

Legionellosis and Clinical Case Investigation

Stacy Davidson, BSN, RN

October 31, 2024



Learning Objectives

- Understand the importance of a thorough case interview and the roles of DPH and local health departments (LHDs) in outbreak investigations.
- Have a better understanding of outbreak detection, investigation and response activities involving epidemiology and environmental health.
- Recognize the value of an effective water management plan for healthcare facilities.

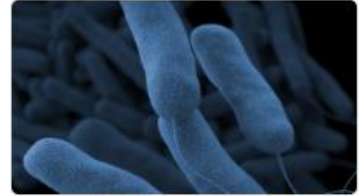
Overview

- 🛡️ A brief overview of legionellosis and *Legionella*
- 🛡️ What contributes to *Legionella* bacterial growth
- 🛡️ Factors leading to clinical infectious disease
- 🛡️ Legionellosis trends in Kentucky
- 🛡️ Reporting requirements in 902 KAR 2:020
- 🛡️ Clinical case investigation by the local health department (LHD)
- 🛡️ Case review at Kentucky Department for Public Health (KDPH)
- 🛡️ Healthcare-associated infections (HAIs)
- 🛡️ Prevention through water management plan (WMP)

Legionellosis

- 🛡️ Legionellosis is the infection caused by *Legionella* bacteria
- 🛡️ Legionellosis cases occur year-round
- 🛡️ More cases occur in summer and early fall
- 🛡️ Relatively recent increase in cases of community-acquired pneumonia (CAP) caused by *Legionella* in younger, healthy adults in Kentucky
- 🛡️ Outbreaks are often associated with large or complex water systems, like those found in hospitals, long-term care facilities, hotels and cruise ships

Legionella: what is it?



- 🛡️ Gram-negative waterborne bacteria
- 🛡️ Found naturally in freshwater environments at low levels
- 🛡️ Grows best in warm water and hot, humid weather
- 🛡️ At least 60 different species, most considered pathogenic
 - Majority of reported cases are caused by *Legionella pneumophila*, particularly serogroup 1 (*Lp1*)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5652433/#:~:text=LD%20risk%20increases%20when%20weather%20is%20warm%20and%20humid>

<https://www.cdc.gov/legionella/hcp/clinical-overview/index.html>

Legionellosis

- 🛡️ Legionellosis refers primarily to 2 clinical syndromes
 - **Legionnaires' disease (LD)** – a severe type of pneumonia
 - **Pontiac fever (PF)** – a milder self-limiting illness without pneumonia
 - Less commonly **extrapulmonary legionellosis**

<https://www.cdc.gov/legionella/about/index.html>

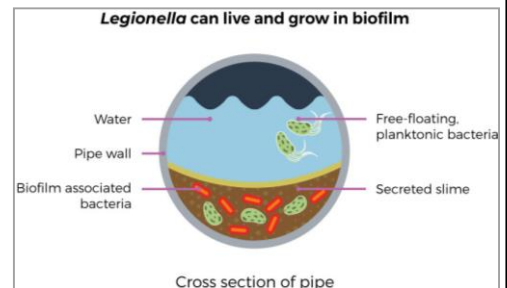
Comparison of LD and PF

	Legionnaires' disease	Pontiac fever
Symptoms	<ul style="list-style-type: none"> • Headache • Muscle aches • Fever, may begin as low grade 104°F, or higher • Cough, which might bring up mucus or may be dry • Shortness of breath • Chest pain/discomfort • Gastrointestinal symptoms, such as nausea, vomiting and diarrhea • Confusion or other mental changes 	<ul style="list-style-type: none"> • Milder, self-limiting • Fever • Chills • Headache • Malaise • Myalgia • Nausea or vomiting (without pneumonia)
Incubation period	2-14 days	24-72 hours
Attack rate	<5%	>90%
Death rate	10% (25% among HAI)	0%
Reason for illness	<i>Legionella</i> bacterial infection	Reactions to endotoxin production by <i>Legionella</i> bacteria

<https://www.osha.gov/legionnaires-disease/medical-information>

Legionella: Ideal Growth

- 🛡️ Ideal conditions: warm, slow-moving or stagnant water with little or no disinfectant
- 🛡️ Thrives in temperatures 77°F–113°F (25°C–45°C)
- 🛡️ Grows in biofilm, where it is protected from extreme temperatures and disinfectant
- 🛡️ Multiplies in building water systems within amoeba and ciliated protozoa
- 🛡️ Can be challenging to identify and eliminate



