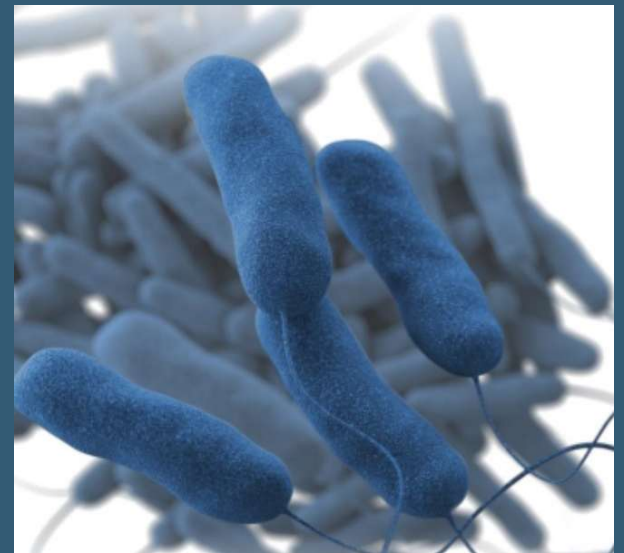


Legionella Trend and Response

Illinois Department of Public Health

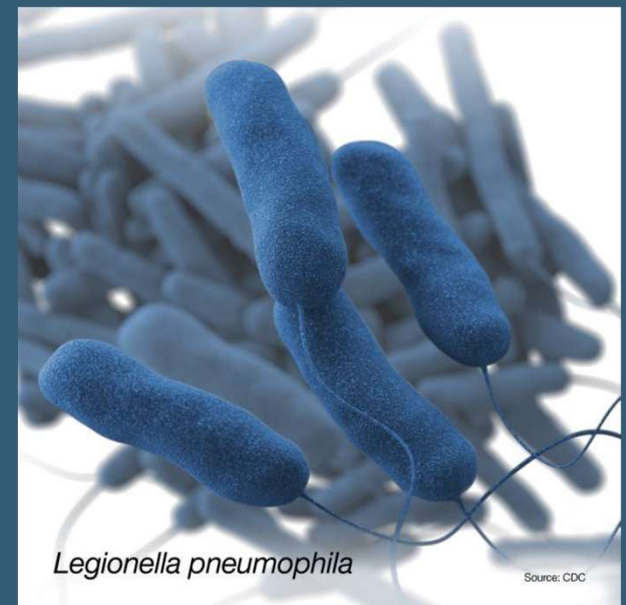


Overview of Topics

- Legionella overview
- IDPH Division of Environmental Health's Response Role
- OPPPs the Basics
- *Legionella* 101
- OPPP Prevention through Water Management
- Environmental Investigations

Legionella

- Gram-negative bacillus
- Intracellular parasite of free-living amoebae
- Naturally occurring in fresh water environments
- Can live and grow in biofilms
- More than 60 species
- *L. pneumophila*: ~90% of U.S. cases of legionellosis



Source: CDC

LEGIONELLOSIS: TWO MANIFESTATIONS OF ILLNESS

Legionnaires' disease

- Severe pneumonia
- Fever, myalgia (muscle pain), cough, shortness of breath
- Treated with antibiotics
- Hospitalization is common

About **1 in 10** people who get Legionnaires' disease will die from the infection.

For those who get Legionnaires' disease during a stay in a healthcare facility, about **1 in 4** will die.

