Legionellosis

A LOCAL HEALTH DEPARTMENT RESOURCE FOR LEGIONELLA DISEASE INVESTIGATIONS AND OUTBREAKS

INFECTIOUS DISEASES AND OUTBREAKS
ALABAMA DEPARTMENT OF PUBLIC HEALTH | JUNE 2023

BASIC EPIDEMIOLOGY

Infectious Agent

Legionella species are Gram-negative bacilli commonly found in water. There are over 50 species and approximately 70 serogroups currently recognized. *L. pneumophila* serogroup 1 is primarily responsible for human disease followed by *L. micdadei, L. bozemanii, L. dumoffi, and L. longbeachae*.

Transmission

Transmission occurs by inhaling aerosols from a water source contaminated with the *Legionella* bacteria. An example is breathing in steam or mist from a contaminated hot tub. Transmission may also occur by aspirating contaminated water. (See *Legionella* Ecology and an Introduction to Environmental Health video for more information.)

Incubation Period

The incubation period for Legionnaires' disease is 2–14 days with most infections occurring 5–6 days after exposure. Pontiac Fever can occur in 5–72 hours after exposure, but most often occurs 24-48 hours after exposure.

(Note: The incubation period for Legionnaires' disease is most commonly 2-14 days, with an average of 5-6 days, but has been reported to be up to 26 days in rare cases. For surveillance purposes, exposure histories are collected for the 14 days prior to onset.)

Communicability

No human-to-human transmission occurs.

Clinical Illness

- **Legionnaires' disease** is a common cause of pneumonia. Symptoms may include a high fever, shortness of breath, chills, non-productive cough, muscle aches and headache. Chest pain altered mental status, abdominal pain, nausea, vomiting, and diarrhea are also common.
- **Pontiac Fever** presents as a self-limited febrile illness that does not result in pneumonia. Symptoms may include fever, cough, headaches, and muscle aches. Complete recovery usually occurs within a week without antibiotics.

Severity

Almost all patients with Legionnaires' disease require hospitalization, and the case fatality rate of Legionnaires' disease is 10% to 25%. The case fatality rate is often higher in nosocomial cases. Pontiac fever generally does not result in death and hospitalization is rarely required.

DEFINITIONS

Clinical Case Definition

Legionellosis is associated with three clinically and epidemiologically distinct illnesses: Legionnaires' disease, Pontiac Fever, and extrapulmonary legionellosis. Clinical criteria alone however, are not sufficient for diagnosis.

- Legionnaires' disease (LD) is characterized by fever, myalgia, cough, and other symptoms with clinical or radiological pneumonia.
- Pontiac Fever is a milder illness that could present similar, less severe symptoms as LD but without pneumonia.
- Extrapulmonary legionellosis: *Legionella* can cause disease at sites outside the lungs (for example, associated with endocarditis, wound infection, joint infection, graft infection).

A diagnosis of extrapulmonary legionellosis is made when there is clinical evidence of disease at an extrapulmonary site and diagnostic testing indicates evidence of *Legionella* at that site.

Laboratory Confirmation

A clinically compatible case that meets at least one of the confirmatory laboratory criteria:

- Isolation (culture) of any *Legionella* organism from lower respiratory secretions, lung tissue, pleural fluid, or extrapulmonary site
- Detection of any *Legionella* species from lower respiratory secretions, lung tissue, pleural fluid, or extrapulmonary site by a validated nucleic acid amplification test (e.g. PCR)
- Detection of *Legionella pneumophila* serogroup 1 antigen in urine using validated reagents
- Demonstration of seroconversion by a fourfold or greater rise in specific serum antibody titer between paired acute and convalescent phase serum specimens to *Legionella pneumophila* serogroup 1 using validated reagents

Note: DFA tests for *Legionella* are not considered confirmatory for determining the case classification of Legionellosis cases.

Case Classifications

- **Confirmed**: A clinically compatible case that meets at least one of the confirmatory laboratory criteria
- **Probable:** A clinically compatible case with an epidemiologic linkage* during the 14-day incubation period

  **Epidemiologic linkage criteria:*
  1) Linkage to a setting with a confirmed source of *Legionella* (e.g. positive environmental sampling result associated with a cooling tower, public accommodation, hot tub, etc.)
  OR
  2) Linkage to a setting with a suspected source of *Legionella* that is associated with at least one confirmed case

Case Categories (Confirmed cases of Legionellosis may be further categorized to describe type of exposure.)

- Travel-associated case
  - 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 14-day incubation period
- Healthcare-associated (nosocomial) case
  - Presumptive: A case with 10 or more days of continuous stay at a healthcare facility* during the 14 days before onset of symptoms
  - Possible: A case that spent a portion of the 14 days before date of symptom onset in a healthcare facility*, but does not meet the criteria for a presumptive healthcare-associated case

  **These definitions apply to cases with multiple facility stays as well*

OUTBREAK INVESTIGATION CRITERIA

Non-Healthcare Facilities (i.e., apartment complex, school, casino)

- Two or more cases of legionellosis who report the same common exposure within a 12 month period.
- Three or more cases of legionellosis who report the same common exposure regardless of the time frame.

Healthcare Facilities (i.e., hospital, long-term care, clinics)

- A case with ≥ 10 days of continuous stay at a healthcare facility during the 14 days before onset of symptoms (*presumptive healthcare-associated LD).

- Two or more possible healthcare-associated legionellosis cases within a 12 month period.
- Three or more possible healthcare-associated legionellosis cases regardless of time frame.

Travel-Associated Outbreak (i.e., hotel, resort, AirBnB/Vrbo)

- Two or more cases of legionellosis in people who stayed overnight in the same accommodation during the exposure period AND had symptom onsets within 12 months of each other.
- Three or more travel-associated legionellosis cases regardless of time frame.

Confined Facilities (i.e., correctional facility, assisted living, group home)

- One case of legionellosis who spent all nights of their incubation period in this setting.
- Two or more legionellosis cases who spent at least one night of their incubation period in this setting within a 12 month period.
- Three or more cases of legionellosis who spent at least one night of their incubation period in this setting regardless of the time frame.

SURVEILLANCE and CASE INVESTIGATION

Case Investigation

District investigators should investigate all reports of clinically suspected Legionellosis. Investigations should **always** include an interview of the case-patient or a surrogate to obtain a detailed exposure history. Please use the Legionellosis Investigation Report Form available in ALNBS or on the Investigation Resources website: https://alnbs.adph.state.al.us/investigation-resources.

Case Investigation Checklist

- ☐ Confirm that the laboratory results meet the case definition.
    - Urinary antigen and respiratory culture are preferred testing methods for clinical *Legionella* confirmation.
    - If only one antibody test was performed and symptoms are consistent with Legionellosis, consider requesting that the attending physician order a convalescent antibody test or a urinary antigen test, especially in an outbreak setting.
- ☐ Review medical records or speak to an infection preventionist or physician to verify demographics, symptoms, underlying health conditions and course of illness.
- ☐ Interview the case-patient (or surrogate).
    - Use the Legionellosis Investigation Form in ALNBS.
        - If cruise ship exposure is reported during the incubation period, interview the patient with the ALNBS Legionellosis Investigation Report Form AND the Legionellosis Cruise Ship Questionnaire at https://www.cdc.gov/legionella/downloads/template-cruise-ship-questionnaire.pdf
        - Jurisdictions that are experiencing a significant increase in Legionellosis cases should interview patients with the ALNBS Legionellosis Investigation Report Form AND also consider completing the Legionellosis Hypothesis- Generating Questionnaire at https://www.cdc.gov/legionella/downloads/template-hypothesis-generating-questionnaire-508.pdf.
    - Determine the patient's onset date. This may be difficult for patients with complex medical histories or those with atypical symptoms. When onset date is uncertain for these reasons, consult all of the following sources:
        - Patient or surrogate interview
        - Medical summaries and progress reports, consultations, radiology (chest x-ray) reports, and medication records (specifically antibiotics) for all medical facilities visited in the 2-4 weeks prior to suspected symptom onset
    - For the 14 days prior to illness onset, identify risk factors, travel history and other

