I. DESCRIPTION AND EPIDEMIOLOGY

A. Overview

*Legionella* spp. are gram-negative bacteria that are found naturally in freshwater but are usually present in insufficient numbers to cause disease. *Legionella* can grow and multiply in warm water sources (77–108 degrees F) that are stagnant and have not been properly cleaned. Water sources including air conditioning cooling towers, hot tubs, hot water tanks, decorative fountains, and large, complex plumbing systems such as those in hospitals and hotels can provide this stagnant, warm environment that facilitates bacterial growth. Exposure occurs through inhalation of aerosolized or aspiration of *Legionella*-contaminated water. Most cases of legionellosis are sporadic, but outbreaks have been associated with hotels, cruise ships, healthcare facilities, and cooling towers.

*Legionella pneumophila* was first identified and named after a large outbreak of respiratory illnesses among attendees of an American Legion convention in Philadelphia in 1976. The outbreak, which resulted in 182 illnesses and 29 deaths, was likely associated with the hotel’s air conditioning system. Since this historic outbreak, there have been numerous species of *Legionella* identified. *Legionella pneumophila* serogroup 1 causes the majority of legionellosis infections. Other *L. pneumophila* serogroups and other *Legionella* species, including *L. micdadei* and *L. longbeachae*, can also cause legionellosis.

Legionellosis refers to two distinct clinical and epidemiological presentations of infection with *Legionella* bacteria, Legionnaires’ disease and Pontiac fever. Legionnaires’ disease is a serious illness characterized by pneumonia. Pontiac fever is a milder, self-limited illness characterized by fever and muscle aches. Legionnaires’ disease will be the main focus of this chapter, though both Pontiac fever and Legionnaires’ disease are reportable diseases in California.

B. Legionellosis in California

Approximately 200 to 250 confirmed cases of legionellosis are reported each year in California.

C. Symptoms

Patients with Legionnaires’ disease develop a severe illness characterized by cough, fever, and pneumonia. Some patients have gastrointestinal symptoms, such as abdominal pain and diarrhea, or generalized symptoms, such as headache and confusion. Complications may include sepsis, respiratory failure, and death.
Persons with Pontiac fever develop illness characterized by an abrupt onset of influenza-like symptoms lasting 2 to 5 days. Symptoms of Pontiac fever may include cough, fever, headaches, and myalgias. Unlike Legionnaires’ disease, chest imaging does not show signs of pneumonia. Pontiac fever is most commonly recognized in an outbreak setting, with an attack rate of over 90% of those exposed.

D. Transmission

Potable water systems, whirlpool spas, and cooling towers provide the conditions needed for Legionella growth and transmission, which include heat, stasis, and aerosolization. Susceptible persons who inhale or aspirate aerosol or water containing sufficient amounts of Legionella can become ill. However, most people who are exposed to Legionella bacteria do not become ill. Host risk factors for developing Legionnaires’ disease include renal or hepatic failure, diabetes, smoking, systemic malignancy, immune system disorders, and age greater than 50 years. Legionellosis is not spread from person to person.

Approximately 20% of all cases of Legionnaires’ disease are thought to be associated with travel. Thus, recent travel with an overnight stay outside of the home is considered a risk factor for illness.

E. Incubation Period

The incubation period for Legionnaires’ disease is 2 to 10 days. Pontiac fever has a shorter incubation period of 24 to 72 hours.

F. Clinical Management

Clinical management decisions should be made by the patient’s primary care physician, intensive care provider, pulmonologist, or infectious diseases specialist. Legionnaires’ disease is treated with antibiotics. Pontiac fever is a self-limited illness that is managed with supportive care and does not benefit from antibiotics.
II. COUNCIL OF STATE AND TERRITORIAL EPIDEMIOLOGISTS (CSTE) SURVEILLANCE CASE DEFINITION

A. Legionellosis (Legionnaires’ Disease or Pontiac fever) (*Legionella pneumophila*)


**Clinical Description**

Legionellosis is associated with two clinically and epidemiologically distinct illnesses: Legionnaires’ disease, which is characterized by fever, myalgia, cough, and clinical or radiographic pneumonia; and Pontiac fever, a milder illness without pneumonia.

**Laboratory Criteria for Diagnosis**

**Suspected:**

By seroconversion: fourfold or greater rise* in antibody titer to specific species or serogroups of *Legionella* other than *L. pneumophila* serogroup 1 (e.g., *L. micdadei*, *L. pneumophila* serogroup 6).

By seroconversion: fourfold or greater rise* in antibody titer to multiple species of *Legionella* using pooled antigen and validated reagents.