Pontiac Fever

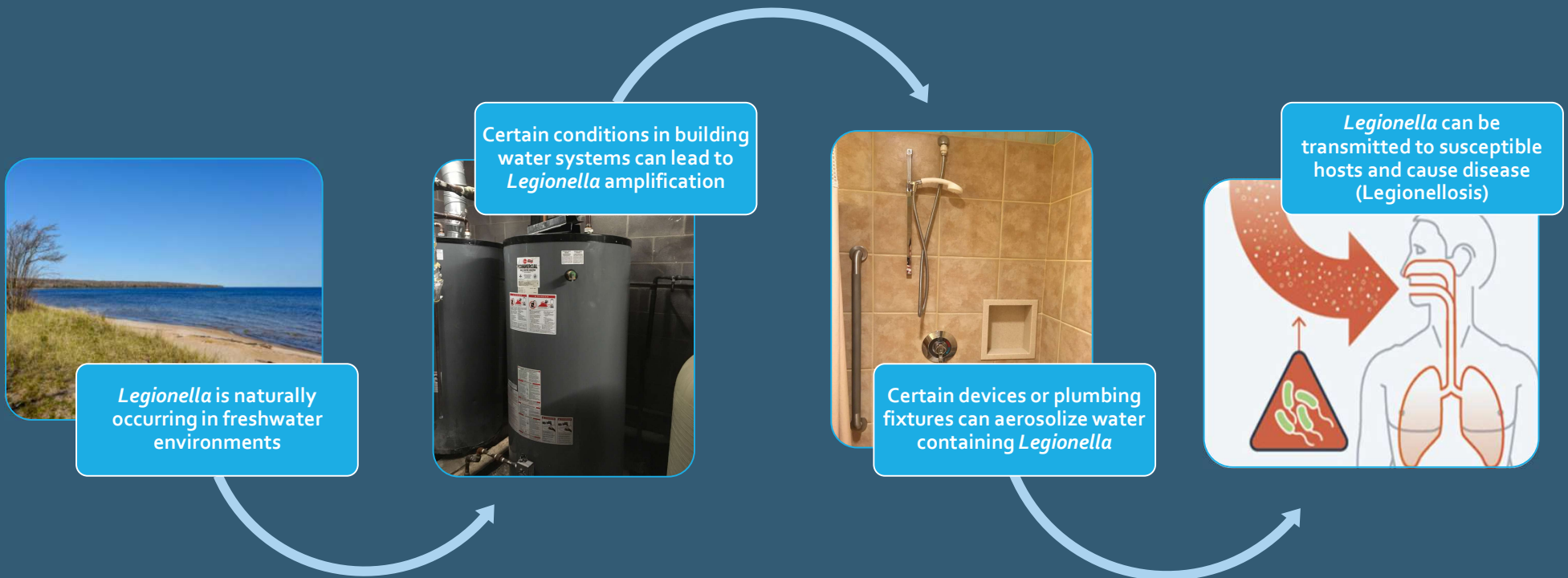
- Flu-like (fever, chills, fatigue)
- No pneumonia (lung infection)
- Does not typically result in hospitalization or antibiotics
- Typically self-resolving

Rarely, *legionella* can cause extrapulmonary infections.

INCREASED RISK OF LEGIONNAIRES' DISEASE

- **Most healthy people exposed to *Legionella* do not get sick**
- **People at increased risk include:**
 - 50 years or older
 - Current or former smokers
 - Chronic lung disease (COPD or emphysema)
 - Weak immune systems or who take drugs that weaken the immune system
 - People with cancer
 - Underlying illness such as diabetes, kidney failure, or liver failure

From *Legionella* in fresh water to clinical disease: Legionellosis Chain of Causation



How is *Legionella* transmitted?

Legionella is transmitted to hosts via aerosolized water or by contaminated water accidentally swallowed into the lungs

Inhalation

- More common
- Breathe in mist or droplets of contaminated water
- Examples of potential sources:
 - Showers
 - Spas
 - Cooling towers
 - Decorative fountains



Aspiration

- Less common
- Exposure for individuals with swallowing difficulties
- Consideration for healthcare
- Examples of potential sources:
 - Ice machines
 - Drinking water