<https://www.cdc.gov/legionella/causes/index.html>

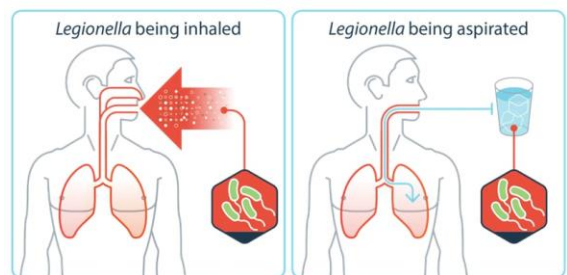
Legionella

- 🛡️ Grows best in large, complex water systems that are not well maintained
- 🛡️ Internal and external factors can contribute to growth
 - Construction
 - Biofilm
 - Water temperature fluctuations
 - Sediment, debris, corrosion (ties up disinfectants)
 - Low disinfectant levels
 - Slow moving or stagnant water flow

<https://www.cdc.gov/control-legionella/php/public-health-strategy/>

Legionella: Who is at Risk?

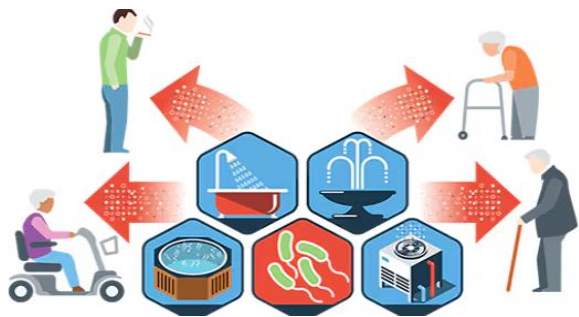
- 🛡️ Becomes a problem when it grows to levels that can cause illness
- 🛡️ Exposure to susceptible host
- 🛡️ People can be exposed when the contaminated water becomes aerosolized and inhaled or aspirated



<https://www.cdc.gov/legionella/causes/index.htm>

Exposure: Aerosolization

- 🛡️ Showerheads and sink faucets
- 🛡️ Cooling towers
- 🛡️ Hot tubs
- 🛡️ Decorative fountains
- 🛡️ Mist machines
- 🛡️ Complex plumbing



<https://wwwnc.cdc.gov/travel/yellowbook/2024/infections-diseases/legionnaires-disease-and-pontiac-fever> <https://www.cdc.gov/legionella/causes/index.html>


Risk Factors: Not Everyone Gets Sick

- 🛡️ **People at increased risk of getting sick if exposed include:**
- 🛡️ Current and former smokers/vapers
- 🛡️ People 50 and older
- 🛡️ People with certain health conditions including, but not limited to
 - Cancer
 - Chronic lung disease
 - Diabetes
 - Kidney failure
 - Weakened immune system

<https://www.cdc.gov/legionella/causes/index.html>

Preferred Diagnostics and Testing

- 🛡️ Culture of lower respiratory secretions (e.g., sputum, bronchoalveolar lavage) on selective media
- 🛡️ *Legionella* urinary antigen test (UAT)
*The UAT only detects *L. pneumophila* serogroup 1
- 🛡️ Isolation of *Legionella* by culture is important for detection of other species and serogroups and for public health investigation


Order both a culture of a lower respiratory specimen and a urinary antigen test when testing patients for *Legionella*.

<https://www.cdc.gov/legionella/downloads/fs-legionella-clinicians.pdf>

Other Diagnostic Testing

- 🛡️ **Culture**
...not possible?
- 🛡️ **PCR** is confirmatory
- 🛡️ **DFA**
- 🛡️ **Testing NOT recommended**
 - Serology: Nonspecific and need 2 specimens with fourfold increase
 - Nasopharyngeal swab tests are NOT confirmatory for legionellosis

<https://www.cdc.gov/legionella/php/laboratories/index.html>

LD Complications

- 🛡️ Respiratory failure
- 🛡️ Acute kidney injury
- 🛡️ Encephalopathy
- 🛡️ Empyema
- 🛡️ Myocarditis
- 🛡️ Rhabdomyolysis
- 🛡️ Death