potential exposures such as hospital, dental, long-term care, and correctional facility visits/stays or visits to any other location where aerosolization of water may have occurred (e.g., gyms, saunas, restaurants with outdoor misters or fountains, truck stops with showers, etc.).
        - Obtain detailed information on travel or facility exposures including exact dates, room numbers, the name of the facility, and the facility's complete physical address (since facilities may have similar names and multiple locations).
    - If at least three, unsuccessful attempts were made to contact the case-patient or surrogate, please complete the case investigation form with available information and indicate the reason for missing information (e.g., lost to follow-up – patient did not return call; multiple messages left).
    - If initially the patient is unable to communicate for interview due to severity of illness, conduct the initial interview with the patient's surrogate and interview the patient when the patient is able to communicate.
- ☐ Implement control measures for cases, contacts, and/or facilities (see list of control measures below).
- ☐ If suspected healthcare-associated, travel-related, or other exposures (e.g., correctional facility case) are identified, notify the central office Legionellosis epidemiologist, using appropriate notification channels (e.g., phone call or email).
    - Notify within 1 business day of when a healthcare facility, correctional facility, or travel-related exposure is identified.
    - The central office Legionellosis epidemiologist will track the high-risk Legionellosis exposures to identify any potential clusters and outbreaks.
    - The central office Legionellosis epidemiologist will share all out-of-state exposures and in-state exposures that may affect out-of- state residents with the Centers for Disease Control and Prevention (CDC) who will notify other states/jurisdictions as needed.
- ☐ When cases report travel or exposure to healthcare facilities or other institutions (e.g., correctional facility) during their incubation periods, or in the event of a cluster or outbreak, complete the applicable steps in the Managing Special Situations section.
- ☐ In the event of a death, a copy of the discharge summary, death certificate, or autopsy report should be obtained.
- ☐ Copies of the medical records (admission report, history and physical, progress notes, laboratory results, radiology reports, discharge summary, etc.) accompanying completed case investigation form(s) is strongly recommended.
- ☐ Once all case information has been entered into the ALNBS investigation form, create a notification for approval.

Prevention and Control Measures

Cases, contacts, and the general public

- Provide education on Legionellosis as needed. Emphasize the following:
    - Low risk of Legionnaires' disease for most healthy individuals
    - No human-to-human transmission
    - Close contacts of the case are at risk only if exposed to the same source as the case
    - Increased risk of infection for individuals who are immunosuppressed, have chronic obstructive pulmonary disease (COPD) or have other risk factors such as diabetes or history of smoking
- Recommend using sterile water for respiratory therapy devices. Do not use tap water.
- Recommend that high risk sources such as hot tubs are maintained properly including:
    - Maintenance of appropriate pH (7.2–7.8) and disinfectant levels
    - Removal of slime or biofilm
    - Replacement of filters as recommended by the manufacturer
    - For more information, see http://www.cdc.gov/legionella/about/prevention.html and www.cdc.gov/healthywater/swimming/rwi/illnesses/legionella.html.
- Recommend that anyone experiencing symptoms be evaluated by a medical provider.

    - Collect demographic information and symptom history on ill contacts.
- No environmental testing of water is recommended for a single case that is only possibly associated with a facility/exposure.
- General prevention messages include:
    - Don't smoke.
    - Don't use hot tubs or whirlpools that are not well maintained.
    - Don't use tap water in humidifiers or respiratory therapy devices.
    - Thoroughly clean and maintain any humidifiers, respiratory therapy devices, hot tubs, fountains or other devices or equipment that can aerosolize water per the manufacturer's directions.

Healthcare providers and facilities (healthcare and non-healthcare)

- Remind local healthcare providers to consider Legionellosis as a cause of pneumonia and report confirmed or clinically suspected cases.
    - Indications for *Legionella* testing (https://www.cdc.gov/legionella/clinicians/diagnostic-testing.html):
        - Patients who have failed outpatient antibiotic therapy for community-acquired pneumonia
        - Patients with severe pneumonia, in particular those requiring intensive care
        - Immunocompromised patients with pneumonia
        - Patients with pneumonia in the setting of a Legionellosis outbreak
        - Patients with a travel history in the two weeks prior to illness onset
        - Patients suspected of healthcare-associated pneumonia
- Notify the director of any facility that the case-patient stayed at or visited during the incubation period.
- Request that the facility notify the health department if any guest/customer/resident/patient complains of respiratory illness or pneumonia after staying/visiting there.
    - If there were additional complaints of illness, collect suspected case-patient names, room numbers and contact information.
- Remind the facility of the importance of proper maintenance.
    - See CDC's Water Systems Maintenance website: https://www.cdc.gov/legionella/wmp/index.html
    - Facilities should take steps to minimize the risk of Legionellosis associated with building water systems. Refer to the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) current guidance (ASHRAE Guideline 12-2020 and ANSI/ASHRAE Standard 188-2018) and the CDC toolkit "Developing a Water Management Program to Reduce Legionella Growth and Spread in Buildings: A Practical Guide to Implementing Industry Standards" for more information.
    - Recommend review of maintenance procedures of hot tubs, pools, whirlpools, birthing tubs, cooling towers, decorative fountains, or any other sources of possible aerosolization of water. Important features in maintenance plans include procedures for:
        - Maintaining appropriate hot and cold water temperatures
        - Maintaining and monitoring pH and disinfectant levels including residual free chlorine
        - Replacing filters per manufacturer's recommendations
        - Performing emergency disinfection/remediation as needed
        - For more information, see www.cdc.gov/legionella/about/prevention.html.
    - Encourage the facility to hire a professional maintenance company for their equipment (e.g., hot tubs, pools) if the facility employees are unfamiliar with proper maintenance procedures.
- Remind the facility to enforce the maximum bather load for pools and hot tubs/spas.
- Encourage facilities to educate physicians to heighten their suspicion for cases of healthcare-associated Legionellosis and to use appropriate methods for its diagnosis. Facilities should

also educate patient-care, infection-control, and engineering personnel about measures to control healthcare-associated Legionellosis.

- Facilities should ensure that nebulizers and other semi critical respiratory care equipment are cleaned with sterile water. Enteral tubes should be flushed with sterile water and enteral feedings should be diluted with sterile water.
    - Providers should make sure that patients who use these devices are aware of these recommendations.
- Each hospital and long-term care facility should form a team of representatives from various departments to develop and write a Legionellosis control plan. The team should be led by a hospital epidemiologist or an infection control professional.
    - This operational plan should encompass several components including:
        - Surveillance strategies
        - Whether environmental culturing is recommended
        - Remediation strategies (if and when necessary)
        - Reporting procedures
    - Hospitals and long-term care facilities should regularly review and update their Legionellosis control plans.
- Point-of-use filtration (0.2 micrometer) may be used at specific faucets, showerheads, and other outlets as an added control measure. (This is more commonly recommended in an outbreak setting.)
- Water testing is generally not recommended in response to single cases that are only possibly associated with a facility.
- For additional information specific to facilities review the Managing Special Situations section.

MANAGING SPECIAL SITUATIONS

TRAVEL-ASSOCIATED CASES

One travel-associated case
If a **single** confirmed case of Legionellosis reported staying at a hotel/resort for at least one day/night during the incubation period, the hotel/resort should be notified. Do not share the patient's name or exact date of stay. With only one confirmed case, the exposure may or may not have occurred at the hotel/resort.

For a **single** confirmed case, the local district investigator will:

- Notify the hotel in writing (letter provided by central office epidemiologist) of the case and
    - Request that the hotel/resort notify the health department if any guest complains of respiratory illness or pneumonia after staying there.
    - Note: Do not share enough details for the hotel to identify the case.
- Environmental (water) sampling and testing is not recommended for a single case staying at a hotel/resort.