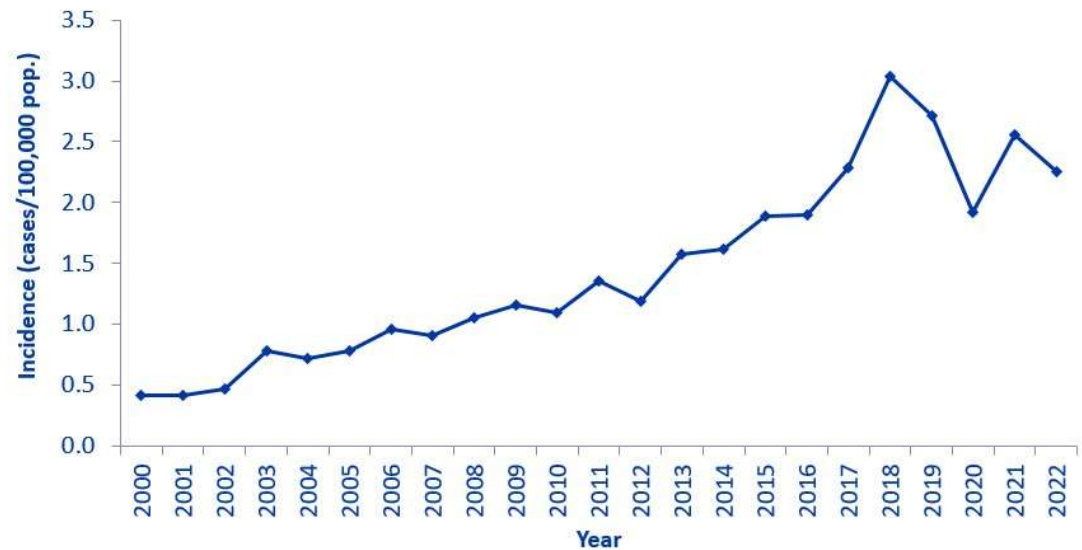


Increased Risk

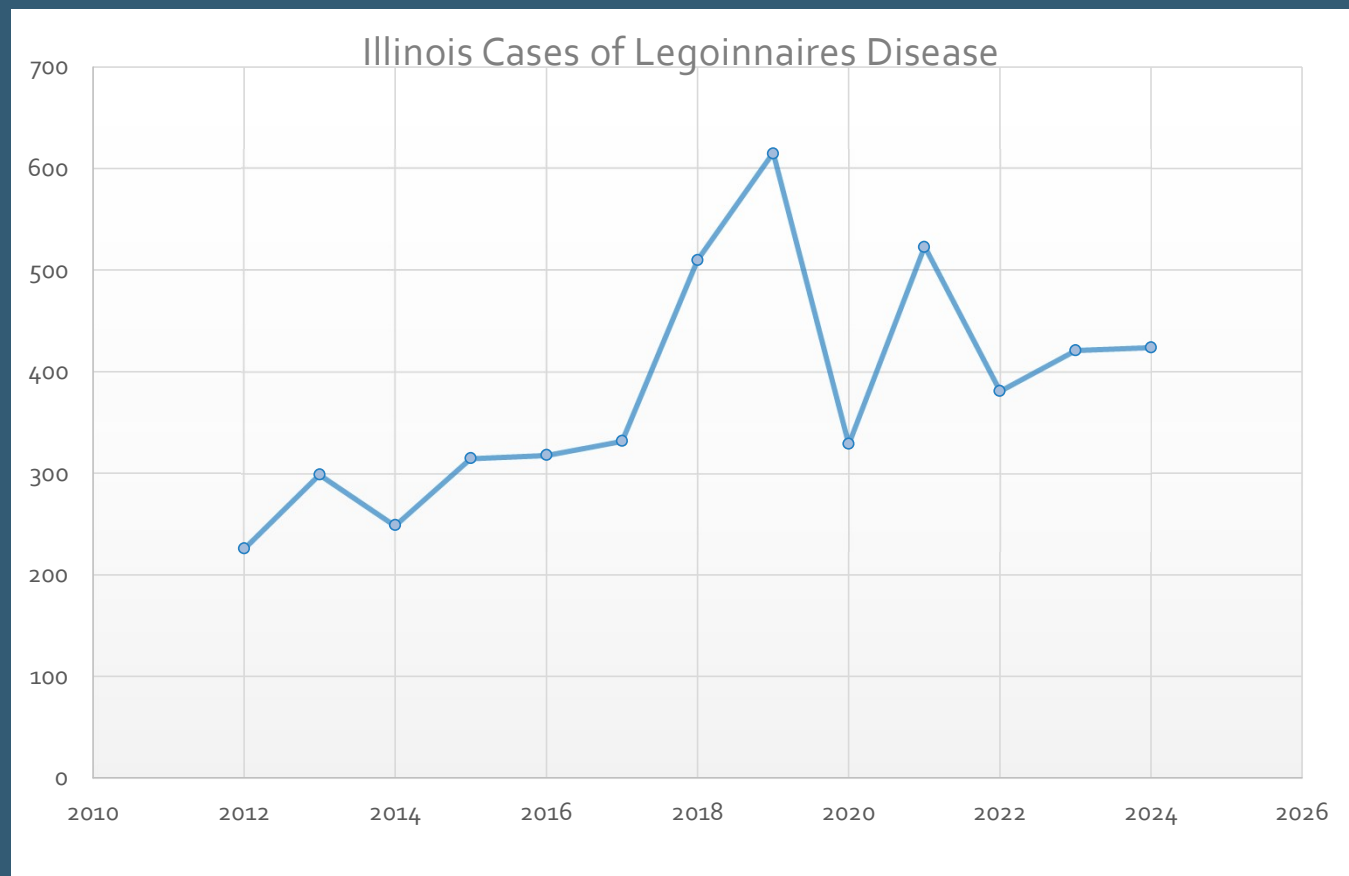
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Legionnaires: National Trend 2000-2018

Legionnaires' disease in the United States, 2000-2022



Legionnaires: Illinois Trend 2012-2024



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Sum:
January	8	5	6	2	15	18	21	25	27	14	24	11	19	20	166
February	7	8	11	12	13	10	18	20	15	11	8	20	25	22	154
March	8	8	13	9	10	6	10	16	13	19	4	16	16	18	132
April	9	6	8	10	9	20	17	11	16	13	8	15	13	14	142
May	9	15	18	19	17	23	20	18	10	17	24	25	41	23	215
June	15	53	34	23	23	45	101	63	25	62	42	31	48	43	516
July	25	61	37	41	48	68	70	91	73	165	80	93	82	51	851
August	55	47	38	82	60	38	40	105	34	56	67	65	51	40	682
September	42	39	46	63	38	30	110	108	60	40	48	48	45		640
October	29	28	21	17	37	41	55	103	23	69	31	47	38		454
November	9	19	7	23	25	21	26	32	18	26	23	19	22		229
December	10	10	10	14	23	12	22	23	15	31	22	31	24		192
Sum:	226	299	249	315	318	332	510	615	329	523	381	421	424	231	4373

