



**Indiana  
Department  
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Health**

# A TALE OF TWO OUTBREAKS

*Case study reviews of two healthcare-associated Legionellosis outbreaks*

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10/21/2025

## OUR MISSION:

To promote, protect, and improve the health and safety of all Hoosiers.

## OUR VISION:

Every Hoosier reaches optimal health regardless of where they live, learn, work, or play.





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# Background

# IDOH HAI *Legionella* team

- Epidemiologists
  - Healthcare-associated infections
  - Community and travel
  - Field team
  - Environmental health specialists
- Additional resources at IDOH
  - Office of Legal Affairs
  - Office of Public Affairs
  - Chief medical officer
  - Regulatory teams



**Infectious Disease  
Epidemiology &  
Prevention Division**

- For healthcare-associated *Legionella* questions
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- For travel or community-associated *Legionella* questions
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# Where do we get our information?

- Centers for Disease Control and Prevention (CDC)
- Environmental Protection Agency (EPA)
- Council of State and Territorial Epidemiologists (CSTE)
- Healthcare Infection Control Practices Advisory Committee (HICPAC)
- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)
- Centers for Medicare & Medicaid Services (CMS)



Image from CDC: <https://phil.cdc.gov/Details.aspx?pid=15278>

# Legionella epidemiology

## Bacteriological

- Gram-negative bacteria typically found in freshwater at very low levels
- More than 60 different species, any of which could be pathogenic
- Most human illness is caused by *Legionella pneumophila* (LP), particularly serogroup 1 (LP1)
- Causes “Legionellosis”: Pontiac Fever, Legionnaires’ disease, and extrapulmonary Legionellosis

## Patient risk factors

- Age  $\geq$ 50 years
- Chronic lung disease
- Immune system disorders due to disease or medication
- Smoking (current or historical)
- Systemic malignancy
- Underlying illness such as diabetes, renal failure, or hepatic failure



# Case classifications

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- Confirmed
  - Clinically compatible with confirmatory laboratory evidence
    - e.g., symptoms such as shortness of breath (SOB) and chest X-ray (CXR)
- Probable
  - Clinically compatible with an epidemiologic link to a confirmed source of *Legionella*
- Suspect
  - Clinically compatible with supportive laboratory evidence
- Not a Case
- Healthcare-associated status
  - Not (community or travel-associated)
    - No exposure to a healthcare facility in the 14 days prior to symptom onset
  - Possibly
    - A portion of 14 days prior to symptom onset at a healthcare facility
  - Presumptively
    - $\geq 10$  continuous days at a healthcare facility during the 14 days prior to symptom onset

# Outbreak basics

- Outbreak vs cluster
  - For *Legionella*, these terms are interchangeable!
  - Per the CDC, health departments can use either term but should be consistent in their use.
- Who leads an outbreak investigation?
  - Local Health Department (LHD)
  - IDOH
    - HAI team
    - Respiratory team
- Case types and timelines
  - A single presumptive case at any time
  - Two possible cases within a 12-month period



# Clinical and environmental testing

## Clinical Testing

- Urine Antigen (UAT)
  - Less invasive
  - Detects ONLY LP-1
- Bronchoalveolar lavage (BAL)
  - Invasive procedure where lungs are washed with fluid, which is then removed and cultured
  - Tests for all species of *Legionella*

## Environmental Testing

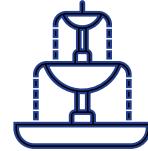
- Legioalert
  - Shorter result time and lower cost
  - Positivity is determined by color (brown) or turbidity, which is subjective
  - Detects ONLY LP
  - Often used for routine testing
    - Should NOT be used for outbreaks
- Culture testing
  - Bulk water or swab samples
  - Tests for all species of *Legionella*
  - Reported in colony forming units per milliliter (CFU/mL)
  - Used by CDC ELITE certified labs<sup>1</sup>

# Water precautions

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Restrict showers



Turn off fountains, cooling towers, or hot tubs



Use bottled water for drinking



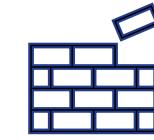
Halt new admissions



Temporarily closing building, affected area, or device



Avoid using sinks or bathtub faucets in patient rooms



Install appropriate point-of-use (POU) filters

# Case Study 1: Hospital Setting, 2023



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# Basic demographic info

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## Facility information

- 224 beds
- State licensed and Medicare certified
- Three separate water loops within water system
- Historic sampling from previous year showed LP1 in domestic water (max 8CFU/mL) and non-LP in cooling tower (10CFU/mL)
- Facility implemented water precautions prior to initial sampling
  - Bottled water for drinking, installation of POU filters