By the detection of specific *Legionella* antigen or staining of the organism in respiratory secretions, lung tissue, or pleural fluid by direct fluorescent antibody (DFA) staining, Immunohistochemistry (IHC), or other similar method, using validated reagents.

By detection of *Legionella* species by a validated nucleic acid assay.

**Confirmed:**

By culture: isolation of any *Legionella* organism from respiratory secretions, lung tissue, pleural fluid, or other normally sterile fluid.

By detection of *Legionella pneumophila* serogroup 1 antigen in urine using validated reagents.

By seroconversion: fourfold or greater rise in specific serum antibody titer to *Legionella pneumophila* serogroup 1 using validated reagents.
Case Classification

**Suspected:** A clinically compatible case that meets at least one of the presumptive (suspected) laboratory criteria. •Travel-associated: a case that has a history of spending at least one night away from home, either in the same country of residence or abroad, in the ten days before onset of illness.

**Confirmed:** A clinically compatible case that meets at least one of the confirmatory laboratory criteria. •Travel-associated: a case that has a history of spending at least one night away from home, either in the same country of residence or abroad, in the ten days before onset of illness.

Comment(s)

The 2005 case definition appearing on this page was re-published in the 2009 CSTE position statement 09-ID-45. Thus, the 2005 and 2010 versions of the case definition are identical.

*CDPH Clarification: this refers to a fourfold rise between acute and convalescent sera, not simply a fourfold elevation above the normal reference value on a single serum specimen.*

II.  CASE SURVEILLANCE, INVESTIGATION, AND REPORTING

A. Purpose of Surveillance, Investigation, and Reporting

- To understand the epidemiology of legionellosis in California and to develop targeted interventions to decrease rates of illness
- To identify legionellosis outbreaks and interrupt potential sources of ongoing transmission, with a focus on the early detection and investigation of travel-associated and healthcare-associated clusters
- To detect new and emerging *Legionella* species or serotypes, and monitor epidemiologic trends
- To educate people about how to reduce their risk of legionellosis

B. Local Health Jurisdiction (LHJ) General Case Investigation Recommendations

- Begin investigation as soon as legionellosis is reported from a healthcare provider or clinical laboratory. These are reportable to public health within 7 calendar days of identification.
- Case-patients should be interviewed using the California Department of Public Health (CDPH) Legionellosis Case Report (see below).
• Obtain detailed information about water, healthcare, and travel exposures in the 10 days prior to symptom onset.

• If a healthcare exposure occurred during part or all of the incubation period, obtain the name of the facility, its address, and dates of stay or exposure. If the exposure was during an inpatient stay at a hospital, obtain medical records for review.

• If the patient traveled during part or all of the incubation period, obtain dates and location of travel, name and address of accommodations, dates of stay, room number, and other water exposures at the location, if available.

• If the patient appears to be part of a point-source outbreak, follow your protocol for outbreak investigations. This should include notifying CDPH about the outbreak.

• For assistance with an investigation of healthcare-associated legionellosis, call the CDPH Healthcare-Associated Infections (HAI) program at 510-412-6060. For assistance with an investigation of community-acquired legionellosis, call the Disease Investigations Section (DIS) at 510-620-3434.

C. LHJ Reporting

LHJ Reporting Overview

Legionellosis cases that meet the suspected or confirmed CSTE case definition should be reported to CDPH. The CDPH Legionellosis Case Report should be used to interview all patients and is available in CalREDIE or as a fillable form on the CDPH forms site (below). This form collects data including demographic characteristics, information regarding symptoms, treatment details, laboratory information, and radiologic studies. Detailed epidemiologic information is also collected, including both inpatient and outpatient healthcare exposures, water exposures, and travel history.

Please review the laboratory criteria necessary to meet the confirmed and suspected legionellosis case definitions. Several different laboratory tests are available to diagnose legionellosis, including the urine antigen test, respiratory culture, and serology (see case definition above). While a positive culture or urine antigen test provides laboratory confirmation of infection, a single serology result of elevated antibody titer is not sufficient. As per the CSTE laboratory criteria above, both acute and convalescent (four to eight weeks after onset of illness) serology must be tested and show a fourfold or greater rise in antibody titer for laboratory confirmation. If only a single antibody titer was collected for a patient, consider contacting the patient’s provider to determine whether the specimen was collected during the acute phase of illness and whether collecting a convalescent titer is warranted to confirm the case. If no other laboratory
studies are performed to meet the confirmed or suspected case definition, the investigator should close cases with a single elevated antibody titer as “Not a Case”.