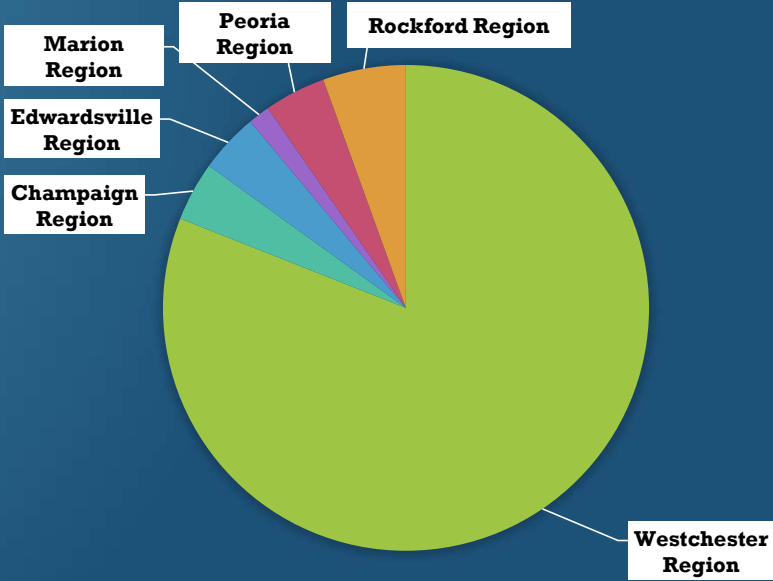
Illinois Legionnaires Case Numbers

LEGIONELLA DISTRIBUTION IN ILLINOIS

*AS OF 1/15/2025

Cases since June 1, 2023

Region at Onset	Cases	Percentage
Westchester Region	614	81.00%
Rockford Region	42	5.54%
Peoria Region	31	4.09%
Champaign Region	30	3.96%
Edwardsville Region	30	3.96%
Marion Region	11	1.45%



Possible reasons for the increasing number of reported cases?

- Increased susceptibility of the population
 - Aging US population
 - More people with immune suppressing medications
- More *Legionella* in the environment
 - Warmer temperatures
 - Aging infrastructure
 - Water-saving building modifications
- Improved diagnostic capabilities
 - UAT availability
- Improved diagnosis and reporting
 - Increased awareness and testing
 - Increased surveillance capacity



What do we know about source attribution?

- 2016: CDC analyzed data from 27 building-associated outbreaks (2000-2014)
- Common Settings
 - Hotels (44%)
 - Long-term care facilities (19%)
 - Hospitals (15%)
- Common Sources
 - Showerheads and sink faucets
 - Cooling towers (22%)
 - Hot tubs (7%)
 - Industrial equipment (4%)



Source: Garrison LE et al. *MMWR*. 2016; 65 (22):557-61 *CSTE All-State Epi Call*; CDC; February 26, 2018

PRIMARY FACTORS IN *LEGIONELLA* GROWTH IN WATER SYSTEMS



Water Age



Disinfectant



Temperature



Biofilm

WATER AGE

- Water age is a major factor in water quality deterioration
- Long water residence time increases likelihood of biofilm formation
 - Dead ends/dead legs
 - Storage
 - Occupancy
 - Low flow fixtures
 - Infrequently used equipment



DISINFECTANT

- Adequate disinfection needed to prevent the growth of *Legionella*
- Premise plumbing systems: Disinfectant levels should be detectable where water enters the building and at points of use
- Measure the pH of the water to determine whether disinfectant used in the building will be effective



TEMPERATURE

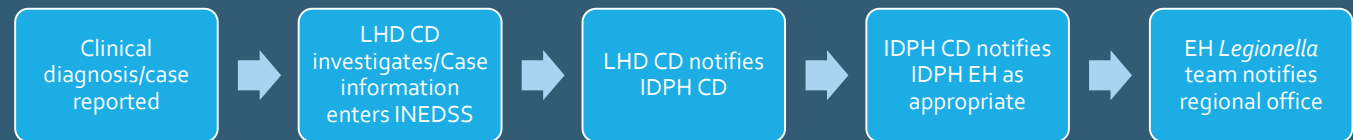
- *Legionella* species are considered thermotolerant
- Able to withstand temperatures of 122 °F for several hours and can also survive temperatures below freezing
- *Legionella* grows best **77 °F - 108 °F**



REPORTING IN ILLINOIS

- Control of Communicable Disease Code identifies legionellosis as a notifiable disease.
- Individual cases of legionellosis are required to *be reported as soon as possible during normal business hours, but within three days, to the local health authority, which shall then report to the Department as soon as possible during normal business hours but within three additional days.* (77 Ill. Adm. Code 690.100 c)
- Additional reporting requirements at 77 Ill. Adm. Code 690.475
- Reported electronically through Illinois' National Electronic Disease Surveillance System (I-NEDSS)

How is IDPH
EH made
aware of
legionellosis
cases?