Multiple travel-associated cases
If **two or more** unrelated, confirmed cases of Legionellosis reported staying at least one night/day at the same hotel within a one-year period, the central office epidemiologist will notify the local district investigator and request a Potential Outbreak Submission Form (POSF) be completed for the suspected outbreak.
(Cases are considered related if they are members of the same household, traveling together, staying in the same room and otherwise spending significant amounts of time together outside of suspected travel exposure. For example, a husband and wife staying in the same room and traveling together would count as related but members of the same sports team staying in different rooms would not be related.)

The lead epidemiologist will:

- Confirm the existence of an outbreak and request the district investigator submit a POSF.
- Using the LD tracking log (S:\A&R\CDC Case Reports\Legionellosis), review case data to determine if other cases are associated with named facility.
- Identify the investigation team and available resources.
    - Schedule initial outbreak call and follow up calls as needed to discuss outbreak investigation priorities (e.g., next steps, recommendations, etc.).
- Draft notification letter to inform facility of suspected outbreak.
    - Letter templates can be found on the epiclassifed drive (S:\A&R\CDC Case Reports\Legionellosis\Letters).
    - Letter must include details of outbreak notification criteria, summary of findings, as well as recommendations. Route through appropriate channels for review and approval.
    - Share approved letter with district investigator to send to facility.
- Construct a case definition (define person, place, and time).
- Find cases systematically and develop a line listing.
- Promptly initiate case finding.
    - Case finding will involve retrospective and prospective surveillance.
- Consider posting an Epi-X call for cases to notify other state and national partners of the suspected outbreak and encourage reporting of additional cases.
- Perform descriptive epidemiology/develop hypotheses.
- Create an epidemic curve.
- Conduct epidemiologic studies (e.g., case-control study) necessary to identify the source(s) of the outbreak.
- Evaluate hypotheses/perform additional studies as necessary.
- Submit a completed **National Outbreak Reporting System (NORS)** outbreak form at the conclusion of the outbreak investigation.
    - Enter into NORS online reporting system at https://wwwn.cdc.gov/NORS/Account/Login

The local district investigator (DI) will:

- Complete the Case Investigation Checklist as referenced above for all known and newly identified cases.
- Submit the POSF at the request of the central office Legionellosis epidemiologist.
- Be the main point of contact for the facility to provide updates, recommendations, and answer questions about the outbreak investigation.
- Notify the hotel/resort in writing (letter provided by the central office epidemiologist) of the cases and
    - Request that the hotel notify the health department if any guest complains of respiratory illness or pneumonia after staying there.
    - Note: Do not share enough details for the hotel to identify the cases.
- Request a copy of the facility's water management plan (WMP) and any recent water testing results (i.e., last 6 months) and share with state toxicologist and investigation team for review.
- If additional clinical testing is warranted, either retrospectively or prospectively, provide testing recommendations and guidance to guests and/or facility staff.

The local environmentalist will:

- Work with the hotel, resort, or rental property manager to conduct an environmental assessment to determine possible sources of exposure and to verify maintenance procedures are being followed. The environmental assessment should be completed by the health department or by an independent contractor familiar with water systems and with documented *Legionella* remediation experience.
    - Note: the environmental assessment is a way to gain a thorough understanding of a facility's water systems and assist facility management with minimizing the risk of Legionellosis. It is not the same as environmental sampling.

- Use the CDC's *Legionella* Environmental Assessment Form to conduct the assessment. The form should be completely filled out.
- Review the *Legionella* Environmental Assessment Form Marking Guide as an instructional resource to complete the *Legionella* Environmental Assessment Form, as well as to increase awareness of conditions that may promote *Legionella* growth and spread.
- Review videos providing information and instruction on the environmental assessment and sampling available at https://www.cdc.gov/legionella/health-depts/environmental-inv-resources.html.
- Request maps of the building layout and water system in order to identify exposure locations and to select sites for environmental sampling (if planned).

- Recommend that the facility or rental property take measures to reduce/eliminate *Legionella* from its water system.
  - The hotel should follow ASHRAE Guideline 12-2020 and ANSI/ASHRAE Standard 188-2018 for controlling and preventing Legionellosis associated with building water systems. The CDC developed a toolkit aimed to provide an easy-to-understand interpretation of ASHRAE Standard 188 (https://www.cdc.gov/legionella/maintenance/wmp-toolkit.html).
  - Recommend that the hotel hire an environmental consultant familiar with water system assessment and with documented *Legionella* remediation experience.
    - The hotel owner should work with the consultant to minimize any risks of *Legionella* colonization and transmission associated with the facility, including addressing any modifiable issues identified by public health or the consultant.
  - CDC's instructions on "Disinfection of Hot Tubs Contaminated with *Legionella*" may be found at http://www.cdc.gov/legionella/downloads/hot-tub-disinfection.pdf.
- Recommend environmental sampling (i.e., collection of water and biofilm swab samples to test for *Legionella*).
  - Environmental sampling should be considered when more than one case of Legionellosis is associated with a hotel within a one-year period and the epidemiological investigation or environmental assessment identifies potential exposures or sources of infection.
  - Sampling should only be performed after a thorough environmental assessment has been done and a sampling plan has been made. The sampling plan should be approved by the health department.
  - Collect water samples and environmental swabs according to the Environmental Sampling and Testing section near the end of this guidance document.
    - Complete the Chain of Custody Form for all environmental samples collected. Form is located in the Document Library under the category "Environmental-Food Program". Click "Outbreak Forms". Select the 'Chain of Custody ENV – Revised 7-05-2023' document.
  - Do not delay interventions necessary to prevent additional cases of Legionellosis (e.g., closing a hot tub to bathers) pending the results of environmental sampling.
  - If sampling results are positive, remediation is necessary. A series of post-remediation samples for culture should be collected and tested in the following timeline to ensure remediation efforts were effective:
    - At least 48 hours after the water system or device has been restored to normal operating conditions
    - Once every two weeks for three months, then
    - Once a month for three months to ensure no growth of *Legionella* bacteria in the water system
  - If *Legionella* is detected in one or more cultures during post-remediation sampling, the facility should:
    - Review and modify the water management program
    - Perform additional remediation, if indicated
    - Implement a new 6-month period for post-remediation follow-up sampling

    - If environmental sampling is done by a contractor, the hotel should provide a copy of the testing results to the health department.
- Consult with the BCL to coordinate shipment of sample collection supplies and discuss drop off procedures at the state lab.

The State Toxicologist will:

- Review the facility's water management plan and recent water testing results (if available).
    - Provide feedback in writing on the WMP and recent test results.
- Review the completed CDC *Legionella* Environmental Assessment and provide feedback on where potential samples may be collected.
- Serve as a consultant to investigation team (DIs, epidemiologists, nurses, environmentalists, and laboratory staff).
- If needed, provide consultation to local environmental staff on the collection, packing, and shipping of environmental samples if samples will be tested at the state lab.

The Bureau of Clinical Laboratories (BCL or state lab) will:

- Test environmental and clinical specimens using conventional biochemical methods to confirm the presence of *Legionella* species.
- Consult with the Centers for Disease Control and Prevention when necessary.
- Consult with local environmentalist to coordinate shipment of sample collection supplies and discuss drop off procedures at the state lab.

HEALTHCARE-ASSOCIATED CASES

One possibly healthcare-associated case

If **one confirmed, possibly healthcare-associated case** of Legionellosis reported exposure to a healthcare facility during his/her incubation period, the healthcare facility should be notified. With only one possible healthcare-associated case, the exposure may or may not have occurred at the facility.

Note: The healthcare-associated Legionellosis recommendations may be used for cases associated with closed, non-healthcare institutions (e.g., correctional facilities). Recommendations may need to be modified slightly to reflect differences in healthcare facilities and non-healthcare facilities.

