the most important source of Legionella transmission.

(Blatt et al. 1994, Stout and Yu 1997, Woo et al. 1992, Yu 1993)



## **Temperature:**

Optimum Growth

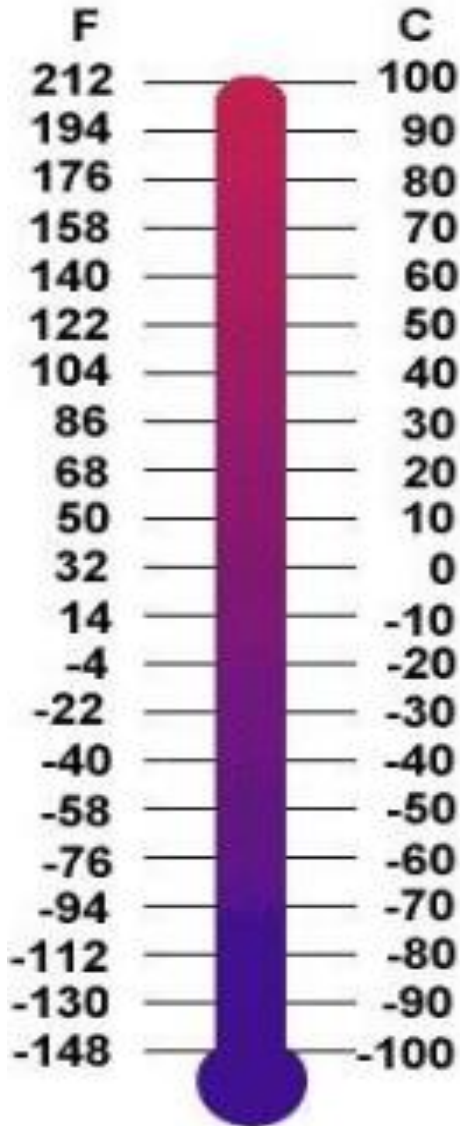
## **Biofilm Formations:**

Low Flow Areas  
Dead Legs

## **Aerosolization:**

Showers  
Faucets

# Important Temperatures:

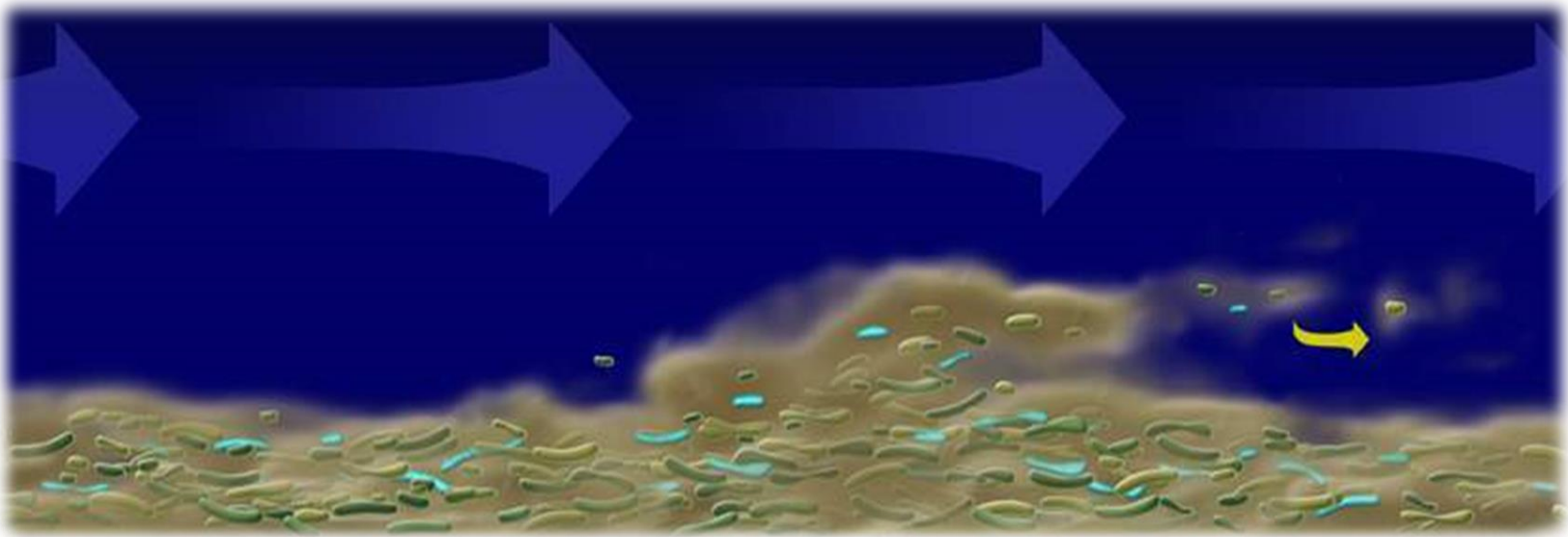


<b>20°C / 68°F</b>	<b>Legionella Bacteria Dormant</b>
<b>25°C to 45°C</b> 37°C / 98.6°F 40°C / 104°F 43°C / 109°F 49°C / 120°F	<b>Optimum Legionella Growth</b> Human Body Temperature Average Shower Temperature Quebec Hot Water Code Ontario Hot Water Code
<b>50°C / 122°F</b>	<b>Legionella Stops Multiplying</b> - 1 <sup>st</sup> Degree Burns 1 Minute
<b>60°C / 140°F</b>	<b>Legionella Dies Slowly</b> - 1 <sup>st</sup> Degree Burns 2 Seconds
<b>65°C / 149°F</b>	<b>Legionella Dies Rapidly</b> - 3 <sup>rd</sup> Degree Burns 2 Seconds



# Biofilm Formation is the Critical Factor

- Free-floating microbes anchor themselves to internal pipe surfaces, faucets, and shower heads and produce biofilm



- Legionella and other bacteria will grow inside of and then slough off the biofilm and enter the bulk water.