IDPH Division of Environmental Health Response Role

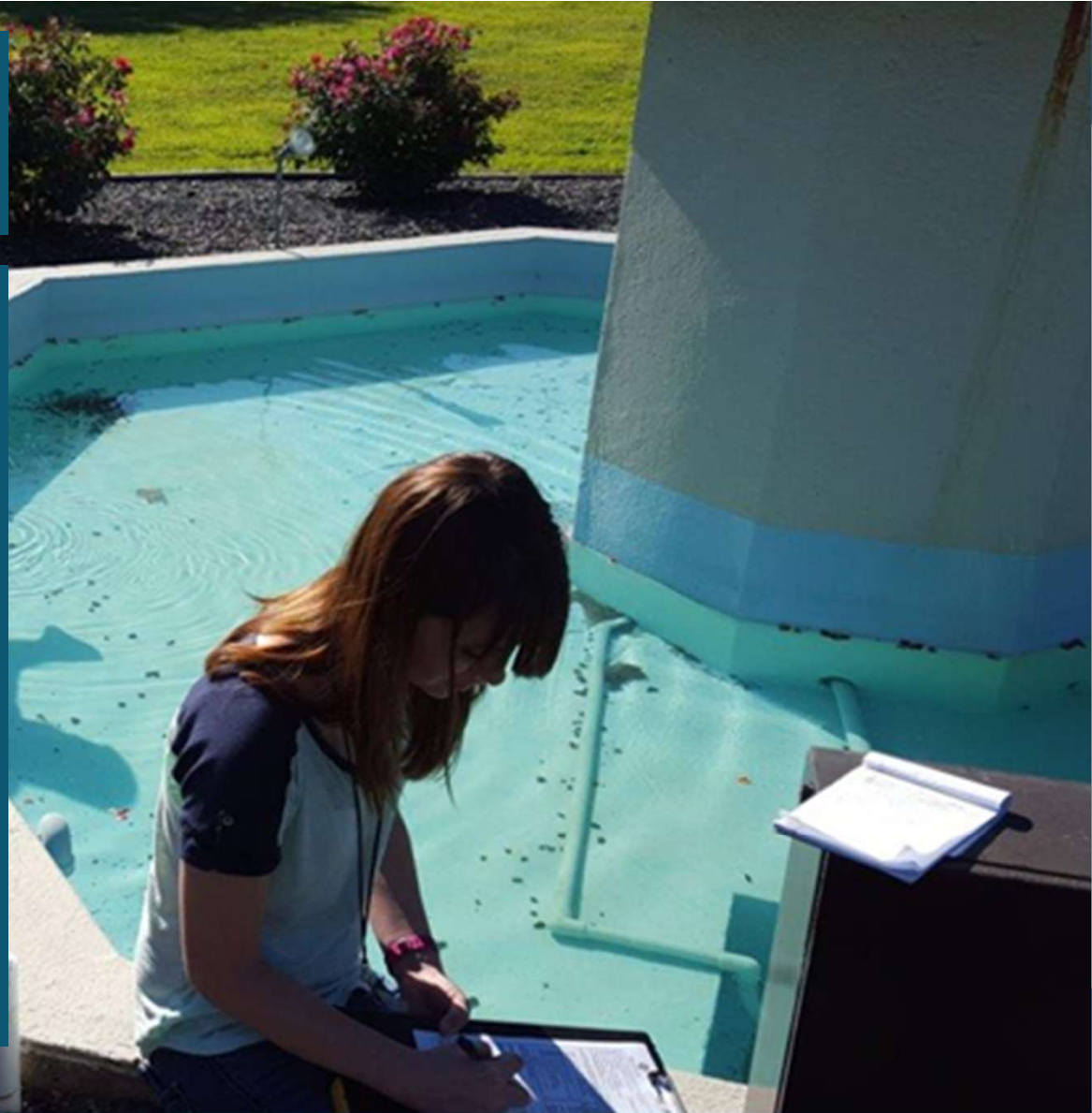
- Part of the larger IDPH *Legionella* Response Team
- Investigate environmental factors associated with water borne disease caused by *Legionella* and other opportunistic pathogens in premise plumbing (OPPPs)
- Assess water management practices of facilities investigated
- Conduct surveys of plumbing installations to determine underlying conditions that may contribute to the growth of OPPPs

LEGIONELLA INVESTIGATIONS

- 2024 – 17 total *legionella* investigations
- What triggers investigation?
 - ≥ 1 case of presumptive healthcare-associated Legionnaires' disease at any time
 - ≥ 2 cases of possible healthcare-associated Legionnaires' disease within 12 months of each other
- Other settings that may be similar to healthcare: correctional centers, senior centers, or other institutional settings.
- Travel-associated outbreaks: 2 or more Legionnaires' disease cases associated with the same travel accommodation in a 12-month period.
- Community-associated outbreaks: an increase in Legionnaires' disease cases in a certain geographic area beyond what one would normally expect for the same time and place.