## Patient information

- Out of state resident
- Illness onset: 7/9/2023
  - Incubation period: 6/25-7/19
- Exposure
  - Presented 6/13 with unrelated symptoms related to leg pain and chronic toe injury
  - Discharged to long-term care facility (LTCF) 7/12
- Presented 7/16 s/p fall and no relief of SOB
  - Diagnosis 7/19/2023 via UAT and CXR
  - Discharged to LTCF 8/18
- Note: Presented again 8/19 due to inability to manage pneumonia at LTCF. Patient expired 8/22/2023



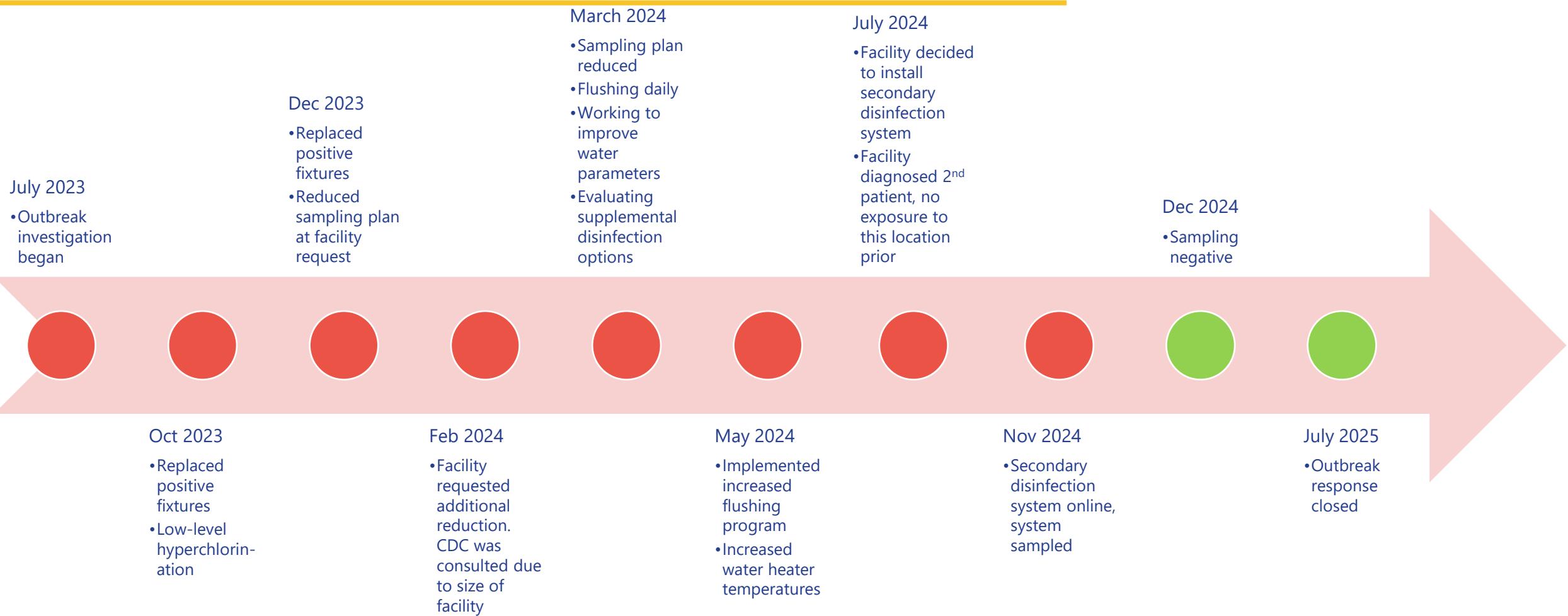
# Initial sampling

- 9/13/2023 via a CDC ELITE certified lab
- All three loops implicated via both bulk water and swab samples
  - 13/60 bulk water
  - 4/46 swabs
- Only LP1 was identified