**We actually know how to minimize legionella bacteria in our systems ...**



**... but with the exception of Quebec, there are no laws in Canada that tell you what to do.**

**That Attitude is Changing !**



# Occupational Health and Safety Act

## Employers' Responsibilities

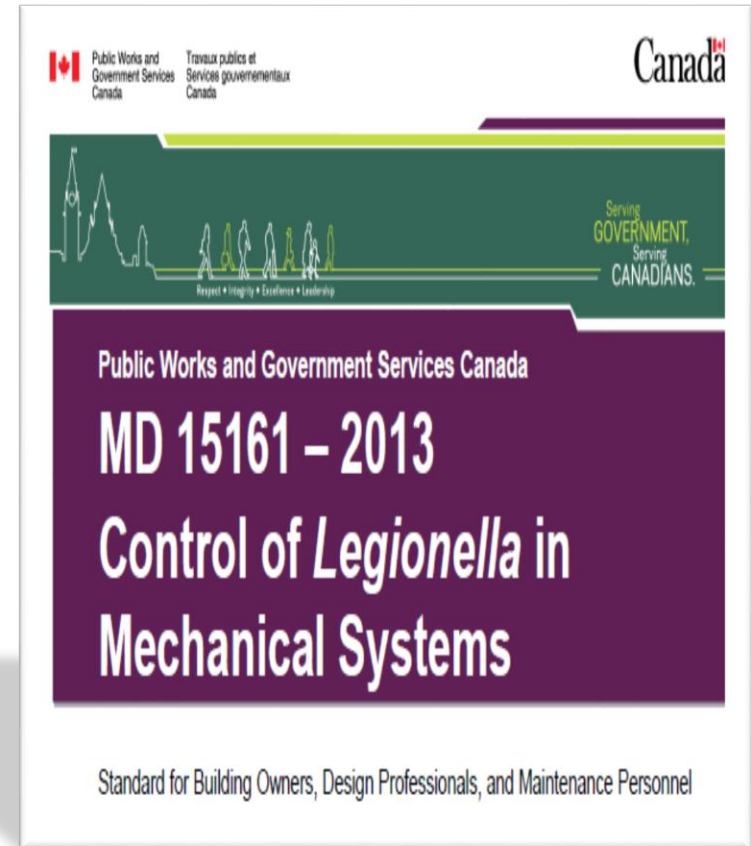
**S. 25(2)(h)** – shall take all reasonable precautions for the protection of workers (i.e. identify, assess and implement control measures to prevent *Legionellae* growth in water and ventilation systems)

## MOL Information Bulletin Workplace Health and Safety



# Updated and New Standards...

- PWGSC has updated MD 15161-2013 – Control of Legionella
- CSA has released Z8000 and has updated the 317.1 Healthcare Standards
- ASHRAE has finally released 188 - 2015

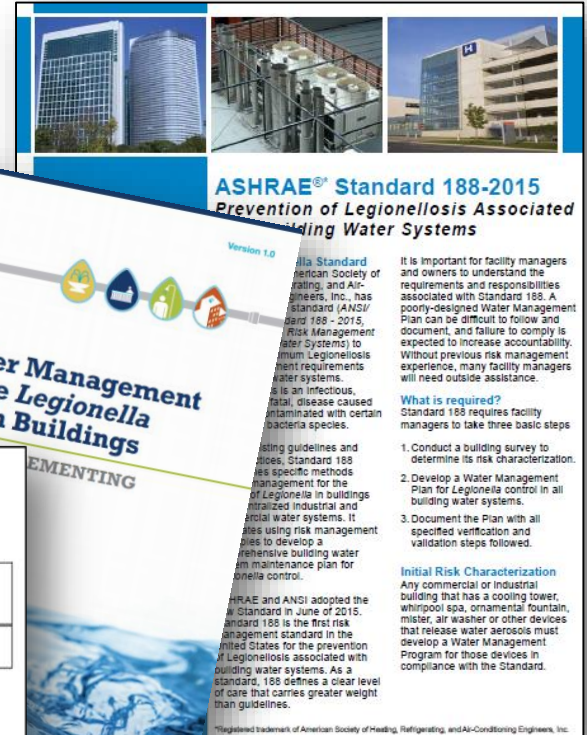



**As standards, these carry far more legal weight than guidelines.**

# Develop A Water Management Plan

- **ASHRAE 188 – 2015**  
American Society of Heating Refrigeration and Air Conditioning Engineers
- **CDC** Centre for Disease Control
- **PWGSC15161** Public Works Gov't Services Canada

**WRHA has developed a plan**



 Winnipeg Regional Health Authority  
Caring for Health - *Prevenir la santé*

## WRHA REGIONAL FACILITIES MANAGEMENT GUIDELINE

### *Legionella* spp. Management and Prevention Program

1.0 **PURPOSE:**

- 1.1 To minimize the presence of *Legionella* spp. in water sources and associated equipment. This guideline applies to domestic hot water systems, cooling towers, and air handling systems such as heating, ventilation, and air conditioning (HVAC) systems and water features.
- 1.2 To implement and manage a *Legionella* spp. Management and Prevention Program (LMPP) to prevent the growth of *Legionella* spp.
- 1.3 To ensure Regional Facilities Management Staff, contractors, patients and visitors are being adequately protected against the hazards of *Legionella* spp.
- 1.4 To assign responsibilities under the LMPP.
- 1.5 To eliminate or reduce the risk, control measures must be in place to prevent the proliferation of organisms in water systems.

