

## A Legionnaire's Disease Cluster Investigation at a Recreational Spa Facility Session 8c (i)

*Megan Canright, MPH, CIH*  
*Forensic Analytical Consulting Services, Inc.*

# *Legionella*

- Gram-negative rod bacteria
- Motile - flagellae
- Many species and serogroups pathogenic
- Naturally occurring in surface, ground waters and soil
- Commonly found in [low] in water systems
- Two associated illnesses:
  - Legionnaire's Disease (pneumonia, lung infection)
  - Pontiac Fever (flu-like illness, not an infection)

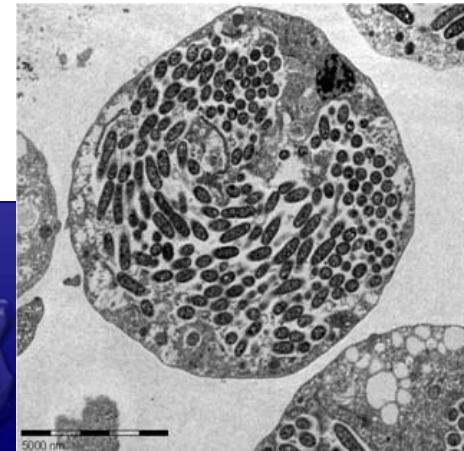
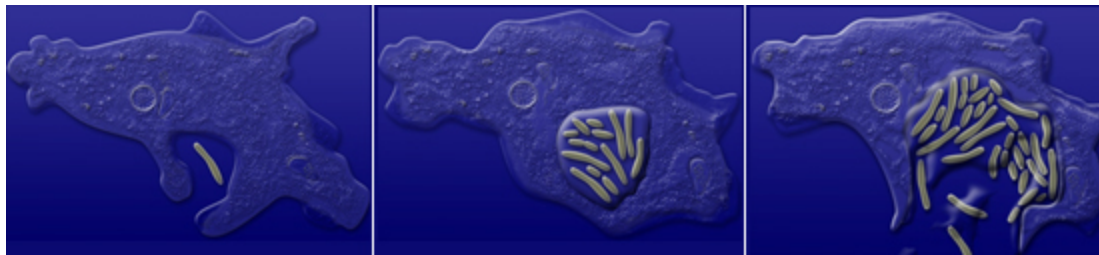


Courtesy of: PathCon Labs

# *Legionella* Growth Conditions

- Water (potable, industrial, lakes, etc.)
- Ideal growth temperature 26-50°C
- Low levels of chemical treatment/oxidant
- Water stagnation/low or no flow (dead legs)
- Biofilms, sediment, scale, algae
- Commensal organisms (amoebae)
- Viable but not culturable...