Water Type (Potable/ Non-potable)	Temp °F	FRO (Free Residual Oxidant)	TRO (Total Residual Oxidant)	pH	Lpn S1	Lpn S2-15	Legionella Spp
					CFU/mL		
Potable	113.5	N/A	0.48	8.27	<0.1	<0.1	<0.1
Potable	125.9	N/A	0.63	7.78	<0.1	<0.1	<0.1
Potable	118.7	N/A	0.41	7.67	<0.1	<0.1	<0.1
Potable	104.9	N/A	0.35	7.78	<0.1	<0.1	<0.1
Potable	115.3	N/A	0.37	7.99	<0.1	<0.1	<0.1
Potable	113.5	N/A	0.55	7.91	<0.1	<0.1	<0.1
Potable	109	N/A	0.78	7.95	<0.1	<0.1	<0.1
Potable	128.6	N/A	0.41	8.04	<0.1	<0.1	<0.1
Potable	128.1	N/A	0.38	7.94	<0.1	<0.1	<0.1
Potable	118.2	N/A	0.39	7.7	<0.1	<0.1	<0.1
Potable	94.1	N/A	0.47	7.68	<0.1	<0.1	<0.1
Potable	117.3	N/A	0.22	7.65	<0.1	<0.1	<0.1
Potable	71.9	N/A	1.07	7.7	<0.1	<0.1	<0.1
Potable	72.4	N/A	.48	7.4	5.5	<0.1	<0.1
Potable	113.5	N/A	0.45	7.63	<0.1	<0.1	<0.1
Potable	109.4	N/A	0.63	7.87	<0.1	<0.1	<0.1
Potable	111.7	N/A	0.56	7.64	<0.1	<0.1	<0.1
Potable	70.1	N/A	.24	8.2	<0.1	<0.1	<0.1
Potable	70.9	N/A	.13	7.9	<0.1	<0.1	<0.1
Potable	77	N/A	.09	7.9	<0.1	<0.1	<0.1

Fig 1. Image from sampling results collected 9/13/2023

# Remediation timeline



# Unique considerations/situations

- Facility was extremely large
  - Collaboration was needed to ensure sampling was representative without being overly financially burdensome
  - Three water loops meant three response timelines
- Facility served patients with high level of acuity as well as chronic conditions
  - Overlapped with respiratory season
- Water parameters
  - Good incoming chlorine, some issue with water temperatures (cold and hot too high)
- Water Management Program
  - Still listed global superheating as a remediation method

**“Superheating”, or “thermal disinfection,” involves flushing all fixtures for 20 minutes with water at 158°F. Literature shows this to be ineffective and often leads to rapid recolonization. Additional considerations include scalding risk, damage to plumbing components, and municipal water temperature discharge limits. ASHRAE explicitly does not recommend global superheating of water systems.**

# Lessons learned

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- Historic positives were remediated per their water management plan, but subsequent testing to verify efficacy was not conducted
  - **Including follow-up testing** could have prevented subsequent contamination of the water system
- The facility had good incoming disinfectant that then varied dramatically within the facility
  - This could have been caused by many things: size/length/material of plumbing, water softeners, water temperatures, water age, etc.
  - **Monitoring residual disinfectant** is critical even when incoming disinfectant is sufficient
  - **Monitoring outlet temperatures** is important to overall system health
- **A secondary disinfection system can help maintain a generally healthy system**

# Case Study 2: Long-Term Care Facility, 2024



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# Basic demographic info

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## Facility information

- 42 beds
  - Last census: 33
- CMS participating
- Historic sampling via Legiolert indicated LP1 contamination
- Facility installed appropriate POU filters onto showers and ice machines, brought in bottled water for drinking

## Patient information

- Illness onset 10/03/2024
  - Incubation period: 09/19-10/03
  - Dyspnea, found unresponsive in respiratory failure
- Exposures
  - Resident of LTCF since 8/1, not known to have left
- Diagnosed with LD 10/3/2024 via UAT and CXR
- Patient survived, returned to LTCF

# Initial sampling

- Collected 10/25/2024 by facility staff
- Tested by a CDC ELITE certified lab
- 22 total tests
  - 1/8 swabs positive
  - 5/14 bulk water samples positive
- LP1, LP2-14, non-LP

TEST	METHOD	Result	UNITS	Date Completed
Legionella SWAB	SM9260J-Confir	650	cfu/swab	11/4/2024
		Positive for Legionella pneumophila serogroup 1, 2-14, and Leg. Species.		
Legionella CULTURE	SM9260J-Confir	270	cfu/mL	11/4/2024
		Positive for Legionella pneumophila serogroup 1, 2-14, and Leg. Species.		
Legionella CULTURE	SM9260J-Confir	1120	cfu/mL	11/4/2024
		Positive for Legionella pneumophila serogroup 1, 2-14, and Leg. Species.		
Legionella CULTURE	SM9260J-Confir	200	cfu/mL	11/4/2024
		Positive for Legionella pneumophila serogroup 1, 2-14, and Leg. Species.		
Legionella CULTURE	SM9260J-Confir	120	cfu/mL	11/4/2024
		Positive for Legionella pneumophila serogroup 1, 2-14, and Leg. Species.		
Legionella CULTURE	SM9260J-Confir	1200	cfu/mL	11/4/2024
		Positive for Legionella pneumophila serogroup 1, 2-14, and Leg. Species.		

Fig 2. Compilation of images from sampling results collected 10/25/2024.