# WRHA DHW Safety Plan Includes:

## Preventative Maintenance for DHW Systems:

- Flush hot water return lines to drain for a minimum of 1 hour each quarter
- Hot water tanks should be drained semi-annually, cleaned, and allowed to thoroughly dry for 3-6 months

## Rotating Legionella Sampling on DHW Systems:

- Routine testing of the domestic hot water (DHW) system should be conducted based on the risk category of the area.
  - ✓ Critical risk: testing every 6 months
  - ✓ Moderate risk: testing every 12 months
  - ✓ Low risk: once every three years.

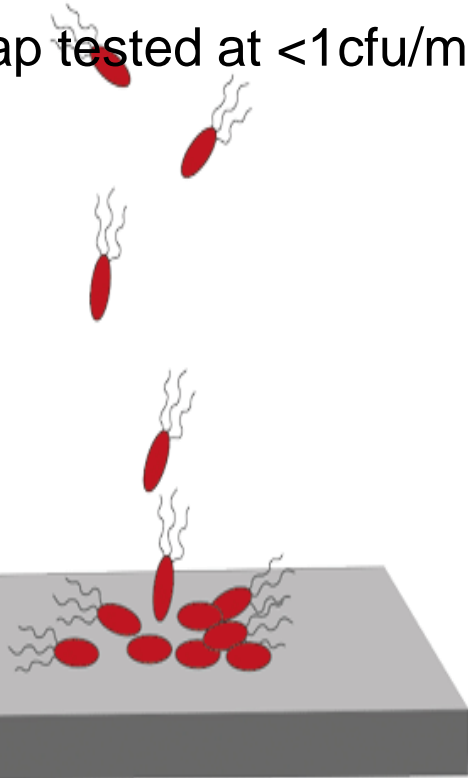
Testing should include the hot and cold water source and the hot water return at all areas



# Sampling Is Not Prevention:

Sampling can detect Legionella in the water, BUT it does nothing to minimize Legionella growth.

- Legionella bacteria are entrained in biofilms and are subsequently released into the flowing water under various circumstances.
- A tap tested at  $<1$  cfu/ml could be much higher an hour later.



- Results showing N/D do not mean there is no bacteria, and a positive result does not necessarily mean it is a cause for alarm
- Results take 10 days so are not indicative of the current state of the water.

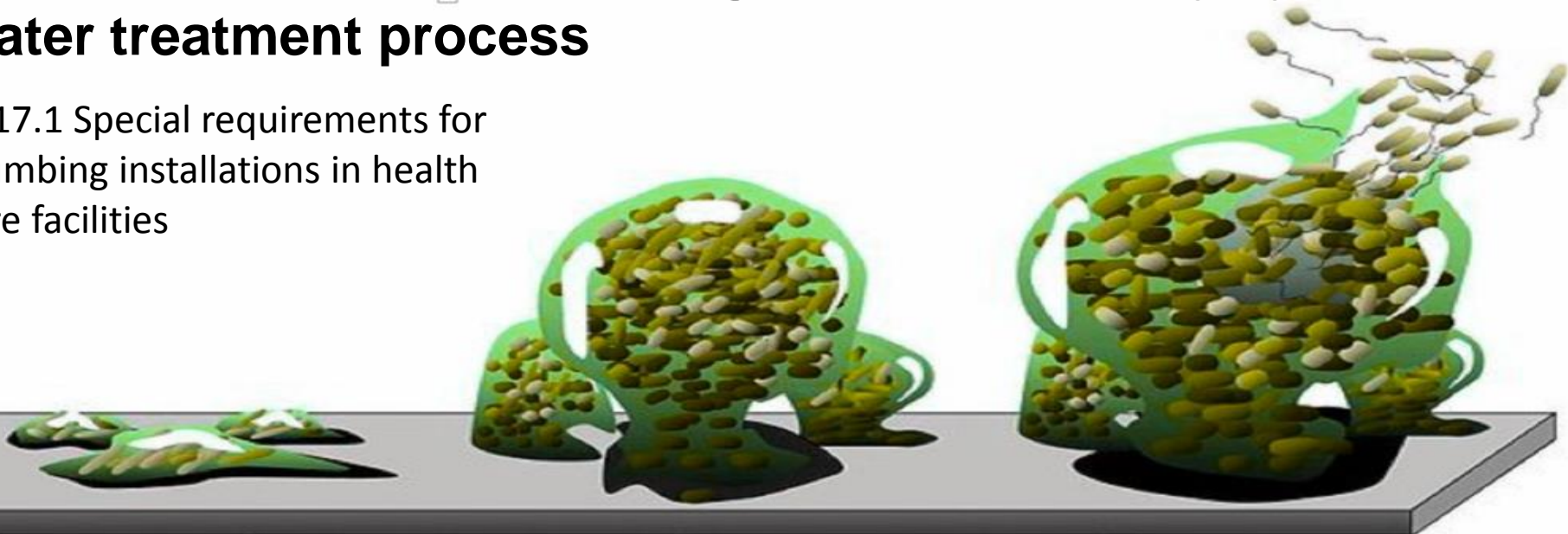
# Systemic Treatment Offers Best Protection

ASHRAE, CDC and CSA all say environmental testing is appropriate for determining if your treatment program is working or in case of an outbreak.