For **one possibly healthcare-associated case**, the local district investigator will:

- Notify the infection preventionist or medical director in writing (letter provided by the central office epidemiologist) of the healthcare facility at which the case-patient stayed to verify that the facility is aware of the case and
- Provide the healthcare facility specific control measures on page 5 of this guidance document.
    - Request that the facility notify the health department if additional nosocomial Legionellosis cases are suspected or identified.
    - Recommend that the facility implement prospective surveillance to identify new cases if the confirmed case reported an inpatient/resident stay at the facility (during the incubation period).
        - At minimum, prospective surveillance should include daily review of chest x-rays, sputum cultures and new diagnoses of pneumonia.
          All patients who develop pneumonia two or more days after admission over the next 60 days should be tested by urinary antigen test and culture (if possible).
        - Once implemented in response to a possible case, prospective surveillance should continue for at least six months.
- Environmental (water) testing is not recommended when a facility has only one possibly healthcare-associated case.

One or more presumptive healthcare-associated case OR multiple possibly healthcare-associated cases

If **one or more presumptive healthcare-associated or two or more possibly healthcare-**

associated cases occur in patients of the same dental or healthcare provider, hospital, residential care facility or other long- term care facility AND the cases have no other identified plausible source of infection OR if other circumstances suggest the possibility of a healthcare-associated infection, the central office epidemiologist will notify the local district investigator and request a Potential Outbreak Submission Form be completed for the suspected outbreak.

For **≥ 1 presumptive healthcare-associated case or ≥ 2 possibly healthcare-associated cases**, The lead epidemiologist will:

- Confirm the existence of an outbreak and request the district investigator submit a Potential Outbreak Submission Form (POSF).
- Using the LD tracking log (S:\A&R\CDC Case Reports\Legionellosis), review case data to determine if other cases are associated with named facility.
- Identify the investigation team and available resources.
    - Schedule initial outbreak call and follow up calls as needed to discuss outbreak investigation priorities (e.g., next steps, recommendations, etc.).
- Draft notification letter to inform facility of suspected outbreak.
    - Letter templates can be found on the Epiclassifed drive (S:\A&R\CDC Case Reports\Legionellosis\Letters).
    - Letter must include details of outbreak notification criteria, summary of findings, as well as recommendations. Route through appropriate channels for review and approval.
    - Share approved letter with district investigator to send to facility.
- Construct a case definition (define person, place, and time).
- Find cases systematically and develop a line listing.
- Promptly initiate case finding.
    - Case finding will involve retrospective and prospective surveillance.
- Consider posting an Epi-X call for cases to notify other state and national partners of the suspected outbreak and encourage reporting of additional cases.
- Perform descriptive epidemiology/develop hypotheses.
- Create an epidemic curve.
- Conduct epidemiologic studies (e.g., case-control study) necessary to identify the source(s) of the outbreak.
- Evaluate hypotheses/perform additional studies as necessary.
- Submit a completed **National Outbreak Reporting System (NORS)** outbreak form at the conclusion of the outbreak investigation.
    - Enter into NORS online reporting system at https://wwwn.cdc.gov/NORS/Account/Login

The local district investigator will:

- Notify the infection preventionist or medical director in writing (letter provided by central office epidemiologist) of the healthcare facility at which the case-patients stayed to verify that the facility is aware of the case(s).
    - If any of the patients reported exposures to multiple facilities during their incubation periods, make sure that all facilities are notified.
    - Notify facilities of cases and public health recommendations, in writing (letter provided by central office epidemiologist).
- Work with the facility to conduct retrospective and prospective surveillance to identity potentially missed or new cases before the earliest onset date and after the most recent onset date, respectively.
    - Retrospective surveillance should include a review of patient medical records and laboratory results in the last 12 months to identify clinically compatible cases.
    - Prospective surveillance should include daily review of chest x-rays, sputum cultures, and new diagnoses of healthcare-associated pneumonia (pneumonia with onset ≥48 hours after admission).
    - Once implemented in response to a presumptive or possible case(s), prospective

surveillance should continue for at least 6 months following the onset date of the most recent healthcare-associated case.
    - Request that the facility notify the health department if additional healthcare-associated Legionellosis cases are suspected or identified.
- Recommend testing of patients with compatible symptoms at least 30 days before the earliest onset date of a healthcare-associated case and at least 2 months (60 days) after the onset date of the most recent healthcare-associated case.
    - All patients who developed healthcare-associated pneumonia in the last 30 days from the earliest illness onset should be tested with a urine antigen test.
    - All patients who develop healthcare-associated pneumonia two or more days after admission for at least 2 months (60 days) after the latest onset date of a health-care associated case should be tested by both culture **and** urine antigen.
    - This testing should be extended beyond 2 months when there is evidence of ongoing transmission or when recommended prevention and control measures have not been completed.
    - Testing may be done in-house or by a commercial laboratory.
    - Clinical *Legionella* isolates/cultures should be retained (not discarded) by the hospital/lab or sent to the state public health lab (with approval from the public health lab).
- Remind the facility to report to its regulatory authority as appropriate.
- Request that the IP notify facility staff about the outbreak so that medical personnel consider Legionellosis in the differential diagnosis for patients with nosocomial and community-acquired pneumonia, and test and report suspected cases as directed.
- Request medical personnel consider clinically-compatible illnesses in facility staff.
- Request the facility's WMP and any recent water test results (i.e., last 6 months) and share with state toxicologist and investigation team for review.
- Work with key investigators (e.g., epidemiologists, nurse supervisor/manager, environmentalists, state toxicologist) to review the facility's infection control measures to prevent Legionellosis exposures and work with the facility to identify potential gaps.
- Be the main point of contact for the facility to provide updates, recommendations, and answer questions about the outbreak investigation.

The local environmentalist will:

- Work with the facility to conduct an environmental assessment to determine possible sources of exposure and to verify that maintenance procedures are being followed. If not conducted by health department staff, the environmental assessment can be completed by an independent contractor familiar with water systems and with documented *Legionella* remediation experience.
    - Note: the environmental assessment is a way to gain a thorough understanding of a facility's water systems and assist facility management with minimizing the risk of Legionellosis. It is not the same as environmental sampling.
    - Use the CDC's *Legionella* Environmental Assessment Form to conduct the assessment. The form should be completely filled out.
    - Review the *Legionella* Environmental Assessment Form Marking Guide as an instructional resource to complete the *Legionella* Environmental Assessment Form, as well as to increase awareness of conditions that may promote *Legionella* growth and spread.
    - Review videos providing information and instruction on the environmental assessment and sampling available at https://www.cdc.gov/legionella/health-depts/environmental-inv-resources.html.
    - Ask the facility to provide maps of the building layout and water system in order to identify exposure locations and to select sites for environmental sampling (if planned).

- Consider using methods to limit exposure of high-risk patients to potentially contaminated water sources, pending successful reduction in levels of *Legionella* colonization within the facility's water system including:
    - Restrictions on showering
    - Restrictions on use of potable hot water: shift to using sterile water for bathing, drinking, oral hygiene, wound care, and dilution of drinks (bottled water may also be an option for some activities)
    - Installing point-of-use filtration at faucets and showerheads
- Recommend that the facility take measures to reduce/eliminate *Legionella* from its water system.
    - The facility should follow ASHRAE Guideline 12-2020 and ANSI/ASHRAE Standard 188- 2018 for controlling and preventing Legionellosis associated with building water systems. The CDC developed a toolkit aimed to provide an easy-to-understand interpretation of ASHRAE Standard 188 (https://www.cdc.gov/legionella/wmp/toolkit/index.html).
    - Recommend that the facility hire an environmental consultant familiar with water system assessment and with documented *Legionella* remediation experience. The facility owner should routinely work with the consultant to minimize any risks of *Legionella* colonization and transmission associated with the facility, including addressing any modifiable issues identified by public health or the consultant.
- Recommend environmental sampling (i.e., collection of water and biofilm swab samples to test for *Legionella*), if warranted.
    - Water testing should be considered when one presumptive healthcare-associated case or two or more possible healthcare-associated cases of Legionellosis are associated with a facility within a one-year period.
    - Sampling should only be performed after a thorough environmental assessment has been done and a sampling plan has been made. The sampling plan should be approved by the health department.
    - Collect water samples and environmental swabs according to the Environmental Sampling and Testing section near the end of this document.
        - Complete the Chain of Custody Form for all environmental samples collected. Form is located in the Document Library under the category "Environmental-Food Program". Click "Outbreak Forms". Select the 'Chain of Custody ENV – Revised 7-05-2023' document.
    - Do not delay interventions necessary to prevent additional cases of Legionellosis (e.g., cleaning equipment, implementing water restrictions, installing point-of-use filters) pending the results of environmental sampling.
    - If sampling results are positive, remediation is necessary. A series of post-remediation samples for culture should be collected and tested in the following timeline to ensure remediation efforts were effective:
        - At least 48 hours after the water system or device has been restored to normal operating conditions
        - Once every two weeks for three months, then
        - Once a month for three months to ensure no growth of *Legionella* bacteria in the water system
    - If *Legionella* is detected in one or more cultures during post-remediation sampling, the facility should:
        - Review and modify the water management program
        - Perform additional remediation, if indicated
        - Implement a new 6-month period for post-remediation follow-up sampling
    - If environmental sampling is done by a consultant, the healthcare facility should provide a copy of the testing results to the health department.
- Consult with BCL to coordinate shipment of sample collection supplies and discuss drop off procedures at the state lab.