All legionellosis reports are reviewed by the DIS or HAI program Legionella Subject Matter Expert (SME). Legionellosis cases are not confirmed and closed by the state until reviewed by a CDPH SME. All confirmed cases closed by the state SME are included in CDC’s year-end national case count.

Instructions for CalREDIE-participating jurisdictions (Legionellosis):

- Enter the patient information into CalREDIE upon notification of the case by the clinical laboratory or healthcare provider. Select “Legionellosis” as “Disease Being Reported”.

- In the Clinical Information tab under the Hospitalization Details section, enter related discharge diagnoses (e.g., pneumonia or Legionnaires’ disease).

- In the Laboratory Information tab, enter specimen type (urine, respiratory, etc.), type of test, and results. If Legionella antibody titers are being reported, verify that there is a fourfold or greater rise between acute and convalescent antibody titers in order to meet the laboratory criteria for diagnosis. A single antibody titer is not sufficient to fulfill either the suspected or confirmed case definition. Enter serogroup information, if available. Chest radiology findings (or a related discharge diagnosis) must be included in order to assign as Legionnaires’ disease.

- In the Epidemiologic Information tab, enter all healthcare, water, and travel exposures. Include as much detail as possible. Choose either Legionnaires’ disease or Pontiac fever based on chest radiology findings, clinical course, and discharge diagnoses.

- For purposes of case classification for the final year-end case count, the CalREDIE report will NOT be reviewed by SME and “Closed by State” unless the process status is “Closed by LHD”, regardless of the resolution status. The “Closed by LHD” process status is the trigger for the SME to review the incident report.

- If data required to confirm the resolution status are missing, the SME will contact the LHJ investigator for additional information and will change the process status to “Returned to LHD.”

Instructions for CalREDIE NON-participating jurisdictions:

- For jurisdictions currently not participating CalREDIE, case report data must still be reported:
  https://archive.cdph.ca.gov/pubsforms/forms/CtrlIdForms/cdph8588.pdf
Reporting Travel-Associated Cases
CDC estimates that more than 20% of Legionnaires’ disease is associated with travel. Clusters of Legionnaires’ disease associated with travel to hotels or aboard cruise ships have been well documented. Travelers may be exposed to *Legionella* at a hotel or other accommodations but may not become symptomatic and get diagnosed until they have returned home, often in another state. To capture clusters and outbreaks of legionellosis cases associated with travel, all travel-associated legionellosis cases are reported by state health departments to CDC, and CDC maintains national-level surveillance for these cases.

If a LHJ investigator finds that a case-patient has traveled or stayed overnight somewhere other than their usual residence during part or all of the incubation period, then the case meets the case definition for possible or definite travel-associated legionellosis. When interviewing the patient, the local investigator should request the dates of travel, names and addresses of accommodations, room numbers, and water exposures and report either by phone or by email within one working day to DIS staff. This includes collecting information on non-traditional accommodations such as vacation rentals. DIS will then notify the CDC Travel Legionellosis Group by email of the travel-associated case. When two or more legionellosis case-patients report the same hotel/accommodations within a 12 month period, CDC classifies this as a travel-associated legionellosis cluster.

If a case-patient from another jurisdiction, including another state, traveled within California, DIS will notify the LHJ where the potential exposure occurred. The LHJ (of the case-patient’s residence) investigator must still complete and submit the CDPH Legionellosis Case Report either in CalREDIE or as a hard copy (for CalREDIE non-participating jurisdictions).

Reporting Healthcare-Associated Cases
A healthcare facility refers to any entity licensed by CDPH Licensing and Certification (e.g., hospital, skilled nursing facility, acute rehab facility). In CalREDIE, the Epidemiologic Information tab of the Legionellosis Case Report collects information about healthcare exposures that occurred prior to onset of symptoms. If the patient reports an inpatient or long term care facility (LTCF) overnight stay during part or all of the incubation period, then the patient meets the case definition for “possible” or “definite” healthcare-associated legionellosis.

CDPH HAI Program defines healthcare-associated Legionnaires’ disease as the following:

**Definite healthcare-associated Legionnaires’ disease:** A patient that was hospitalized or a resident in one or more healthcare facilities during the entire 2 to 10 day incubation period prior to the onset of symptoms.
Possible healthcare-associated Legionnaires' disease: A patient that was hospitalized or a resident in one or more healthcare facilities for a portion of the 2 to 10 day incubation period prior to the onset of symptoms.