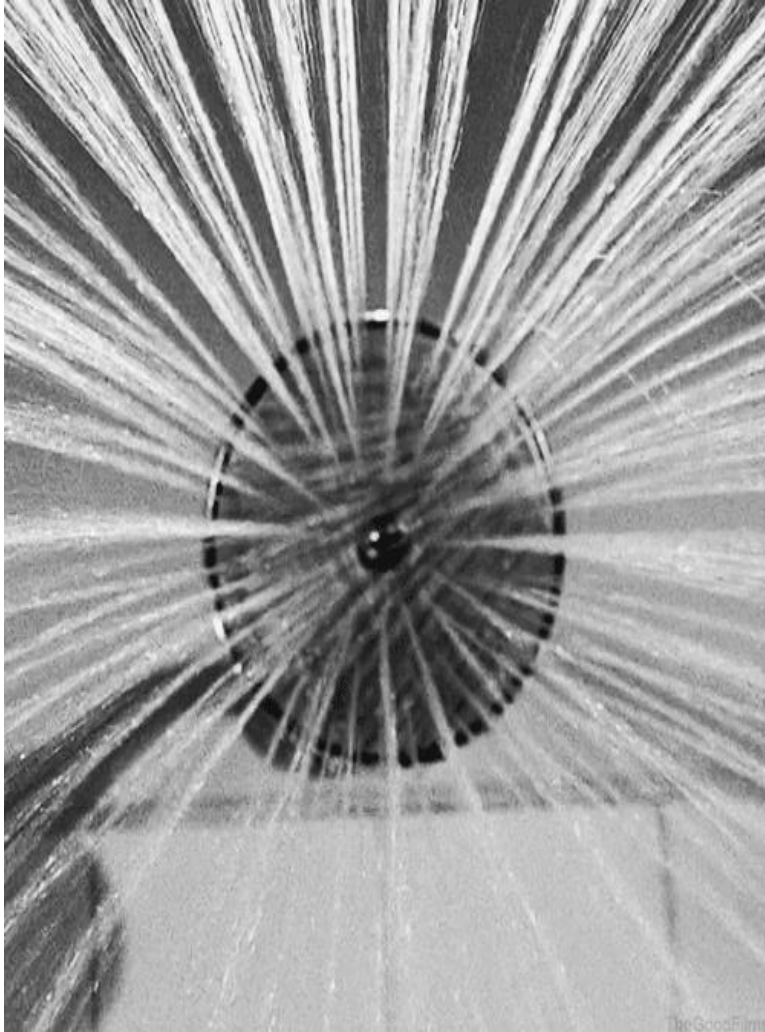
In addition to primary infection control strategy, the HCF should consider implementing a complementary systemic water treatment process

Z317.1 Special requirements for plumbing installations in health care facilities





# Flushing is NOT a Systemic Treatment



**Routine flushing** is a “**Best Practice**” to ensure a regular flow of water to all areas and allowing any disinfectants to enter the outlets.

**Remedial flushing**, in response to a trigger determined by the WMP, ensures the immediate removal of ‘out of spec’ water to an area.

**Does not have any effect on biofilm or long term effects on minimization.**

# Thermal is NOT a Systemic Treatment

During thermal disinfection the water temperature should be increased and maintained at 71° – 77°C, for at least 30 minutes while progressively flushing each outlet.

- The risk of scalding to vulnerable patients must be controlled and should not be accessible by facility occupants during the thermal process
- Only a short-term sanitation measure. There is minimal if any effect on biofilms. Recolonization of the water system can occur rapidly
- High temperatures may cause damage to elastomeric seals causing pump failures



# Systemic: Secondary Chlorine Feed

**Automatically feed low levels of chlorine directly to the hot water distribution loop.**

- NSF approved for domestic water systems
- Chlorine has very little retention time, no effect on biofilm
- Overfeed can be very corrosive



# Systemic: Chlorine Dioxide Feed

The efficacy of ClO<sub>2</sub> against Legionella is well documented.

- Less corrosive than hypochlorite and produces less hazardous byproducts (THM)
- Longer residual than chlorine
- Must be generated on site, high maintenance requirements and not very effective against biofilms



# Point of Use Filtration:



- 0.2 micron bacterial retention membrane filters form a barrier against Legionella and other water borne pathogens
- Scientifically validated for 31 or 62 days
- There is a replacement and maintenance cost.



# Systemic: Copper Silver Ionization

Can be used as a Remedial or Systemic treatment method to minimize Legionella bacteria

- Efficacy is Scientifically Validated
- Safe for People and Piping
- Easy to Install and Maintain
- Economical
- Spec'd into New Hospitals Across Canada



Winnipeg HSC Ann Thomas



# Cu Ag – The Healthcare Option of Choice



- **Winnipeg HSC** (3)
- Peter Lougheed (3)
- Foothills Hospital (5)
- Rockyview Calgary (5)
- St Joseph's Toronto (2)
- Miller Centre NL (3)
- Baycrest (2)
- Health Sciences
- Holy Cross Calgary
- Chatham Kent
- Runnymede Health
- Lake Ridge Hospital
- Grand Falls Windsor
- Sioux Lookout
- Peel Regional

- Edson AB (3)
- City Toronto LTC (10)
- Sir Thomas Roddick
- St John's LTC
- Grand Prairie