<https://my.clevelandclinic.org/health/diseases/17750-legionnaires-disease>

Healthcare-Associated LD

- 🛡️ Many people treated in healthcare facilities have underlying conditions that put them at greater risk of illness or death from legionellosis
- 🛡️ LD kills 25% of those who become infected from a healthcare facility
- 🛡️ Most healthcare-associated LD could be prevented with an effective WMP

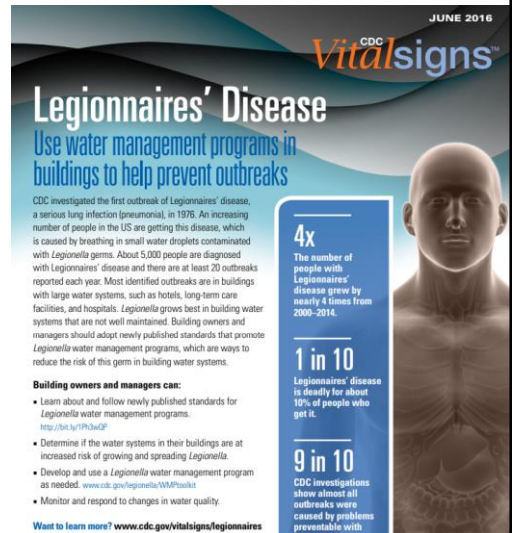


<https://archive.cdc.gov/#/details?url=https://www.cdc.gov/vitalsigns/legionella/index.html>

CMS Requirement Water Management Plan (WMP)

- 🛡️ 2015 ASHRAE Standard 188
- 🛡️ CDC recommends WMP
- 🛡️ In 2017 CMS released a memo establishing WMP requirement

<http://bit.ly/1Ph3wQP>
<https://www.cdc.gov/vitalsigns/pdf/2016-06-vitalsigns.pdf>

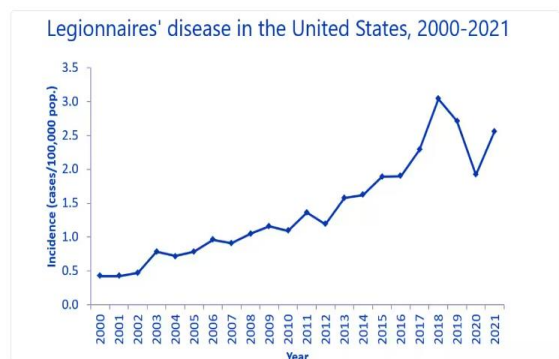


Kentucky Department for Public Health

17

Legionella Surveillance

- 🛡️ Legionellosis is a nationally notifiable condition in the US
- 🛡️ States must report cases to CDC
- 🛡️ CDC conducts national surveillance



Legionnaires' disease incidence has been increasing since 2000.

<https://www.cdc.gov/legionella/php/surveillance/index.html>

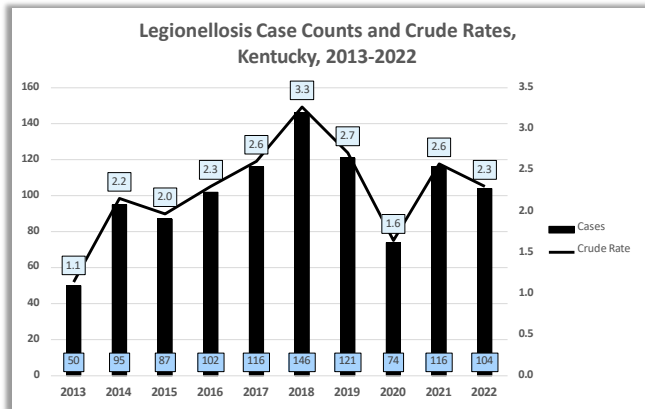
Kentucky Department for Public Health

18

Reported Legionellosis in KY, 2013-2022

Year	Cases	State Population	Crude Rate (per 100,000)
2013	50	4,398,500	1.1
2014	95	4,412,617	2.2
2015	87	4,425,092	2.0
2016	102	4,436,974	2.3
2017	116	4,454,189	2.6
2018	146	4,468,402	3.3
2019	121	4,467,673	2.7
2020	74	4,505,836	1.6
2021	116	4,506,589	2.6
2022	104	4,511,563	2.3
10-Year Total Case Counts			1,011
10-Year Average Case Counts			101
10-Year Est. Pop Avg			4,458,744
10-Year Average Rate			2.3