Environmental Investigations of Legionellosis

- Full investigations are conducted based on the available epidemiologic evidence
- Conducted by IDPH or local health officials
- **Environmental assessment**
 - Identify areas of potential exposure based on epidemiologic information
 - Assess water systems to identify potential amplification
 - Review water management plan
- **Environmental sampling**
 - Only conducted after an environmental assessment
 - Sampling locations selected based on assessment and epidemiology



Environmental assessments identify and describe risks in building water systems.

Temperature

Stagnation

Disinfectant

External
Hazards

Exposure

Learn More about the Water Coming into the Facility

- Identify the water supplier and gain information about:
 - Type of disinfectant
 - Typical water quality delivered from the plant and in the distribution system to the subject facility
 - Recent changes in water treatment
 - Recent (last 6 months) or ongoing major construction on or around the facility premises
 - Was temporary water service provided to the new construction area (e.g. separate meter)?
 - Has jack-hammering or pile-driving been used during the construction process?
 - Have there been disruptions or changes to the existing potable water system during the construction?
 - Recent (last 6 months) pressure drops, boil water advisors, or water disruptions

Environmental Assessment

Water supply

Source

Disinfectant

Service disruptions or construction

Facility characteristics

Type and size of facility

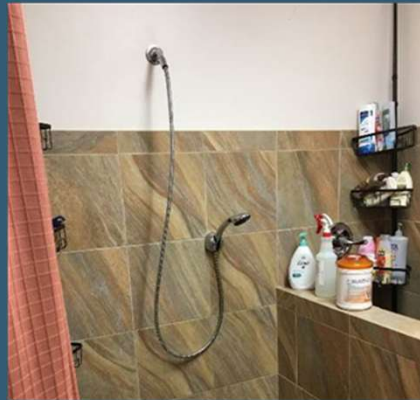
Number of cases

Aerosol generating devices present

Plumbing system (showerheads and faucets)

Cooling towers

Aesthetic water features/decorative fountains



Dead Ends in Plumbing Systems

Actual



Functioning



Making a Sampling Plan

Environmental assessment

Areas that may promote amplification

Temperature and stagnation

Areas that help establish how water is distributed

Point of entry

Medial fixtures

Distal fixtures

Epidemiologic information

Known exposures

Showers

Sources of drinking water (aspiration risk)