The State Toxicologist will:

- Review the facility's water management plan and recent water testing results (if available).
    - Provide feedback in writing on the WMP and recent test results.
- Review the completed CDC *Legionella* Environmental Assessment and provide feedback on where potential samples may be collected.
- Serve as a consultant to investigation team (DIs, epidemiologists, nurses, environmentalists, and laboratory staff).
- If needed, provide consultation to local environmental staff on the collection, packing, and shipping of environmental samples if samples will be tested at the state lab.

The BCL will:

- Test environmental and clinical specimens using conventional biochemical methods to confirm the presence of *Legionella* species.
- Consult with the Centers for Disease Control and Prevention when necessary.
- Consult with local environmentalist to coordinate shipment of sample collection supplies and discuss drop off procedures at the state lab.

CASES ASSOCIATED WITH A CORRECTIONAL FACILITY

A single case of legionellosis who spent all nights of their incubation period (14 days) in this setting triggers a full outbreak investigation.

The lead epidemiologist will:

- Confirm the existence of an outbreak and request the district investigator submit a Potential Outbreak Submission Form (POSF).
- Using the LD tracking log (S:\A&R\CDC Case Reports\Legionellosis), review case data to determine if other cases are associated with named facility.
- Identify the investigation team and available resources.
    - Schedule initial outbreak call and follow up calls as needed to discuss outbreak investigation priorities (e.g., next steps, recommendations, etc.).
- Draft notification letter to inform facility of suspected outbreak.
    - Letter templates can be found on the Epiclassifed drive (S:\A&R\CDC Case Reports\Legionellosis\Letters).
    - Letter must include details of outbreak notification criteria, summary of findings, as well as recommendations. Route through appropriate channels for review and approval.
    - Share approved letter with district investigator to send to facility.
- Construct a case definition (define person, place, and time).
- Find cases systematically and develop a line listing.
- Promptly initiate case finding.
    - Case finding will involve retrospective and prospective surveillance.
- Perform descriptive epidemiology/develop hypotheses.
- Create an epidemic curve.
- Conduct epidemiologic studies (e.g., case-control study) necessary to identify the source(s) of the outbreak.
- Evaluate hypotheses/perform additional studies as necessary.
- Submit a completed **National Outbreak Reporting System (NORS)** outbreak form at the conclusion of the outbreak investigation.
    - Enter into NORS online reporting system at https://wwwn.cdc.gov/NORS/Account/Login

The local district investigator will:

- Notify the infection preventionist or medical director in writing (letter provided by central office epidemiologist) to verify that the facility is aware of the case(s).

- Work with the facility to conduct retrospective and prospective surveillance to identity potentially missed or new cases before the earliest onset date and after the most recent onset date, respectively.
    - Retrospective surveillance should include a review of inmate medical records and laboratory results in the last 12 months to identify clinically compatible cases.
    - Prospective surveillance should include daily review of chest x-rays, sputum cultures, and new diagnoses of pneumonia.
    - Prospective surveillance should continue for at least 6 months following the onset date of the most recent case.
    - Request that the facility notify the health department if additional Legionellosis cases are suspected or identified.
- Recommend testing of inmates with compatible symptoms at least 30 days before the earliest onset date of a case and at least 2 months (60 days) after the onset date of the most recent case.
    - All patients who developed pneumonia in the last 30 days should be tested with a urine antigen test.
    - All patients who develop pneumonia at least 2 months (60 days) after the latest onset date of a case should be tested by both culture **and** urine antigen.
    - This testing should be extended beyond 2 months (60 days) days when there is evidence of ongoing transmission or when recommended prevention and control measures have not been completed.
    - Testing may be done in-house or by a commercial laboratory.
    - Clinical *Legionella* isolates/cultures should be retained (not discarded) by the hospital/lab or sent to the state public health lab (with approval from the public health lab).
- Remind the facility to report to its regulatory authority as appropriate.
- Request that the IP notify facility staff about the outbreak so that their healthcare provider can consider Legionellosis in the differential diagnosis for employees with pneumonia, and test and report suspected cases as directed.
- Request the facility's WMP and any recent water test results (i.e., last 6 months) and share with state toxicologist and investigation team for review.
- Work with key investigators (e.g., epidemiologists, nurse supervisor/manager, environmentalists, state toxicologist) to review the facility's infection control measures to prevent Legionellosis exposures and work with the facility to identify potential gaps.
- Be the main point of contact for the facility to provide updates, recommendations, and answer questions about the outbreak investigation.

The local environmentalist will:

- Work with the facility to conduct an environmental assessment to determine possible sources of exposure and to verify that maintenance procedures are being followed. If not conducted by health department staff, the environmental assessment can be completed by an independent contractor familiar with water systems and with documented *Legionella* remediation experience.
    - Note: the environmental assessment is a way to gain a thorough understanding of a facility's water systems and assist facility management with minimizing the risk of Legionellosis. It is not the same as environmental sampling.
    - Use the CDC's *Legionella* Environmental Assessment Form to conduct the assessment. The form should be completely filled out.
    - Review the *Legionella* Environmental Assessment Form Marking Guide as an instructional resource to complete the *Legionella* Environmental Assessment Form, as well as to increase awareness of conditions that may promote *Legionella* growth and spread.
    - Review videos providing information and instruction on the environmental assessment and sampling available at https://www.cdc.gov/legionella/health-depts/environmental-