Source: RDS Five Year Summary Tables



Case counts based on MMWR print criteria for that calendar year available at <https://www.cdc.gov/legionella/php/surveillance/>

902 KAR Chapter 2 Regulation 020

902 KAR 2:020. Reportable disease surveillance.

RELATES TO: KRS 214.645, 214.625(5)(c), 214.990(1), 215.520, 216.015, 258.065, 258.990, 311.282, 311.571, 315.010, 321.181(4), 333.020, 333.130


STATUTORY AUTHORITY: KRS 194A.050, 211.090(3), 211.180(1)(a), 214.010

NECESSITY, FUNCTION, AND CONFORMITY: KRS 211.180(1)(a) authorizes the cabinet to implement a statewide program for the detection, prevention, and control of communicable diseases, chronic and degenerative diseases, dental diseases and abnormalities, occupational diseases and health hazards peculiar to industry, home accidents and health hazards, animal diseases that are transmissible to man, and other diseases and health hazards that can be controlled. KRS 214.010 requires every physician, advanced practice registered nurse, and every head of family to notify the local health department of the existence of diseases and conditions designated by administrative regulation of the cabinet. This administrative regulation establishes notification standards and specifies the diseases requiring immediate, urgent, priority, routine, or general notification, in order to facilitate rapid public health action to control diseases and to permit an accurate assessment of the health status of the commonwealth.


<https://apps.legislature.ky.gov/law/kar/902/002/020.pdf>

Reporting LD

- 🛡️ Electronic lab report (ELR) ★
- 🛡️ Electronic case report (eCR) ★
- 🛡️ Direct Data Entry ELR and eCR
- 🛡️ Email or fax lab reports and EPID 200 (not preferred)
- 🛡️ Out of state reports via EpiX
 - Fax or encrypted email
 - Phone



Kentucky Reportable Disease Form
 Department of Public Health
 Division of Epidemiology and Health Planning
 275 East Main St., Mailstop H3E-A
 Frankfort, KY 40621-0001