Examples: a “definite” healthcare-associated Legionnaires' disease case in a healthcare facility from day 2 to day 10; a “possible” healthcare-associated Legionnaires’ disease case in a healthcare facility from day 3 to day 8

Details, including the dates of hospitalization or LTCF stay, name and address of the facility, and whether the patient is still at the facility, should be collected via patient/proxy interview and/or chart abstraction. It is important to try and estimate the onset date of illness to the extent possible to determine the exposure period, rather than using date of diagnostic testing. If the patient meets the criteria for “definite” healthcare-associated Legionnaires' disease, please notify the HAI Program at HAIProgram@cdph.ca.gov as soon as possible. Healthcare facilities must report the occurrence of a “definite” case of healthcare-associated Legionnaires’ disease to the Licensing & Certification (L&C) District Office. The LHJ investigator must still complete and submit the CDPH Legionellosis Case Report either in CalREDIE or as a hard copy (for CalREDIE non-participating jurisdictions).

LHJs should contact the HAI Program if they have questions regarding the occurrence of a “possible” case of healthcare-associated Legionnaires’ disease; the likelihood of association with a healthcare facility and the need for further assessment can vary considerably from case to case, depending on a number of factors.

Recommendations for investigating healthcare-associated Legionnaires’ disease cases can be found in the HAI Program's investigation quicksheet, available online: http://www.cdph.ca.gov/programs/hai/Pages/PHPPartners.aspx.

A list of L&C District Offices can be found here: https://www.cdph.ca.gov/Programs/CHCQ/LCP/Pages/DistrictOffices.aspx.
For facilities not licensed by California Department of Health Care Services such as assisted living facilities, retirement homes, and other residential care facilities, details regarding exposures that occurred during a case-patient’s stay in these facilities should be recorded in the Epidemiologic Information section of the Legionellosis Case Report, and be reported to DIS.

**Reporting Outbreaks and Clusters**

Suspected outbreaks should be reported within 24 hours to CDPH.

- **CalREDIE-participating jurisdictions**: Create a new outbreak in CalREDIE. From the dropdown list for “Disease”, select the disease category “Respiratory, Waterborne”. In the Outbreak Report tab, from the “Disease/pathogen Identified” dropdown, select “Legionellosis”. In the Electronic Filing Cabinet, select “New Case Report” and complete the following forms:
  - Waterborne Outbreak Report – 01. General
  - Waterborne Outbreak Report – 02. Water General
  - and one of the following forms depending on the source of the outbreak
    - 03. Rec Water Treated
    - 04. Rec Water Untreated
    - 05. Drinking Water
    - 06. WNID/WUI (Water Not Intended for Drinking or Water of Unknown Intent)

- **Non-participating jurisdictions**: Complete and submit the [Waterborne Disease Outbreak Report form](https://www.cdc.gov/nors/pdf/nors_cdc_5212-form.pdf) based on the type of water associated with the outbreak (Treated Recreational Water, Untreated Recreational Water, Water Intended for Drinking, Water Not Intended for Drinking or Water of Unknown Intent). The complete form is available at the following link: (CDC 52.12, [https://www.cdc.gov/nors/pdf/nors_cdc_5212-form.pdf](https://www.cdc.gov/nors/pdf/nors_cdc_5212-form.pdf)).

**D. Laboratory Considerations/ Microbial Diseases Laboratory (MDL) Resources**

**Laboratory Testing Overview**

The definitive method for diagnosing Legionnaires' disease is through isolation of the organism, usually from respiratory specimens (e.g., sputum, bronchoalveolar lavage). However, *Legionella spp.* do not grow on standard media and require special media buffered charcoal yeast extract (CYE) agar for growth. While the specificity of culture is 100%, the sensitivity is lower.

Most cases of legionellosis are diagnosed using the urine antigen test. However, this test only detects *Legionella pneumophila* serogroup 1 and does not detect other serogroups or other *Legionella* species. The test detects the *Legionella*
lipopolysaccharide antigen which becomes detectable in 80% of patients on days one to three of illness. This test may remain positive for months after the resolution of illness, and it is not affected by antibiotic therapy.

Serological testing for antibody titers must be collected in the acute and convalescent stages in order to meet the case definition for legionellosis. A four-fold rise in antibody titer must be demonstrated, which typically takes 4 to 8 weeks. Of note, a proportion of the healthy population has a chronically elevated *Legionella* antibody titer, and others do not mount an antibody response. Therefore, the four-fold increase in antibody titer is required to establish the diagnosis.