inv-resources.html.
    - Ask the facility to provide maps of the building layout and water system in order to identify exposure locations and to select sites for environmental sampling (if planned).
- Consider using methods to limit exposure of high-risk patients to potentially contaminated water sources, pending successful reduction in levels of *Legionella* colonization within the facility's water system including:
    - Restrictions on showering
    - Restrictions on use of potable hot water: shift to using sterile water for bathing, drinking, oral hygiene, wound care, and dilution of drinks (bottled water may also be an option for some activities)
    - Installing point-of-use filtration at faucets and showerheads
    - Avoid consumption of non-sterile ice from facility ice machines for anyone at risk for aspiration or who has swallowing difficulties.
    - Turn off any decorative fountains, hair salon sinks/faucets, garden hoses, or other devices that create a mist or aerosolize water.
- Recommend that the facility take measures to reduce/eliminate *Legionella* from its water system.
    - The facility should follow ASHRAE Guideline 12-2020 and ANSI/ASHRAE Standard 188- 2018 for controlling and preventing Legionellosis associated with building water systems. The CDC developed a toolkit aimed to provide an easy-to-understand interpretation of ASHRAE Standard 188 (https://www.cdc.gov/legionella/wmp/toolkit/index.html).
    - Recommend that the facility hire an environmental consultant familiar with water system assessment and with documented *Legionella* remediation experience. The facility owner should routinely work with the consultant to minimize any risks of *Legionella* colonization and transmission associated with the facility, including addressing any modifiable issues identified by public health or the consultant.
- Recommend environmental sampling (i.e., collection of water and biofilm swab samples to test for *Legionella*), if warranted.
    - Water testing should be considered when one case of Legionellosis is associated with a facility within a one-year period.
    - Sampling should only be performed after a thorough environmental assessment has been done and a sampling plan has been made. The sampling plan should be approved by the health department.
    - Collect water samples and environmental swabs according to the Environmental Sampling and Testing section near the end of this document.
        - Complete the Chain of Custody Form for all environmental samples collected. Form is located in the Document Library under the category "Environmental-Food Program". Click "Outbreak Forms". Select the 'Chain of Custody ENV – Revised 7-05-2023' document.
    - Do not delay interventions necessary to prevent additional cases of Legionellosis (e.g., cleaning equipment, implementing water restrictions, installing point-of-use filters) pending the results of environmental sampling.
    - If sampling results are positive, remediation is necessary. A series of post-remediation samples for culture should be collected and tested in the following timeline to ensure remediation efforts were effective:
        - At least 48 hours after the water system or device has been restored to normal operating conditions
        - Once every two weeks for three months, then
        - Once a month for three months to ensure no growth of *Legionella* bacteria in the water system
    - If *Legionella* is detected in one or more cultures during post-remediation sampling, the facility should:
        - Review and modify the water management program
        - Perform additional remediation, if indicated

        - Implement a new 6-month period for post-remediation follow-up sampling
    - If environmental sampling is done by a consultant, the healthcare facility should provide a copy of the testing results to the health department.
- Consult with BCL to coordinate shipment of sample collection supplies and discuss drop off procedures at the state lab.

The State Toxicologist will:

- Review the facility's water management plan and recent water testing results (if available).
    - Provide feedback in writing on the WMP and recent test results.
- Review the completed CDC *Legionella* Environmental Assessment and provide feedback on where potential samples may be collected.
- Serve as a consultant to investigation team (DIs, epidemiologists, nurses, environmentalists, and laboratory staff).
- If needed, provide consultation to local environmental staff on the collection, packing, and shipping of environmental samples if samples will be tested at the state lab.

The BCL will:

- Test environmental and clinical specimens using conventional biochemical methods to confirm the presence of *Legionella* species.
- Consult with the Centers for Disease Control and Prevention when necessary.
- Consult with local environmentalist to coordinate shipment of sample collection supplies and discuss drop off procedures at the state lab.

CASES ASSOCIATED WITH AN "OPEN" FACILITY

One facility-associated case

If **one confirmed case** of Legionellosis reported exposure to a source of aerosolized water (pool, whirlpool, hot tub, mister, etc.) at a public/communal facility during at least one day/night during the incubation period, the facility should be notified. Do not share the patient's name or exact date of exposure. With only one confirmed, possibly facility-associated case, the exposure may or may not have occurred at the facility or event.

For a **single case**, the local district investigator will:

- Notify the facility in writing of the case (letter provided by central office epidemiologist) and
    - Request that the facility notify the health department if any customer complains of pneumonia after visiting the facility.
    - Note: Do not share enough details for the facility to identify the case.
- Environmental (water) sampling and testing is not recommended for a single case reporting exposure to the facility or event.

Multiple facility-associated cases

If **two or more confirmed cases** of Legionellosis reported exposure to a source of aerosolized water (pool, whirlpool, hot tub, mister, etc.) at a facility during at least one day/night during the incubation period within a one-year period, the central office epidemiologist will notify the local district investigator and request a Potential Outbreak Submission Form be completed for the suspected outbreak.

For **multiple cases**, the lead epidemiologist will:

- Confirm the existence of an outbreak and request the district investigator submit a Potential Outbreak Submission Form (POSF).
- Using the LD tracking log (S:\A&R\CDC Case Reports\Legionellosis), review case data to determine if other cases are associated with named facility.
- Identify the investigation team and available resources.
    - Schedule initial outbreak call and follow up calls as needed to discuss outbreak investigation priorities (e.g., next steps, recommendations, etc.).

- Draft notification letter to inform facility of suspected outbreak.
    - Letter templates can be found on the Epiclassifed drive (S:\A&R\CDC Case Reports\Legionellosis\Letters).
    - Letter must include details of outbreak notification criteria, summary of findings, as well as recommendations. Route through appropriate channels for review and approval.
- Construct a case definition (define person, place, and time).
- Find cases systematically and develop a line listing.
- Promptly initiate case finding.
    - Case finding will involve retrospective and prospective surveillance.
- Consider posting an Epi-X call for cases to notify other state and national partners of the suspected outbreak and encourage reporting of additional cases.
- Perform descriptive epidemiology/develop hypotheses.
- Create an epidemic curve.
- Evaluate hypotheses/perform additional studies as necessary.
- Conduct epidemiologic studies (e.g., case-control study) necessary to identify the source(s) of the outbreak.
- Submit a completed **National Outbreak Reporting System (NORS)** outbreak form at the conclusion of the outbreak investigation.
    - Enter into NORS online reporting system at https://wwwn.cdc.gov/NORS/Account/Login

The local district investigator will:

- Complete the Potential Outbreak Submission Form.
- Notify the facility in writing (letter provided by central office epidemiologist) of the cases and
    - Request that the facility notify the health department if any customer complains of pneumonia after visiting the facility.
    - Note: Do not share enough details for the facility to identify the case.
- Contact local hospital infection control staff and emergency room staff to determine whether they have observed an increase in community-acquired pneumonia patients admitted to the hospital.
    - If cultures/isolates or respiratory specimens are available on potential cases, these should be held (i.e., not discarded) in case further testing is requested.
- Inform primary care physicians, emergency room staff, and radiologists in the potential outbreak area and any other locations necessary of the following:
    - That there is a cluster of Legionellosis cases
    - The signs and symptoms of Legionellosis
    - The recommended lab tests to confirm Legionellosis
    - Reporting requirements and contact information for the health department
    - Request the facility consider clinically-compatible illnesses in staff of the affected facility.
- Be the main point of contact for the facility to provide updates, recommendations, and answer questions about the outbreak investigation.

The local environmentalist will:

- Work with the facility to conduct an environmental assessment to determine possible sources of exposure and to verify maintenance procedures are being followed. If not conducted by health department staff, the environmental assessment can be completed by an independent contractor familiar with water systems and with documented *Legionella* remediation experience.
    - Note: the environmental assessment is a way to gain a thorough understanding of a facility's water systems and assist facility management with minimizing the risk of Legionellosis. It is not the same as environmental sampling.
    - Use the CDC's *Legionella* Environmental Assessment Form to conduct the