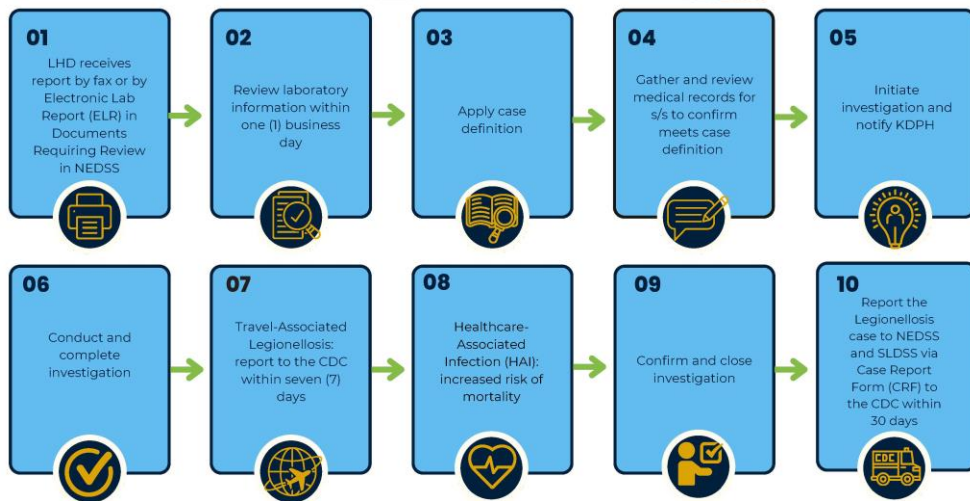
EPID 200 - 2/2021 Disease Name _____

Fax or Mail the Completed Form to the Local Health Department

DEMOGRAPHIC DATA				
Patient's Last Name	First	M.I.	Date of Birth (mm/dd/yyyy)	Age
Address			City	State ZIP Code County of Residence
Phone Number	Ethnic Origin <input type="checkbox"/> Hisp. <input type="checkbox"/> Non-Hisp.	Race <input type="checkbox"/> W <input type="checkbox"/> B <input type="checkbox"/> Asian <input type="checkbox"/> NH/PI <input type="checkbox"/> Am. Ind./Alaska Native <input type="checkbox"/> Other		
Sex Assigned at Birth: <input type="checkbox"/> M <input type="checkbox"/> F <input type="checkbox"/> Unk.	Current Gender Identity: <input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Transgender Male-to-Female <input type="checkbox"/> Transgender Female-to-Male <input type="checkbox"/> Unknown Additional Gender Identity (specify):			
DISEASE INFORMATION				
Disease/Organism		Date of Onset	Date of Diagnosis	
List Symptoms/Comments			Highest Temperature Days of Diarrhea	
Hospitalized? <input type="checkbox"/> Yes <input type="checkbox"/> No	Admission Date	Discharge Date	Died? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unk.	Date of Death
Hospital Name:		Is Patient Pregnant? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, Due Date (EDC):		
School/Daycare Attended? <input type="checkbox"/> Yes <input type="checkbox"/> No	Outbreak Associated? <input type="checkbox"/> Yes <input type="checkbox"/> No	Food Handler? <input type="checkbox"/> Yes <input type="checkbox"/> No	Healthcare Worker? <input type="checkbox"/> Yes <input type="checkbox"/> No	Employer Name:
Name of School/Daycare:		Name of Agency/Completing Form		
Name:	Agency:	Attending Physician Name:		
Address:	Address:	Date of Report:		
Phone:	Phone:	Phone:		
LABORATORY INFORMATION				
Date	Name or Type of Test	Name of Laboratory	Specimen Source	Results

<https://www.chfs.ky.gov/agencies/dph/dehp/idb/Documents/EPID200.pdf>

Legionellosis Reporting Workflow



CDC Legionellosis Case Definition

Revised 09/12/2024

<https://ndc.services.cdc.gov/case-definitions/legionellosis-2020/>
 National Notifiable Disease Surveillance System (NNDSS, AKA NEDSS)
 Supplemental Legionnaires' Disease Surveillance System (SLDSS)



Legionellosis Case Reports: Forms and Instructions

Extended Case Report Form

<https://www.cdc.gov/investigate-legionella/media/pdfs/extended-case-form.pdf>

Includes the following sections

- Patient Information and Demographics
- Clinical Information and Outcome
- Travel, Healthcare and Other Exposure Information
- Laboratory Data
- Underlying Conditions or Prior Illnesses

The image shows a CDC form titled "LEGIONELLOSIS CASE REPORT". It includes fields for patient name, address, reporting state, city, county, and state of residence. It also has sections for laboratory data, underlying conditions, and travel information. The form is labeled "Form Approved" and "Date: 05/01/2018".

<https://www.cdc.gov/investigate-legionella/php/data-research/forms-and-instructions.html>

Interview Tools

KDPH Long-term Care Facility (LTCF) Resident Survey

Cruise Ship Questionnaire

Medical record abstraction form

The image shows a form titled "Legionella Resident Survey for Long Term Care Facility". It includes fields for "Investigation ID:", "NEDSS ID:", "Abstractor's Initials:", and "Today's Date:". Below these is a section for "Epidemiologic/Exposure Information:" with the instruction: "The following questions are about water exposures in the 14 days prior to symptom onset at FACILITY". There are five numbered questions, each with a "Yes", "No", or "Unknown" option and a "if yes:" section with sub-questions (a, b, c) for dates and durations.

<https://www.cdc.gov/investigate-legionella/media/files/template-cruise-ship-questionnaire.docx>

Travel-Associated Legionellosis

- Overnight travel associated cases are reported to CDC within 7 days

<https://www.cdc.gov/investigate-legionella/media/pdfs/extended-case-form.pdf>

Healthcare-Associated LD

- Clinic
- Hospital
- LTCF
- Other



<https://www.cdc.gov/investigate-legionella/php/healthcare-resources/healthcare-facilities.html>

Types of Healthcare-Associated LD Exposure

- 🛡️ Inpatient
- 🛡️ Outpatient
- 🛡️ Visitor or volunteer
- 🛡️ Employee

<https://www.cdc.gov/investigate-legionella/php/healthcare-resources/healthcare-facilities.html>