# Efficacy of Cu Ag:



Lot No.	Contact Time	CFU/mL Recovered	CFU/mL Log <sub>10</sub>	Percent Reduction	Log <sub>10</sub> Reduction
EPI Lot 1F/275	30 min	3.5E+01	5.51	99.9892	4.97
	1 hour	< 5.0E+00	< 0.70	> 99.9985	> 5.81
	2 hours	< 5.0E+00	< 0.70	> 99.9985	> 5.81
	4 hours	< 5.0E+00	< 0.70	> 99.9985	> 5.81
	24 hours	< 5.0E+00	< 0.70	> 99.9985	> 5.81
EPI Lot 2F/275	30 min	4.0E+01	1.60	99.9877	4.91
	1 hour	< 5.0E+00	< 0.70	> 99.9985	> 5.81
	2 hours	< 5.0E+00	< 0.70	> 99.9985	> 5.81
	4 hours	< 5.0E+00	< 0.70	> 99.9985	> 5.81
	24 hours	< 5.0E+00	< 0.70	> 99.9985	> 5.81
EPI Lot 3F/275	30 min	2.0E+01	1.30	99.9938	5.21
	1 hour	< 5.0E+00	< 0.70	> 99.9985	> 5.81
	2 hours	< 5.0E+00	< 0.70	> 99.9985	> 5.81
	4 hours	< 5.0E+00	< 0.70	> 99.9985	> 5.81
	24 hours	< 5.0E+00	< 0.70	> 99.9985	> 5.81

**Scientifically Validated: by Good Laboratory Practices (GLP) Legionella kill test**

**After 24 hr contact time > 5.5 log reduction of Legionella!**



# Efficacy of Cu Ag:



From 80% Positive to 0% in 3 weeks

Well proven to reduce Legionella in peer review and in PRACTICE

**SUMMARY**

"A Decade of Total Pre Nosocomial Legionellosis Copper Ionization"

D. G. MAKI<sup>1,2</sup>, S. STOL

<sup>1</sup>Univ. of Wisconsin Sch. Of Me  
<sup>2</sup>Univ. of Wisconsin Sch.

**BACKGROUND:** In 1991 3 cases of prompted sampling of potable water in transplant center; 54% of samples were Hyperchlorination was implemented, however a novel commercial system (TarnPure), in copper ions are added to municipal water and our investigations and efficacy of this for Legionellosis.

**METHODS:** All 10 clinical Lpn I RFPEP, as were random isolates from: volume random sampling of our water sin for nosocomial Lpn infection by routine urine Lpn antigen testing.

**RESULTS:** In the 3 years prior technology, 75% of random water cultu since adoption of the ionization techn yielded Lpn, in all instances < 20 CFU/10 cases of nosocomial Legionellosis hospitalized patients ( 0.46 per 10,000 technology, we have had no cases of no adverse effects linked to the ionizat

**CONCLUSIONS:** Even with low Lpn infections occurred, and hyperchlori nosocomial Lpn infection. However, essentially eliminated Lpn from ou against infection of a highly vulnera

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**Pinchin Environmental Microbiology Laboratory**  
**Certificate of Analysis**

**CUSTOMER:** Viada Llashko, Bernard Siedlecki  
**PROJECT NAME:** [REDACTED]  
**DATE ANALYSED:** March 28, 2016

**PROJECT NO.:** 110995.001  
**LAB REFERENCE NO.:** m70829  
**ANALYSED BY:** Partinder Puri, B.Sc.

**RESULTS FOR LEGIONELLA ANALYSIS**

Customer Sample number:	6	7	8	9	10
Lab Sample number:	m70829-6	m70829-7	m70829-8	m70829-9	m70829-10
Description	Room B209	Room B211	Room B218	Room B216	Room B214
Sample type:	Water (500mL)	Water (500mL)	Water (500mL)	Water (500mL)	Water (500mL)
Procedure comments	Acid Treatment	Heat Treatment	Untreated	Heat Treatment	Untreated
Background flora	-	-	-	-	-
Reporting units	CFU/mL	CFU/mL	CFU/mL	CFU/mL	CFU/mL
L. pneumophila serogroup 1	ND	ND	ND	ND	ND
L. pneumophila serogroup 2-14	ND	ND	ND	ND	ND
L. pneumophila Total	ND	ND	ND	ND	ND
Other Legionella species (Non Legionella pneumophila Legionella NI/PL)	ND	ND	ND	1	ND
TOTAL CFU	N/A	N/A	N/A	1	N/A
Detection Limit	1	1	1	1	1

**Signature of Analyst** *[Signature]*

**Note:**

- The result(s) relate only to the sample(s) tested.
- This test report shall not be reproduced except in full, without written approval of the laboratory.
- Procedure comments applicable for positive results only, acid or heat treatment may reduce the number of Legionella.
- Background flora rated on a scale of - to +++; the presence of background flora limits the detection of Legionella.
- ND: Not detected in the volume analyzed and at the specified detection limit, N/A: Not applicable.