assessment. The form should be completely filled out.
    - Review the *Legionella* Environmental Assessment Form Marking Guide as an instructional resource to complete the *Legionella* Environmental Assessment Form, as well as to increase awareness of conditions that may promote *Legionella* growth and spread.
    - Review videos providing information and instruction on the environmental assessment and sampling available at https://www.cdc.gov/legionella/health-depts/environmental-inv-resources.html.
    - Ask the facility to provide maps of the building layout and water system in order to identify exposure locations and to select sites for environmental sampling (if planned).
- Consider using methods to limit exposure of high-risk patients to potentially contaminated water sources, pending successful reduction in levels of *Legionella* colonization within the facility's water system including:
    - Restrictions on showering
    - Restrictions on use of potable hot water: shift to using sterile water for drinking and hand washing.
    - Installing point-of-use filtration at faucets and showerheads
- Recommend that the facility take measures to reduce/eliminate *Legionella* from its water system.
    - The facility should follow ASHRAE Guideline 12-2020 and ANSI/ASHRAE Standard 188- 2018 for controlling and preventing Legionellosis associated with building water systems. The CDC developed a toolkit aimed to provide an easy-to-understand interpretation of ASHRAE Standard 188 (https://www.cdc.gov/legionella/wmp/toolkit/index.html).
    - Recommend that the facility hire an environmental consultant familiar with water system assessment and with documented *Legionella* remediation experience. The facility owner should routinely work with the consultant to minimize any risks of *Legionella* colonization and transmission associated with the facility, including addressing any modifiable issues identified by public health or the consultant.
- Recommend environmental sampling (i.e., collection of water and biofilm swab samples to test for *Legionella*), if warranted.
    - Water testing should be considered when one multiple cases of Legionellosis are associated with a facility within a one-year period.
    - Sampling should only be performed after a thorough environmental assessment has been done and a sampling plan has been made. The sampling plan should be approved by the health department.
    - Collect water samples and environmental swabs according to the Environmental Sampling and Testing section near the end of this document.
        - Complete the Chain of Custody Form for all environmental samples collected. Form is located in the Document Library under the category "Environmental-Food Program". Click "Outbreak Forms". Select the 'Chain of Custody ENV – Revised 7-05-2023' document.
    - Do not delay interventions necessary to prevent additional cases of Legionellosis (e.g., cleaning equipment, implementing water restrictions, installing point-of-use filters) pending the results of environmental sampling.
    - If sampling results are positive, remediation is necessary. A series of post-remediation samples for culture should be collected and tested in the following timeline to ensure remediation efforts were effective:
        - At least 48 hours after the water system or device has been restored to normal operating conditions
        - Once every two weeks for three months, then
        - Once a month for three months to ensure no growth of *Legionella* bacteria in the water system
    - If *Legionella* is detected in one or more cultures during post-remediation sampling, the facility should:

        - Review and modify the water management program
        - Perform additional remediation, if indicated
        - Implement a new 6-month period for post-remediation follow-up sampling
    - If environmental sampling is done by a consultant, the facility should provide a copy of the testing results to the health department.
- Consult with BCL to coordinate shipment of sample collection supplies and discuss drop off procedures at the state lab.

The State Toxicologist will:

- Review the facility's water management plan and recent water testing results (if available).
    - Provide feedback in writing on the WMP and recent test results.
- Review the completed CDC *Legionella* Environmental Assessment and provide feedback on where potential samples may be collected.
- Serve as a consultant to investigation team (DIs, epidemiologists, nurses, environmentalists, and laboratory staff).
- If needed, provide consultation to local environmental staff on the collection, packing, and shipping of environmental samples if samples will be tested at the state lab.

The BCL will:

- Test environmental and clinical specimens using conventional biochemical methods to confirm the presence of *Legionella* species.
- Consult with the Centers for Disease Control and Prevention when necessary.
- Consult with local environmentalist to coordinate shipment of sample collection supplies and discuss drop off procedures at the state lab.

CASES ASSOCIATED WITH A COMMUNITY

If **multiple confirmed cases** of Legionellosis (e.g., in residents, visitors/travelers, etc.) are reported within a one-year period with exposure to the same community AND no potential common source has been identified, the central office epidemiologist will notify the local district investigator and request a Potential Outbreak Submission Form be completed for the suspected outbreak.

A cluster of Legionellosis cases with a common exposure can involve both Legionnaires' disease and Pontiac fever and health departments should be alert to this possibility. Questions regarding ill contacts of Legionnaires' disease case patients should not be limited to persons with symptoms of pneumonia.

The lead epidemiologist will:

- Confirm the existence of an outbreak and request the district investigator submit a Potential Outbreak Submission Form (POSF).
- Identify the investigation team and available resources.
    - Schedule initial outbreak call and follow up calls as needed to discuss outbreak investigation priorities (e.g., next steps, recommendations, etc.).
- Construct a case definition (define person, place, and time).
- Find cases systematically and develop a line listing.
- Promptly initiate case finding in the community.
    - Case finding will involve retrospective and prospective surveillance.
- Consider posting an Epi-X call for cases to notify other state and national partners of the suspected outbreak and encourage reporting of additional cases.
- Perform descriptive epidemiology/develop hypotheses.
- Map cases to identify commonalities in location or proximity and consult with state toxicologist to identify possible environmental sources.
- Create an epidemic curve.
- Conduct epidemiologic studies (e.g., case-control study) necessary to identify the source(s) of the outbreak.

- Evaluate hypotheses/perform additional studies as necessary.
- Submit a completed **National Outbreak Reporting System (NORS)** outbreak form at the conclusion of the outbreak investigation.
    - Enter into NORS online reporting system at https://wwwn.cdc.gov/NORS/Account/Login

The local district investigator will:

- Notify the central office *Legionella* epidemiologist with information on the suspected cluster.
- Complete the Potential Outbreak Submission Form if cluster is confirmed.
- Verify the diagnosis
- Obtain clinical records and lab reports
- Request additional clinical testing if needed
- Ask facilities to retain *Legionella* isolates/cultures (if culture was performed)
- Inform primary care physicians, emergency room staff and radiologists in the potential outbreak area and any other locations necessary of the following:
    - That there is a cluster of Legionellosis cases
    - The signs and symptoms of Legionellosis
    - How a case of Legionellosis is diagnosed
    - Preferred testing methods to identify Legionellosis cases
- Recommend which patients to test (e.g., patients with community- acquired pneumonia)
- Share reporting requirements and contact information for the health department
- Contact local hospital infection control staff and emergency room staff to determine whether they have observed an increase in community-acquired pneumonia patients admitted to the hospital.
- Cultures should be requested to be sent to the public health laboratory and held appropriately.
- Interview cases with the Legionellosis Investigation Form or with a Legionellosis hypothesis-generating form to identify common exposures (https://www.cdc.gov/legionella/downloads/template-hypothesis-generating-questionnaire-508.pdf).
- Provide general control measures
    - Source control should be implemented as soon as a likely source is identified.
    - Do not wait for laboratory results on suspected sources before implementing control measures.

The local environmentalist will:

- Conduct an environmental investigation
- Assess the community to identify possible sources of exposure (e.g., cooling towers, chiller units, supermarket/restaurant misters, swamp coolers, decorative fountains, whirlpool spas, municipal water system, wells and streams)
- Collect water samples and environmental swabs according to the Environmental Sampling and Testing section near the end of this document.
    - Complete the Chain of Custody Form for all environmental samples collected. Form is located in the Document Library under the category “Environmental-Food Program”. Click “Outbreak Forms”. Select the ‘Chain of Custody ENV – Revised 7-05-2023’ document.
- Consult with BCL to coordinate shipment of sample collection supplies and discuss drop off procedures at the state lab.
    - Ask the BCL to retain cultures/isolates that are outbreak-related so that these may be compared to clinical isolates.

The State Toxicologist will:

- Work with central office epidemiologist to review 3 mile radius of suspected cluster to identify possible environmental sources.
- Serve as a consultant to investigation team (DIs, epidemiologists, nurses, environmentalists,

and laboratory staff).
- If needed, provide consultation to local environmental staff on the collection, packing, and shipping of environmental samples if samples will be tested at the state lab.

The BCL will:
- Test environmental and clinical specimens using conventional biochemical methods to confirm the presence of *Legionella* species.
- Consult with the Centers for Disease Control and Prevention when necessary.
- Consult with local environmentalist to coordinate shipment of sample collection supplies and discuss drop off procedures at the state lab.

COMMUNICATIONS

During an outbreak response, it is important to have a communication plan to keep all involved parties updated on the current situation. Resources that outline what should be included in these types of communications can be found here: https://www.cdc.gov/legionella/health-depts/communications-resources.html

CLINICAL LABORATORY PROCEDURES

Specimens and isolates associated with Legionellosis cases are not routinely submitted to the BCL. When multiple Legionellosis cases are associated with a single facility, the BCL will accept isolates from other laboratories conducting environmental testing if patient isolates (*Legionella* culture from clinical specimens) are available for comparison.