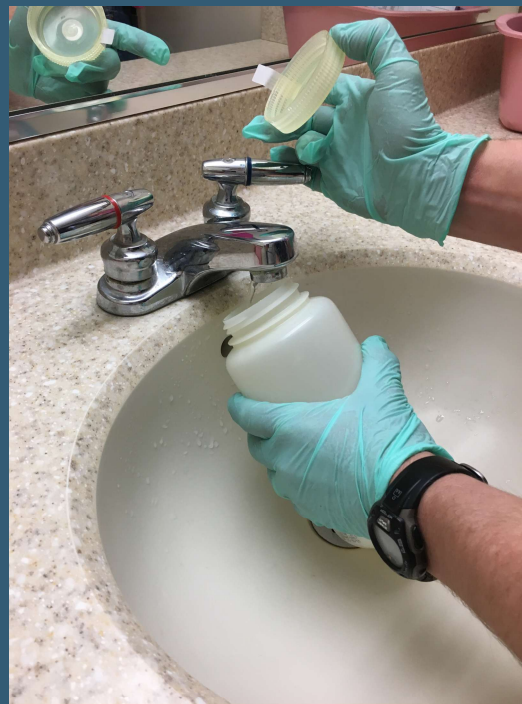
Suspect exposures

Lavatories



Environmental Sampling

Bulk Water

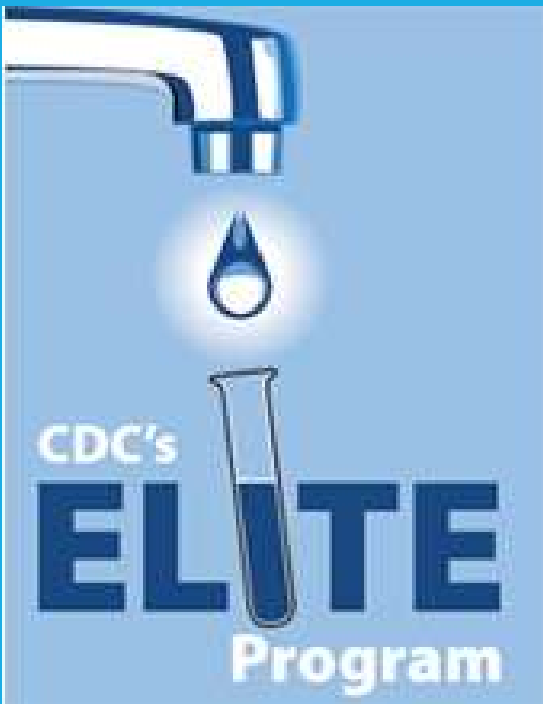


Biofilm Swab



Laboratories

- *Legionella* can be difficult to isolate
- CDC created the Environmental *Legionella* Isolate Techniques Evaluation (ELITE) Program as a way for laboratories to test their *Legionella* isolation techniques against standardized samples
- Listing of CDC ELITE member laboratories available online



Analytical Methods

Culture

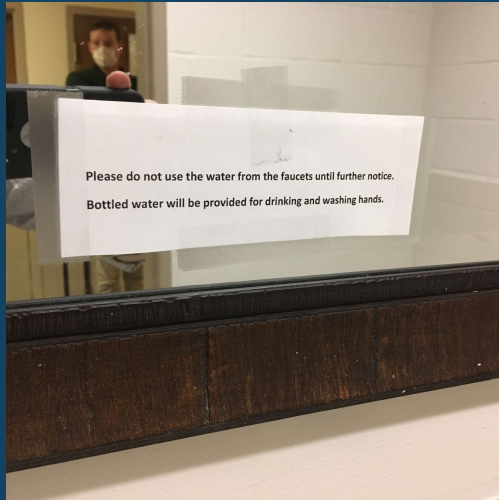


- Gold standard
- Detects *Legionella* species from all viable systems/samples
- Environmental isolate
- Slow (10 days or more)

DNA Detection (PCR)



- Useful tool to complement culture
- Rapid results
- Highly specific
- Cannot discriminate between DNA from viable or dead organisms



Immediate Control Measures in Potable Water Outbreaks

- Restricting showers (using sponge baths)
- Avoiding exposure to hot tubs
- Installing 0.2 micron biological point-of-use filters on any showerheads or sink/tub faucets intended for use
- Halting new admissions or temporarily closing the building, affected area, or device
- Distributing notifications letters to the appropriate audience(s)

Prevention with Risk Management

- Key to preventing Legionnaires' disease is to make sure that water systems are designed and maintained in order to reduce the risk of *Legionella* growth and spread
- Water management programs identify hazardous conditions and take steps to minimize the growth and transmission of OPPPs
- Such programs are now an industry standard for healthcare facilities and large buildings in the United States

Principles of Water Management

- Maintaining water temperatures outside the ideal growth range for *Legionella* growth
- Prevent water stagnation
- Ensure adequate disinfection
- Maintain devices to prevent scale, corrosion, and biofilm growth all of which provide a habitat and nutrients for *Legionella*

Prevention and Control

Key to preventing Legionnaires' disease is to reduce risk of *Legionella* growth and spread

Building owners and managers can do this by maintaining building water systems and implementing controls for *Legionella*

CDC has resources available:

Water Management Toolkit

Legionella Control Toolkit



Toolkit for Controlling *Legionella* in Common Sources of Exposure (*Legionella* Control Toolkit)

INFORMATION ON CONTROLLING *LEGIONELLA* IN COMMONLY IMPLICATED SOURCES OF LEGIONNAIRES' DISEASE OUTBREAKS

CDC Toolkit for Controlling *Legionella* in Common Sources of Exposure

Released February 2021

Uses:

- Evaluation of hazardous conditions
- Implementation of control measures per ASHRAE 12-2020
- Complement existing resources for WMPs
- Support environmental assessments during investigations

Module Breakdown

- Controlling *Legionella* in:
 - Potable water systems
 - Cooling towers
 - Hot tubs
 - Decorative fountains
 - Other devices
- Routine testing for *Legionella*
- Each module discusses:
 - Design
 - Operation, Maintenance, and Control Measures/Limits
 - Remediation



Controlling *Legionella* in Potable Water Systems

No single control measure ensures the control of
Legionella in potable water systems

Design

- Pipe insulation
- Dead leg elimination
- Placement of thermostatic mixing valves
- Recognize risks of low-flow and mechanically complex fixtures
- Identify where disinfectant residuals may decay rapidly
- Use appropriately sized storage
- Consider installing sampling points

Operation, Maintenance, & Control Limits

- Water quality monitoring
- Proper storage of hot water (above 140 degrees F)
- Store and circulate cold waters below favorable range
- Ensure disinfectant is detectable
- Adopt routine flushing procedures
- Clean and maintain water system components
- Do not presume supplemental disinfection systems will control *Legionella* without an adequate WMP
- Consider *Legionella* testing

Remediation



Remediation may be necessary if an outbreak or illness is suspected



Before remediation it is important to confirm the presence of *Legionella*



Chemical shock using an elevated level of disinfectant for a limited duration can control *Legionella* in potable water systems



Thermal shock of water systems is not recommended due to frequent failure and rapid recolonization

Remediation

- After remediation activities, confirm elimination of *Legionella*
- Following a successful *Legionella* remediation procedure, recolonization of the water system is likely unless the underlying conditions supporting *Legionella* growth are addressed.