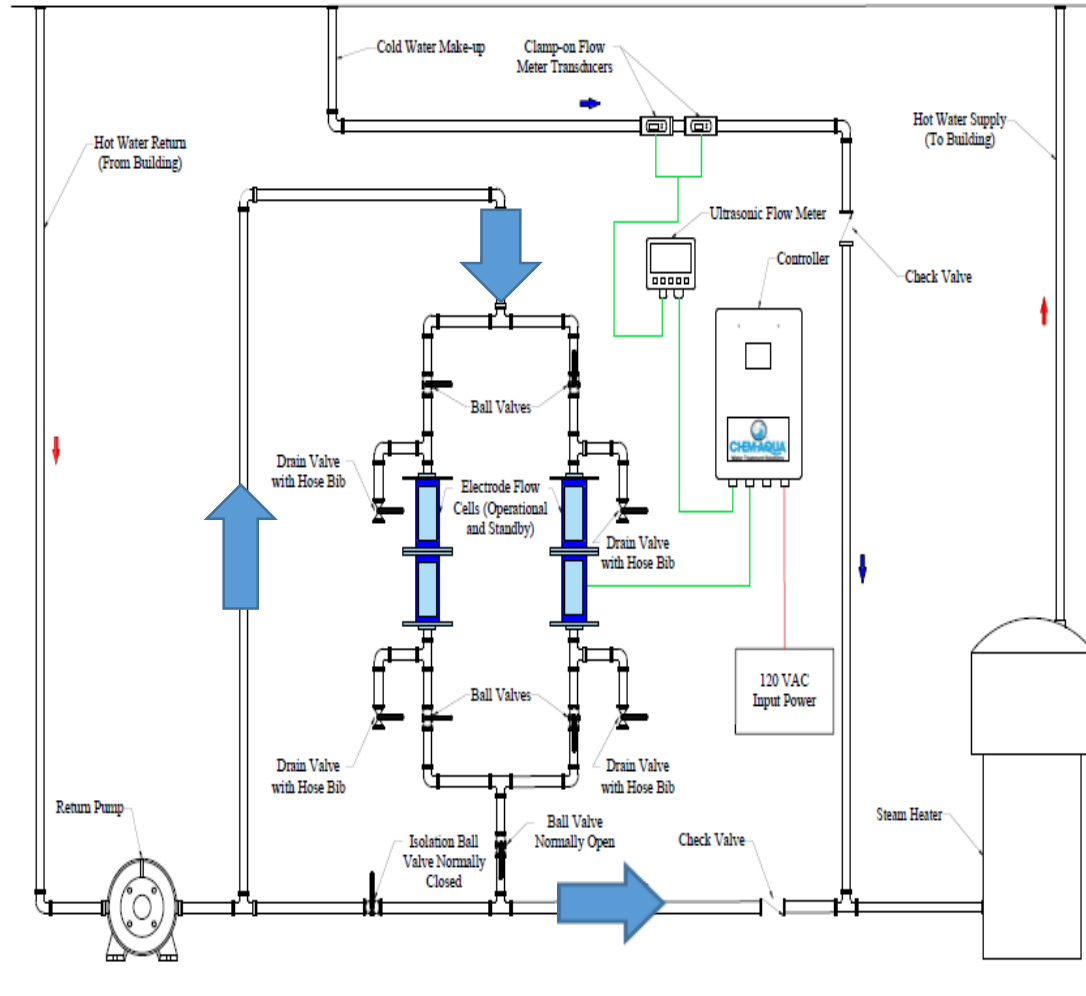
**AIC**  
American Infection Control

Control of legionella in care facilities  
Necula Codru MPH<sup>1</sup>, John Streptis PE<sup>2</sup>