Courtesy of: Centers for Disease Control

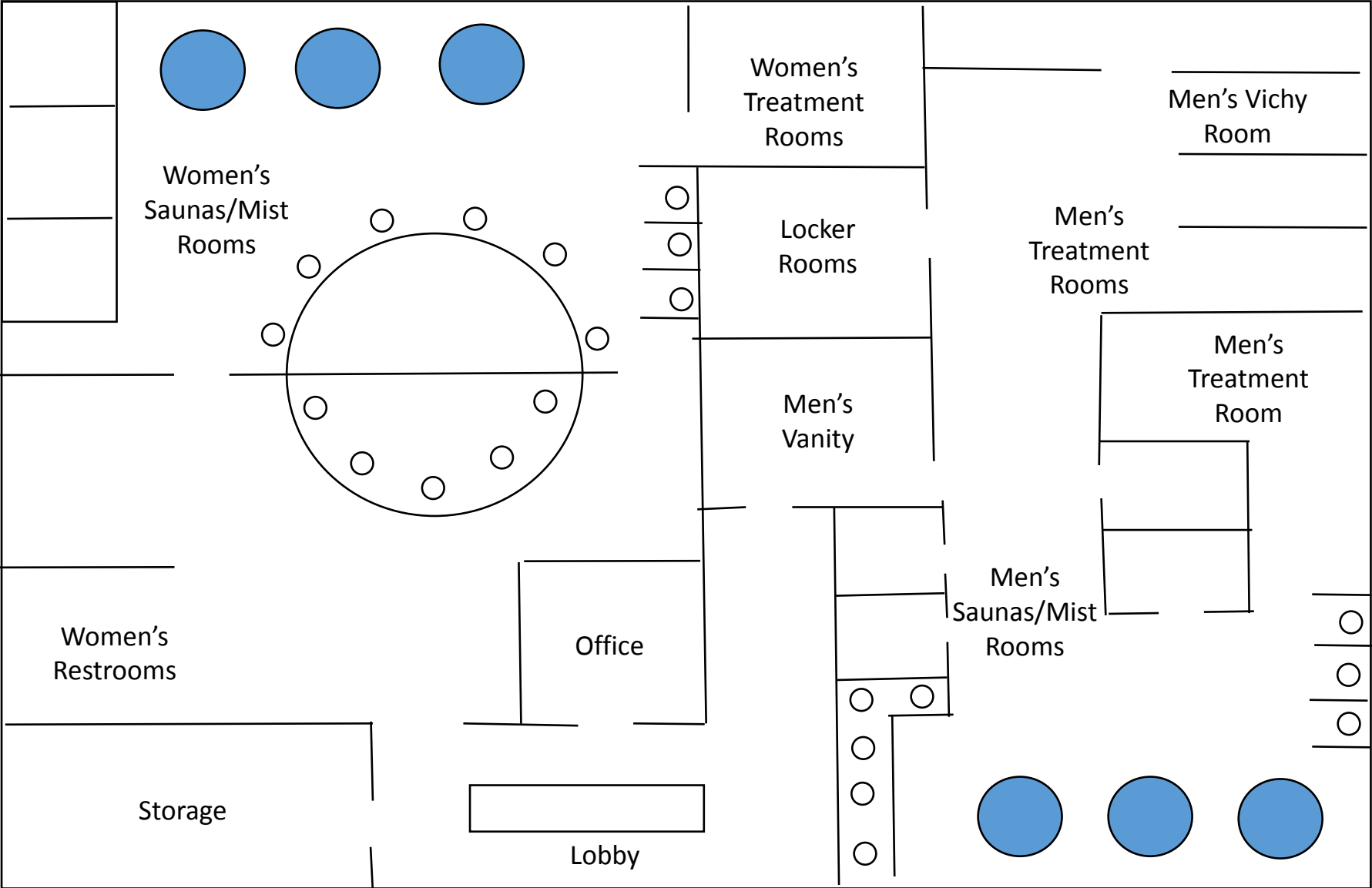


# Case Study: Recreational Spa

- Jimjilbang (Korean style gender segregated spa)
- Three story recreational facility
- Caters to Korean population, many elderly patrons
- 24 hour operation
- 9 cases of Legionnaire's Disease within several weeks
  - 6 male, 3 female
  - All aged 50+
  - ...during investigation 1 additional male



Courtesy of: Client Website (not disclosed for privacy)



# Building Water Systems



- Potable Water
  - DCW chlorine treated
  - DHW softened, rooftop boilers
  - Hot water circulating temperature 140°F+
  - Free chlorine residual non-detect
- Package HVAC units (no evap coolers)
- No irrigation
- Fire Sprinklers, no known cross connections

# Public Health Agency Involvement

- Minimal involvement at first
- Initial site visit, no sampling
- PH official acquires Legionnaire's Disease
- **Heavy** involvement thereafter
  - Public notification requirements
  - “Voluntary” closure of spa area (-\$\$\$)
  - Strict oversight and mandated controls
  - Mandated consultant retention
  - Side by side sampling
  - “Recommended” sampling locations





# Qualitative Risk Assessment

## Flow/Use/Maintenance

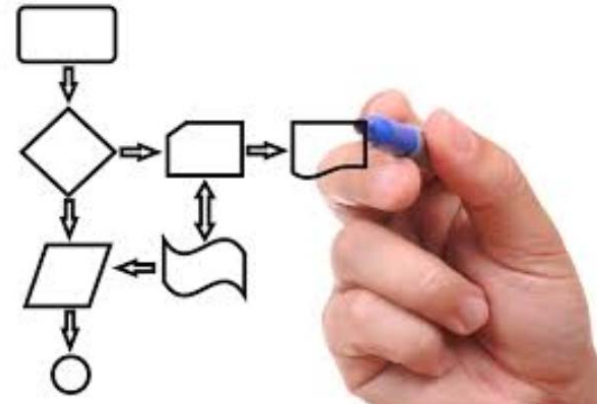
- 2<sup>nd</sup> Floor Men's/Women's Restrooms
- Men's standing showers
- Men's/Women's sauna showers