Polymerase chain reaction (PCR) assay is a rapid test for the detection of *Legionella*, but sensitivity and specificity varies. It can detect infections caused by different *Legionella* species and serogroups and can rapidly establish the diagnosis.

Direct fluorescent antibody staining (DFA) is a rapid test that may be available in some laboratories, but it has lower sensitivity and is less frequently used.

**CDPH MDL Resources**

MDL is able to confirm and speciate both environmental and clinical isolates of *Legionella spp.*, but does not perform primary isolation. A protocol for pulsed-field gel electrophoresis (PFGE) testing is not available at this time, and MDL does not do additional molecular subtyping. MDL may assist LHJs in sending specimens and isolates to CDC for additional testing. CDC is able to perform the following tests:

- [Legionella species identification and typing](http://www.cdc.gov/laboratory/specimen-submission/detail.html?CDCTestCode=CDC-10159)
- [Legionella species molecular detection](http://www.cdc.gov/laboratory/specimen-submission/detail.html?CDCTestCode=CDC-10160)
- [Legionella species studies](http://www.cdc.gov/laboratory/specimen-submission/detail.html?CDCTestCode=CDC-10161)

**IV. CASE MANAGEMENT AND PUBLIC HEALTH CONTROL MEASURES**

**A. Management of Cases**

There are no specific regulations guiding the management of patients with legionellosis.

**B. Management of Contacts**

There are no specific regulations guiding the management of contacts of legionellosis. *Legionella* is not transmitted from person-to-person.
C. Infection Control Measures
Hospitalized patients should be cared for using standard precautions.

D. Special Considerations
An environmental investigation is typically not warranted for sporadic cases of legionellosis. During a legionellosis outbreak, however, an environmental investigation is critical. Once a suspected source is identified (e.g., a hotel or healthcare facility), environmental investigation includes onsite evaluation of the water system and collection of samples (e.g., water samples, swabs of shower heads). If *Legionella* bacteria are isolated from a water system, remediation is recommended. A *Legionella* consultant may be helpful during the environmental investigation and remediation process.

MDL does not perform testing for *Legionella* spp. from environmental samples. CDC maintains a list of laboratories that participate in the Environmental *Legionella* Isolation Techniques Evaluation (ELITE) Program (http://www.cdc.gov/legionella/elite.html). These labs are proficient at isolating *Legionella* from water samples.

Specific details of environmental investigations, environmental sampling protocols, and remediation are beyond the scope of this document. Additional resources are available below.

V. APPLICABLE STATE STATUTES

There are no applicable state statutes regulating the management of patients with legionellosis.

VI. ADDITIONAL RESOURCES

A. General Information/Patient Education

- CDPH legionellosis webpage: https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Legionellosis(Legionnaires'_Disease_PontiacFever).aspx


B. Environmental Sampling

- CDC Environmental Specimen Collection and Management: http://www.cdc.gov/legionella/specimen-collect-mgmt/index.html
C. References

  http://www.who.int/water_sanitation_health/emerging/legionella.pdf

VII. UPDATES

Original version finalized and completed on XX, 2016

VIII. SUMMARY OF ACTION STEPS

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<th>Action</th>
<th>Specific Steps</th>
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| □ Begin case investigation as soon as a positive test for legionellosis is reported from a clinical laboratory or healthcare provider. | • Obtain and review clinical documentation, medical records, and lab reports as applicable.  
  • Contact patient for interview. |
| □ Confirm case definition | • In order to count as a confirmed case of legionellosis, both clinical illness and laboratory criteria must be fulfilled.  
  o If serological testing was done, verify that both acute and convalescent sera were collected and results reflect the case definition.  
  o Document chest imaging results. |
### Action

- Attempt to identify source of exposure

### Specific Steps

- Use the CDPH Legionellosis Case Report in CalREDIE or posted online to guide your interview.
- Include as many details as possible about water, travel, and healthcare exposures.
  - If the patient has a history of travel with an overnight stay or longer outside of their county of residence in the ten days prior to illness onset, notify DIS within one working day.
  - If the patient meets the surveillance criteria for “definite” healthcare-associated Legionnaires’ disease (either in an acute inpatient setting or long term care facility), notify HAI Program as soon as possible.
- If the patient appears to be part of an outbreak, follow your protocol for outbreak investigations). This should include notifying CDPH DIS or HAI Program about the outbreak. Suspected outbreaks should be reported within 24 hours to CDPH.

If you require assistance with your investigation, call IDB Disease Investigations Section at 510-620-3434. If the investigation involves healthcare-associated legionellosis, call the HAI Program at 510-412-6060.