Published by Elsevier, Amsterdam, NL

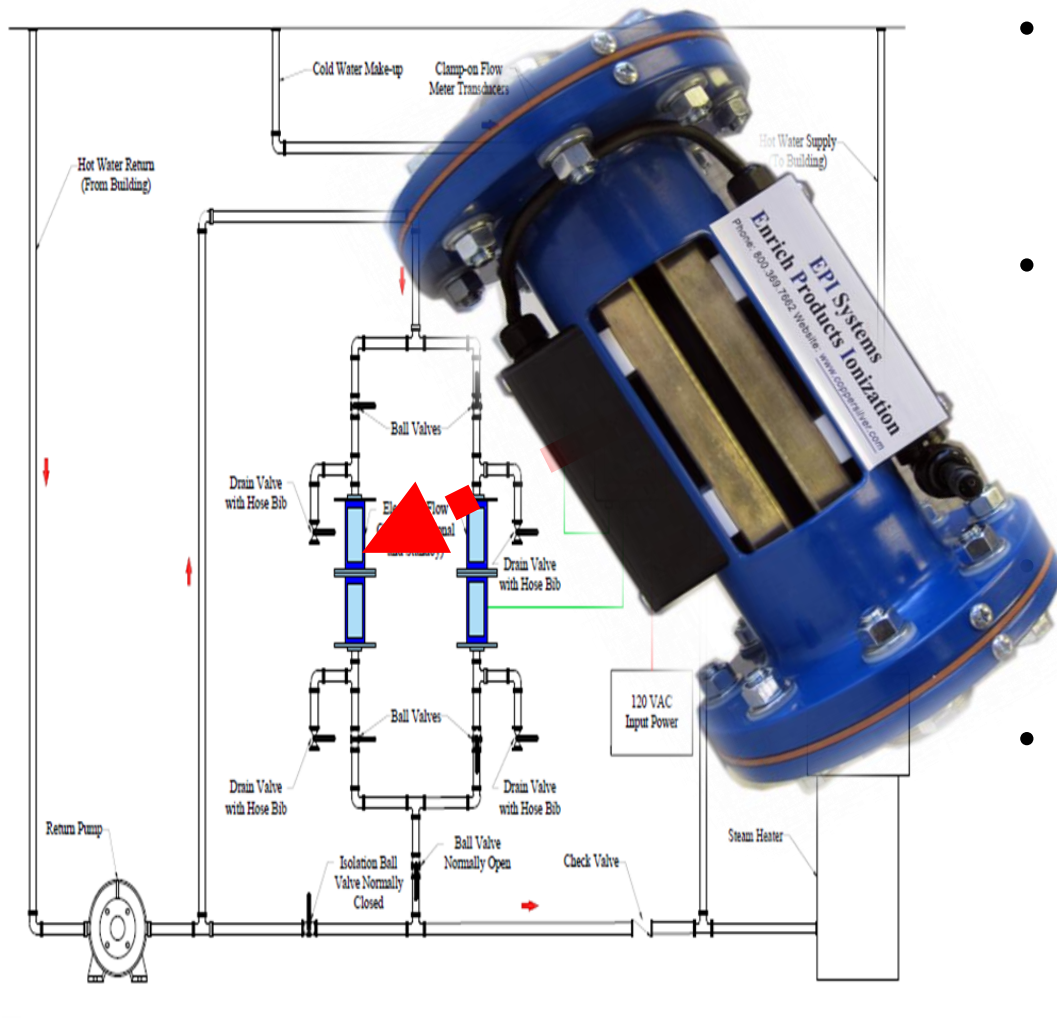


# How Does Cu Ag Ionization Work?



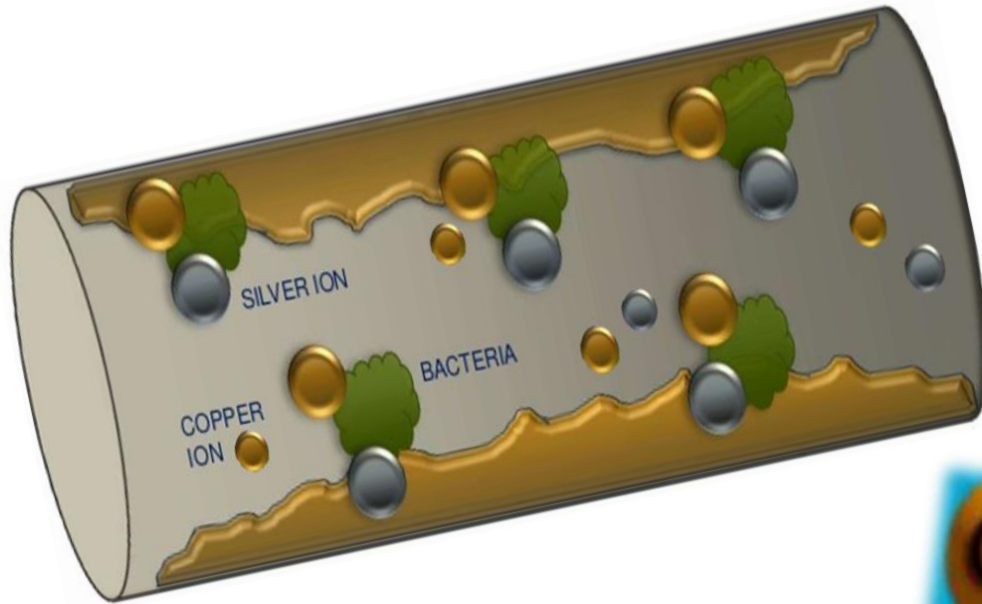
- The system is plumbed on a bypass into the return line of the hot water recirculating pump.
- The water flows through the flow cell

# How Does Cu Ag Ionization Work?



- The flow meter senses make up and sends a 4-20 signal to controller
- Controller sends DC charge to flow cell, which alternates creating the ionization inside the cell
- Inside the flow cell are cu ag electrodes.
- The copper and silver ions are knocked off the electrodes and dispensed into the water system

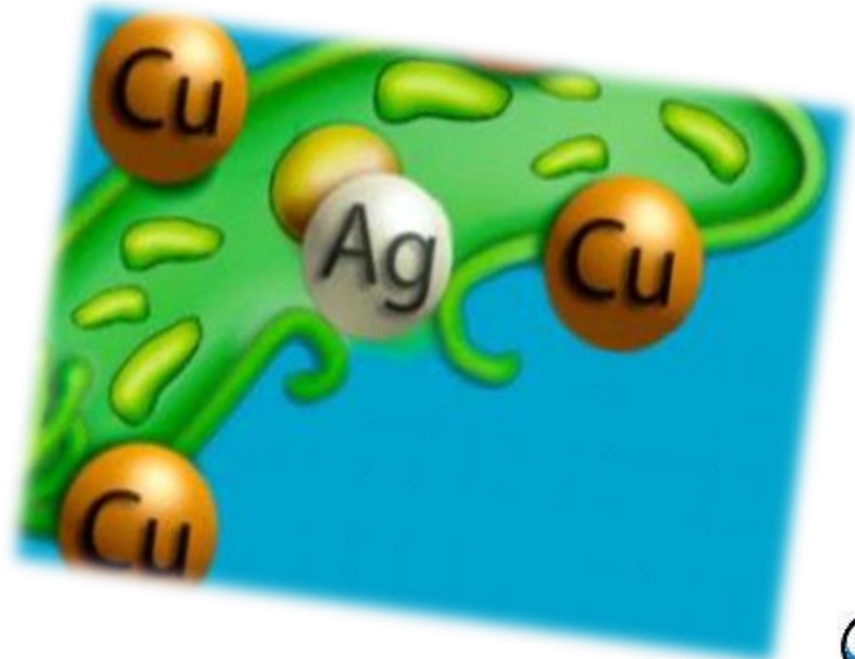
# How Does Copper Silver Ionization Work?