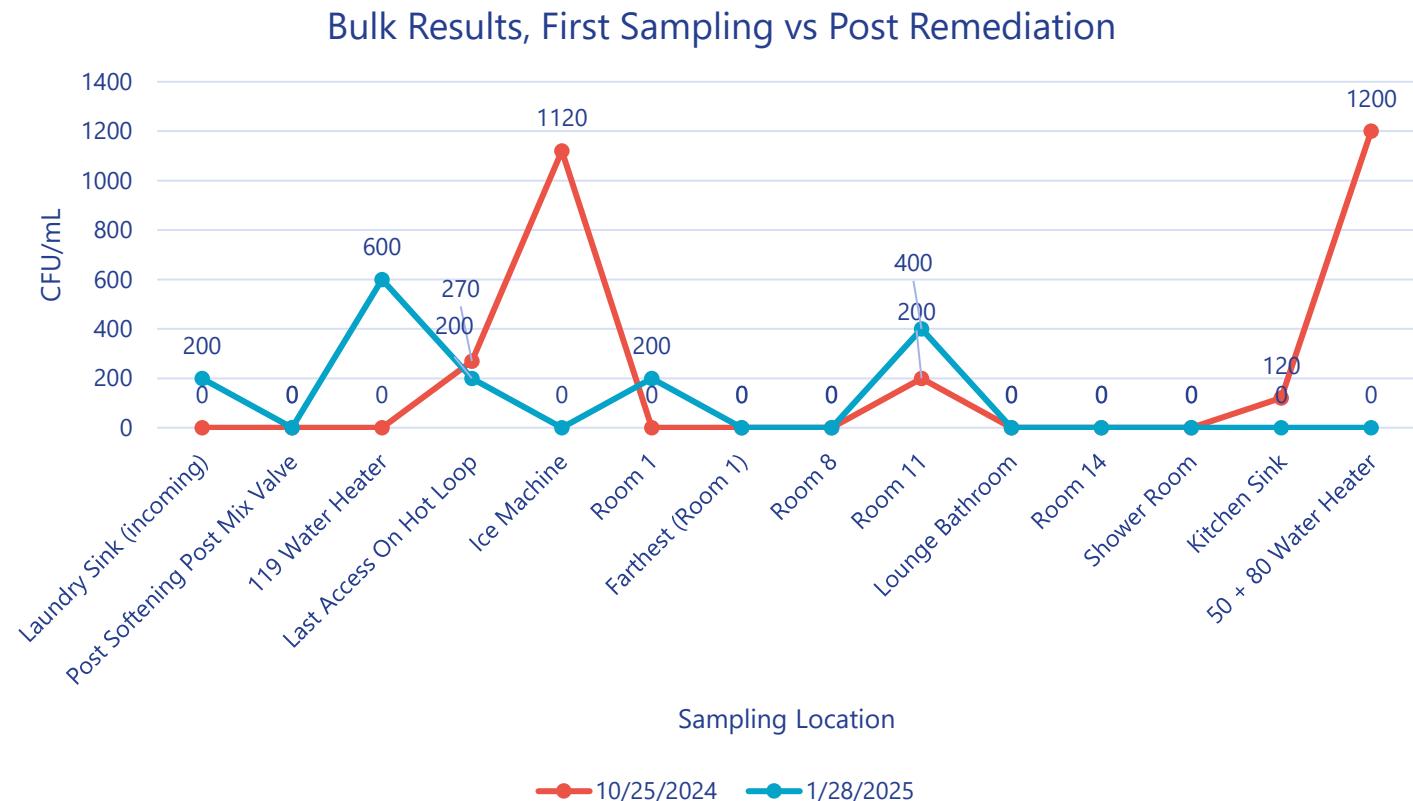


# Remediation timeline



# Unique considerations/situations

- Out-of-use shower room being used for storage created a dead leg in the system
- Facility did not hire a water consultant initially
- Use of Legiolert tests early-on
- Facility staff were not familiar with water management programs



# Lessons learned

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- **Adherence to a well-developed, robust, written water management program** is critical for controlling *Legionella* and other opportunistic premise plumbing pathogens
- **Hiring a water consultant** can be extremely useful for facilities to identify which remediation method(s) would be most effective for their specific system
  - Inappropriate selection or application of remediation methods can be ineffective, harmful to building occupants, damaging to plumbing and water system components, and could encourage resurgence of *Legionella*
- Using a **culture-based environmental testing method** ensures detection of non-LP species
- Ensuring **education/recommendations** about *Legionella* epidemiology, remediation, and best practices are digestible for all stakeholders is critical to outbreak response success

# Questions?

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