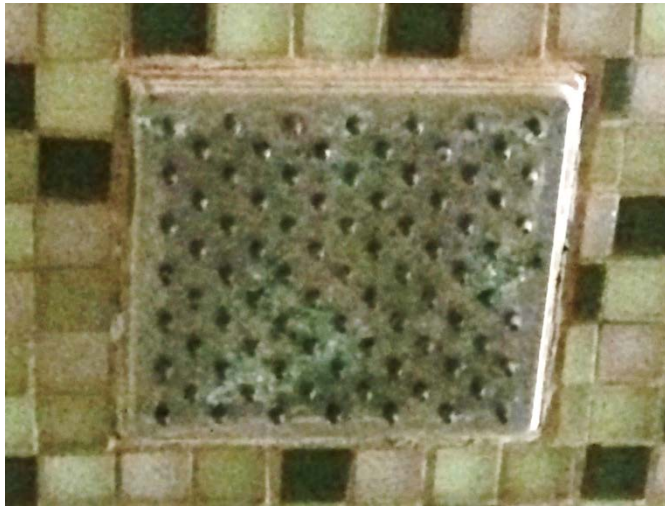
## Temperature

- Men's/Women's Warm Spas

## Oxidant

- Women's Spa cascading fountain
- Men's/Women's Spas (all)





OH2017 Harrogate International Centre  
25 - 27 April 2017

# Interim Control Measures

- Proactive primary treatment of water system (chlorine)
- Draining, cleaning, disinfection of all shower heads and all spas
- Draining, cleaning, disinfection of women's fountain
- Documented spa and fountain chlorination
- Flushing program for low-use fixtures
- Additional validation sampling
- Water management practices and written plan
- DPH – mandated POU filtration
- DPH – mandated secondary treatment

# HSE Guidance (2012)

Source	<i>Legionella</i> Count (CFU/L)	Recommended Action
Cooling Towers	≤100	System under control; maintain controls
	>100 – 1,000	Reassess control program; adjust biocide
	>1,000	Implement immediate corrective action
Potable Water	<100	In Healthcare, any detection should be investigated
	>100 - <1,000	Depends on positivity. resample with risk assessment or remediation
	>1,000	Immediate resample, risk assessment, and remediation

# AIHA Guidance (2015)

<b><i>Legionella</i> Results ( CFU/L) and Hazard Action Criteria</b>						
<b>Source</b>	Acceptably Low*	Action	Possible Amp	Action	Indicates Amp	Action
Humidifiers & Misters	<1,000	1	1,000-10,000	2	>10,000	3
Decorative Fountains/Features	<1,000	1	1,000-10,000	2	>10,000	3
Hot Tubs, Whirlpools, Spas	<1,000	1	1,000-10,000	2	>10,000	3
Potable Water	<10,000	1	10,000-100,000	2	>100,000	3
Industrial Working Fluids	<10,000	1	10,000-100,00	2	>100,000	3
Cooling Towers & Evaporative Coolers	<100,000	1A	100,000-1,000,000	2A	>1,000,000	3A

# Water Sample Results (CFU/L)

Location	DPH June		FACS June		FACS July	
	Pre	Post	Pre	Post-	Pre-	Post-
Men's vanity sink		-	150,000	10,000	<500	<500
Men's Vichy shower	-		<500	<500	<500	500
Men's warm spa sump	+		20,000	N/A	<500	500
Men's cold spa sump			<500	N/A	<500	<500
Men's hot spa sump			1,000	N/A	<500	<500
Men's standing shower			240,000	<500	1,000	<500
Men's mist sauna shower			<500	<500	<500	<500
Men's cold sauna shower			<500	<500	<500	<500
Men's tx room shower			<500	<500	<500	4,900
Men's janitor closet			<500	<500	<500	<500
Men's 2 <sup>nd</sup> floor RR sink			5,000	1,500	500	<500

# Water Sample Results (CFU/L)

Location	DPH June		FACS June		FACS July	
	Pre	Post	Pre	Post	Pre	Post
Women's fountain	+	N/A	3,000,000	N/A	15,000	N/A
Women's cold spa sump		N/A	<500	N/A	<500	N/A
Women's warm spa sump	-	N/A	10,000	N/A	1,500	N/A
Women's hot spa sump		N/A	1,500	N/A	<500	N/A
Women's sitting shower			1,000	<500	<500	<500
Women's Tx room shower			<500	<500	<500	<500
Women's 2 <sup>nd</sup> floor RR sink			15,000	500	130,000	1,000
Municipal supply			N/A	1,000	5,000	<500

# Ongoing Water Management Plan

- Water Management Team
- Daily flushing of low use fixtures by janitorial staff
- Regular cleaning/disinfection of fixtures
  - Showers, aerators, accessible piping
- Removal/conversion of decorative fountain
- Routine cleaning/disinfection of spas and changeout of filters
- Daily monitoring of spa and fountain chlorine
- Secondary treatment system (mandated by DPH)
- POU filtration removed after ~3 months
- Spa closed for 6+ months (\$1M + in loss)



Questions?

Thank you!

Megan Canright, MPH, CIH

[mcanright@forensicanalytical.com](mailto:mcanright@forensicanalytical.com)

+1 858 859 3322