Routine *Legionella* Testing

Validation of the water management program through
routine environmental testing for *Legionella*

Routine *Legionella* Testing

- Routine testing differs from testing performed in response to an outbreak or illness
- Routine testing means sampling that is performed proactively as part of an effort to reduce risk of *Legionella* growth and transmission
- There is no “safe” level or type of *Legionella*
- The presence of any *Legionella* should trigger response activities

Factors to Consider When Reviewing Routine *Legionella* Test Results

- Test results are WMP performance indicators and not a measure of human illness
- Not intended for use if a building or device is associated with LD cases or an outbreak
- Multiple factors to performance indicator interpretation:
 - Concentration
 - Change in concentration over time
 - Extent
 - Type of *Legionella*

Uncontrolled	Poorly Controlled	Well Controlled			
<p>≥10 CFU/mL in potable water</p> <p>OR ≥100 CFU/mL in non-potable water</p>	<p>1.0-9.9 CFU/mL in potable water</p> <p>OR 10-99 CFU/mL in non-potable water</p>	<p>Detectable to 0.9 CFU/mL in potable water</p> <p>OR Detectable to 9 CFU/mL in non-potable water</p>	<p>No Legionella detected in a single round of testing</p>	<p>No Legionella detected in multiple rounds of testing</p>	<p>No Legionella detected in multiple rounds of testing with methods that detect viable and non-viable bacteria of any Leg species</p>

Concentration

Uncontrolled	Poorly Controlled	Well Controlled			
100-fold or greater increase in concentration	10-fold increase in concentration	Legionella concentration steady	No Legionella detected in a single round of testing	No Legionella detected in multiple rounds of testing	No Legionella detected in multiple rounds of testing with methods that detect viable and non-viable bacteria of any Legionella species

Change in Concentration Over Time

Uncontrolled	Poorly Controlled	Well Controlled			
<p>Detection in multiple locations AND a common source location OR Detection across many locations within a water system</p>	<p>Detection in a common source location that serves multiple areas OR detection in more than one location within a water system</p>	<p>Detection a few of many tested locations within a water system</p>	<p>No Legionella detected in a single round of testing</p>	<p>No Legionella detected in multiple rounds of testing</p>	<p>No Legionella detected in multiple rounds of testing with methods that detected viable and non-viable bacteria of any Leg species</p>

Extent

Type of *Legionella* (Species and Serogroup)

- Highly associated
 - *L. pneumophila* serogroup 1
 - Non-LP1 *L. pneumophila*
 - Presence of multiple different *Legionella* species or serogroups
- Less-associated
 - Any non-*pneumophila* *Legionella* species including “blue-white” fluorescent *Legionella*

CDC Vital Signs: Deficiencies in Environmental Control Identified in Outbreaks of Legionnaires' Disease – North America, 2000- 2014

- CDC evaluated information from summaries of CDC LD outbreak investigations for 23 land-based outbreaks
- Categorized water system maintenance deficiencies as process failures, human errors, equipment failures or **unmanaged external changes** (in which adjustments were not made to account for events outside a building water system)
- Unmanaged external changes included:
 - Broken water main
 - Extensive construction
 - Maintenance of water main resulting in pressure disruptions and water outages
 - Stagnation prior to occupation of new buildings
 - Heavy, rainfall, high humidity, and flooding preceding onset of causes (suspected inadequate maintenance of cooling towers)
- 35% (8 of 23 outbreaks) were linked to unmanaged external changes
- 48% (11 of 23 outbreaks) deficiencies in more than one category were reported



IDPH PLUMBING SYSTEMS & WATER QUALITY GUIDANCE

- Where feasible, the Program encourages water suppliers to support users by:
 - Informing users of disinfectant, disinfectant levels, and note any recent disruptions or proposed changes in water treatment
 - Working with building owners and operators to ensure standard checkpoints near buildings or at the meter to the building have been checked and residuals meet expected standards
 - Installing auto-flushing devices or increasing hydrant flushing in areas experiencing reduced use
 - Consider establishing a response plan to address an outbreak associated with your system
 - Employ local plumbing inspectors

Thank you!

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