Healthcare-Associated LD Case Classifications

- 🛡️ **Presumptive**
 - Stayed at one or more healthcare facilities
 - **Duration:** ≥10 days of continuous stay during 14-day exposure period
- 🛡️ **Possible**
 - Does not meet the above criteria
 - Stayed at or visited one or more healthcare facilities
 - **Duration:** Any portion of the 14 days before symptom onset

<https://www.cdc.gov/investigate-legionella/php/healthcare-resources/healthcare-facilities.html>

If 1 Possible Healthcare-Associated LD Case is Found

- 🛡️ The LHD will notify facility
- 🛡️ Provide recommendation and resources and assistance as needed
 - Conduct retrospective case surveillance chart review
 - Conduct enhanced prospective surveillance for 12 months
 - Testing suspected HAI pneumonia cases via Preferred clinical testing
 - Complete ICAR Module11
 - Complete environmental assessment
 - Review the water management plan and update as needed

<https://www.cdc.gov/infection-control/media/pdfs/IPC-mod11-water-exposure-508.pdf>

<https://www.cdc.gov/control-legionella/php/healthcare/water-management.html>

What is a Healthcare-Associated Outbreak?

- 🛡️ CDC recommends a [full public health outbreak investigation](#) for the source of *Legionella* in a facility upon identification of:
 - ≥ 1 case of presumptive healthcare-associated LD (HALD) at any time
 - ≥ 2 cases of possible HALD within 12 months of each other
- 🛡️ Presumptive HALD
 - Typically, inpatient; may have stayed at >1 healthcare facility
 - ≥ 10 days of continuous stay during 14-day exposure period
- 🛡️ Possible HALD
 - Inpatients AND employees, outpatients, visitors/volunteers
 - Any portion of the 14 days before symptom onset

https://www.cdc.gov/investigate-legionella/php/healthcare-resources/planning-investigation.html#cdc_generic_section_2-determine-if-a-full-investigation-is-needed

Outbreak Investigation

- 🛡️ Every investigation is unique
- 🛡️ Multiple steps
- 🛡️ Planning
- 🛡️ Periodic reassessments



<https://www.cdc.gov/investigate-legionella/php/public-health-strategy/investigations.html>

Public Health Recommendations and Actions

- 🛡️ Not punitive
- 🛡️ Meant to provide resources and be proactive
- 🛡️ Review your facility and understand your water system and risk
- 🛡️ Find risk factors and take action before other cases are found





Index of Suspicion

Clinicians:

- Know your facility
- Be aware of building issues, work and construction that could create ideal conditions for *Legionella* growth
- Have a way to be alerted if water sample testing is positive for *Legionella*
- If there is a HALD case, consider making testing more routine and proactive
- Remember that diagnosis with another condition (influenza, cardiac issue, COPD, etc.) may make secondary infection with *Legionella* more likely
 - » Do not exclude LD from your differential due to presence of other infections
- Call your LHD or KDPH sooner rather than later if you see concerning trends

Healthcare-Associated LD

Testing for healthcare-associated LD is especially important if any of the following are identified in your facility:

-  Other patients diagnosed with healthcare-associated LD in the past 12 months
-  Positive environmental tests for *Legionella* in the past 2 months
-  Changes in water quality that may lead to *Legionella* growth (such as low chlorine levels)
-  Infection control staff may have more information about these situations

Legionellosis Fast Facts



- 🛡️ The majority of legionellosis infections occur between May and November each year, but it can occur any time of the year.
- 🛡️ Increased Legionnaires' Disease (LD) infections occur among people:
 - Aged 50+,
 - Current and former smokers,
 - Alcoholics or heavy drinkers,
 - Underlying medical conditions, weakened immune systems, and/or cancer
- 🛡️ About 1 in 10 (10%) people with LD will die.
- 🛡️ About 1 in 4 (25%) healthcare associated LD cases will die.
- 🛡️ Typical LD outbreaks occur among healthcare related cases (e.g., nursing home patients) or patients with a travel history.
- 🛡️ Relatively recent increase in cases of community acquired pneumonia (CAP) caused by *Legionella* in younger, healthy adults in Kentucky.

https://www.cdc.gov/legionella/communication-resources/infographic.html?CDC_AAref_Val=https://www.cdc.gov/legionella/infographics/legionella-affects-water-systems.html

Legionella

- 🛡️ Construction
- 🛡️ Biofilm
- 🛡️ Water temperature fluctuations
- 🛡️ Sediment, debris, corrosion (ties up disinfectants)
- 🛡️ Low disinfectant levels
- 🛡️ Slow moving or stagnant water flow

How *Legionella* affects building water systems and people

1. Internal and external factors can lead to *Legionella* growth in building water systems.



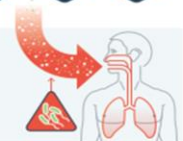
2. *Legionella* grows best in large, complex water systems that are not adequately maintained.