**Industry Standard for Efficacy:**

**0.20 -0.80 ppm of copper  
0.01 – 0.08 ppm of silver  
in the bulk water**

**Copper destroys the bacteria by piercing the outer membrane and Silver gets absorbed and kills by disrupting cell DNA.**

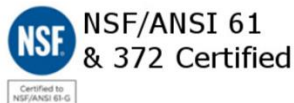
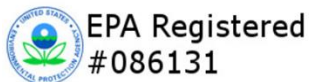


# HMI Controller – The Brain:



- Interacts with the flow meter and the electrode cell resulting in a controlled generation of copper and silver ions
- UL Listed to: UL 508 and CAN/CSA C22.2 No. 14, for Industrial Control Equipment
- Compatible with most BMS systems. Remote monitoring available

Width: 18.4" x Height: 32" x Depth 7", 54 Lbs.  
120-240 VAC, 50/60 Hz, single-phase.



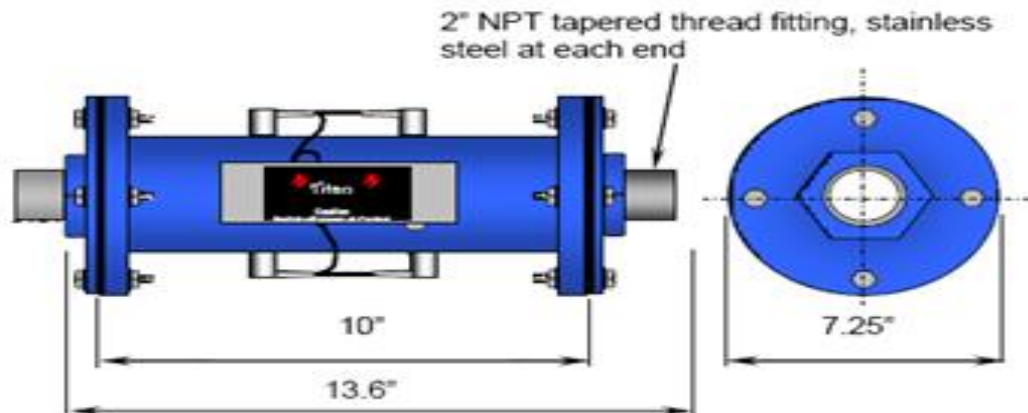
# Ultrasonic Flow Meter:

- Ultrasonic Flow meter controller displays the rate of flow and totalized water usage.
- Non Pipe invasive flow meter transducers are mounted to the outside of the make-up water piping.
- Back lit screen for viewing in all lighting conditions.



# Electrode Cell:

- Machined from a solid core of Aluminum, 6061 T-6 with no welds. The cell body can withstand pressures greater than 200 psi @ 200 F.
- 2" SS 316 male NPT threads for pipe connections
- Electrical quick connect is an insulated water tight connector



# The Electrodes:

- High purity copper-silver alloy bars EPA accepted for use in cold and hot drinking water
- 30% silver and 70% copper
- The electrodes are sacrificial and will need replacement.
- A secondary flow cell is recommended for redundancy



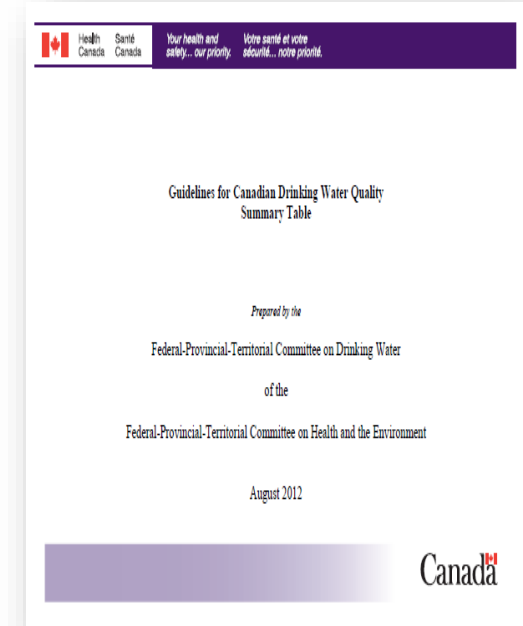


# Cu Ag Safety Issues:



## Health Canada's *Guidelines for Canadian Drinking Water Quality*-

- No MAC (maximum acceptable concentrations) for copper or silver in drinking water.
- Copper does have an AO (aesthetic objective) of less than or equal to 1.0 mg/L (ppm)



**All Chem-Aqua Cu Ag Systems are NSF Approved.**

**NSF and established industry practices target levels of: 0.20-0.80 Cu and 0.010 -0.080 Ag**



# Systemic Systems ARE NOT Plug & Play



As with all systems to control 'live' water-borne bacteria ...

... They only work with the proper monitoring and testing.

# Maximize the Efficiency of Your System



Depending on the conditions of the treated water, periodic maintenance is required on the electrodes.



Regular electrode cleaning increases the efficiency and life of the electrodes

# Replacement Electrodes



- Electrodes are sacrificial and will require replacement as they wear out
- EPI electrodes are guaranteed for 2 years

# Copper Silver Ionization

- EPA Best Lab Practices show a 99.9% kill of Legionella bacteria with CuAg



- Minimizes waterborne pathogens and provides residual protection for up to 6-12 weeks



# Questions?