3. Water containing *Legionella* is aerosolized through devices.



4. People can get sick when they breathe in small droplets of water or accidentally swallow water containing *Legionella* into the lungs. Those at increased risk are adults 50 years or older, current or former smokers, and people with a weakened immune system or chronic disease.



www.cdc.gov/legionella

03/08/21

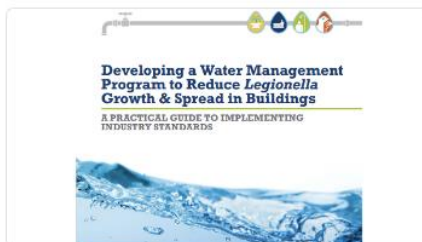
<https://www.cdc.gov/legionella/infographics/legionella-affects-water-systems.pdf>

Water Management Plan – Written Plan

- 🛡️ Required by CMS and Joint Commission since 2017
- 🛡️ Many buildings need a WMP for their building water system or specific devices
- 🛡️ WMPs identify hazardous conditions determined by WICRA and outline controls and validation of controls to minimize the health impact of waterborne pathogens
- 🛡️ Developing and maintaining a WMP is a multi-step process that requires continuous review
- 🛡️ Participation of IP, ID/Epidemiologist, Facilities and Administration and others

<https://www.cdc.gov/control-legionella/php/wmp/index.html>

Resources



Toolkit: Developing a *Legionella* Water Management Program

A CDC toolkit on developing water management programs to reduce risk for Legionnaires' disease.

MAR. 15, 2024



Toolkit: Controlling *Legionella* in Common Sources of Exposure

A CDC toolkit with actionable information on control measures to prevent Legionnaires' disease.

MAR. 15, 2024

<https://www.cdc.gov/control-legionella/php/toolkit/index.html>



COVID-19 ▾ Members ▾ Resources ▾ Committees ▾ Fellowships & Training ▾ Policy ▾ About ▾

Goals

- Develop revisions to the current case definition (09-ID-45) to address current challenges and gaps in Legionnaires' disease surveillance
- Identify and document best practices for Legionnaires' disease surveillance, cluster identification, and outbreak response
- Identify and engage national partners

Resources

Water Management Program Template

Water Management Program (WMP) Evaluation Tool

Water Management Program Evaluation Tool – Excel supplement

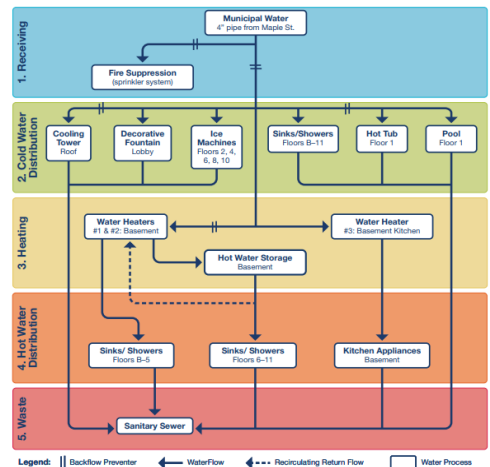
Recommendations for the Review of Water Management Programs to Reduce Risk of *Legionella* in Healthcare and Community Facilities

<https://www.cste.org/page/Legionnaires>

Preventing Legionnaires' Disease (PreventLD) Training

Free training available

- Online at your own pace
- Available continuing education units from NEHA
- Audience:
 - Public health professionals, including infection preventionists
 - Building managers, maintenance/engineering staff, and safety officers
 - Equipment and water treatment suppliers as well as consultants



<https://www.cdc.gov/control-legionella/php/training/index.html>

Thank you.

Stacy Davidson, BSN, RN
Nurse Consultant Inspector
Stacy.Davidson@ky.gov