Contact the BCL (334-290-6130) for approval:
- When submitting clinical or environmental isolates to the BCL that are related to an outbreak
- To request molecular typing at CDC's lab to confirm that isolates from cases are identical (case- patients are exposed to the same source)

Specimen Collection

Clinical specimen

Acceptable specimens: sputum, bronchial washing, tracheal aspirate, or lung biopsy

- Bronchial washing or tracheal aspirate:
  - Collect washing or aspirate using sterile water, not saline
  - 2mL minimum volume needed
  - Refrigerate at 2º–8 ºC. Do not freeze.
- Sputum, expectorated:
  - Collect in a sterile container
  - Collect specimen under the direct supervision of a nurse or physician
  - Have patient rinse or gargle with water first to remove excess oral flora
  - Instruct patient to cough deeply to produce a lower respiratory specimen (not postnasal fluid)
  - For pediatric patients unable to produce a sputum specimen, a respiratory therapist should collect a specimen via suction. The best specimen should have <10 squamous cells/100X field (10X objective and 10X ocular).
  - Refrigerate at 2 º–8 ºC. Do not freeze.
- Sputum, induced:
  - Collect in a sterile container
  - Have patient rinse mouth with water after brushing gums and tongue
  - With the aid of a nebulizer, have patient inhale approximately 25 ml of 3-10% sterile saline

    - Refrigerate at 2 º–8 ºC. Do not freeze.
- Lung biopsy:
    - Collect during surgery or cutaneous biopsy procedure
    - Place in an anaerobic transport system or sterile, screw-cap container
    - Add several drops of sterile saline to keep small pieces of tissue moist
    - Always submit as much tissue as possible. If excess tissue is available, save a portion of surgical tissue at -70°C in case further studies are needed. Never submit a swab that has been rubbed over the surface of a tissue.
    - Refrigerate at 2º–8ºC. Do not freeze.
    - Do not suspend the specimen in formalin or other preserving liquid.

Clinical isolates (pure cultures)

- Submit a pure culture on a BCYE slant
- May be kept at ambient temperature

Laboratory Submission Form

- For clinical specimens and isolates, use the BCL Requisition Form for Laboratory Testing (https://www.alabamapublichealth.gov/bcl/assets/bcl-requisition-form.pdf).
- On the form under the "Test Requested" section, check the box "Microbiology Reference/Gram Stain".
    - Under the "Additional Information That Might Be Required" section write "Legionella" in the open space.
- Make sure the patient's name and approved secondary identifier on the form exactly match what is written on the specimen tube.
    - An approved secondary identifier should be one of the following: date of birth, medical record number, social security number, Medicaid number, or CDC number.
    - Make sure to fill in the date of collection, date of onset, and diagnosis.

Specimen Shipping

- Transport temperature for clinical specimens: Keep at 2º–8ºC (refrigerated/ice packs). Do not use dry ice.
- Transport temperature for isolates (pure culture): May be shipped at ambient temperature. Do not use dry ice.
- Ship specimens via overnight delivery on cold packs or wet ice (double bagged) within 24 hours of collection if possible.
    - Note: While *Legionella* may survive extended transport, their isolation may be compromised by overgrowth of commensal bacteria in the specimens; therefore, specimens should arrive at the laboratory as soon as possible for the best results.
- DO NOT ship specimens on a Friday or the day before a state holiday unless special arrangements have been made with the BCL.
    - Ship specimens to:
      Bureau of Clinical Laboratories
      204 Legends Court
      Prattville, Alabama 36066-7893

Frequent Causes for Rejection:

- Sputum specimen consists of saliva only
- Insufficient quantity submitted for testing
- Discrepancy between name on specimen container and name on submission form
- Container broken in transport
- Expired media used

Results Available:

- Culture results typically available in 3–21 days (15 days of no growth = negative result)

ENVIRONMENTAL SAMPLING AND TESTING

Inhalation of aerosols containing *Legionella* is presumed to be the primary means of acquiring Legionellosis. Aerosolized waters from cooling towers, evaporative condensers, showers, and humidifiers have been identified as sources of infection. *Legionella* species have been recovered from a wide variety of domestic water systems and are ubiquitous in freshwater environments. Domestic water systems are complex environments in which concentrations of legionellae can fluctuate considerably depending upon water temperature, biocide levels, and presence of natural hosts (i.e., protozoa) for legionellae to parasitize.

Recommendations for Environmental Sampling

When to Sample:

- Hotels, gyms, spas and other similar facilities
    - Baseline environmental sampling (in the absence of associated cases) is not recommended.
    - Environmental testing is not recommended for a single case whose illness may be associated with a hotel or similar facility.
    - Environmental sampling should be considered when more than one case of Legionellosis is associated with a hotel or similar facility within a one-year period and the epidemiological investigation or environmental assessment identifies potential exposures or sources of infection.
    - Sampling should only be performed after a thorough environmental assessment has been done and a sampling plan has been made. The sampling plan should be approved by the health department.

- Healthcare facilities
    - Baseline environmental sampling for *Legionella* (no patient cases detected)
    - All healthcare facilities should, in implementing their WMP, assess their risk of *Legionella* transmission. Each facility should evaluate environmental, engineering, and patient population factors to determine whether there is a reasonable potential for nosocomial transmission.
    - Baseline water distribution system cultures should be performed if the results of the risk assessment indicate the facility has a significant risk of *Legionella* transmission.
    - For more information on assessing a facility's risk of *Legionella* transmission, see the CDC's Worksheet to Identify Buildings at Increased Risk for Growth and Spread
    - Environmental sampling in the context of a patient case(s)
        - Water testing should be considered when one presumptive healthcare-associated case or two or more possible healthcare-associated cases of Legionellosis are associated with a facility within a one-year period.
        - Water testing should be done if remediation efforts were implemented, and a new case is identified with exposure occurring after remediation was done.

Sampling Considerations and Procedures:

- Purpose of sampling: To determine the source of transmission and extent of colonization
- If environmental sampling is pursued, the samples should be collected and processed in a way that maximizes the recovery of *Legionella*.
- Instructional/training videos: "How to Make a Sampling Plan", "How to Sample Potable Water", "How to Sample Cooling Towers", and "How to Sample Spas and Fountains" at https://www.cdc.gov/legionella/videos.html.

Choosing Sites for Sampling:

- See CDC's "Sampling Procedure and Potential Sampling Sites" document: https://www.cdc.gov/legionella/downloads/cdc-sampling-procedure.pdf.
    - Potential sampling sites for hotels include hot tubs/whirlpools (including filters, jets, tanks, water lines, etc.); swimming pools (including skimmer baskets); showerheads and faucets in pool showering facilities, if applicable; decorative fountains; potable water supply to and within the facility (including hot water heaters, holding tanks, water returns, etc.); cooling towers; sprinkler systems; and potential sources of exposure in guest rooms (faucets, showerheads, etc.).
    - Potential sampling sites for healthcare facilities include potable water supply to and within the facility (including hot water heaters, holding tanks, water returns, etc.); potable water outlets (faucets, showers, etc.), especially those in or near patient rooms; ice machines; cooling towers and evaporative condensers; humidifiers (e.g., nebulizers) and other respiratory therapy equipment; and other potential sources of exposure (e.g., decorative fountains, whirlpools, safety showers and eyewash stations, etc.).
    - All showers and faucets in all case rooms (primary room where case stayed and other rooms where case exposures may have occurred [e.g., surgical recovery rooms]) should be sampled, along with showers and sink faucets in additional rooms.
    - Choose rooms proximal and distal to risers or hot water heaters and on various floors based on the results of the environmental assessment.
    - Ideally, sample at least a couple of outlets on every floor and/or wing. Some sites should also be selected at random for sampling.
    - In most situations, it is appropriate to sample only the hot water. However, there are situations where taking some cold water samples is helpful.
        - For example, in hot climates (like Alabama!), the cold water may be warm enough for rapid *Legionella* amplification (>77°F).
            - Note: In most recent *Legionella* outbreak investigations in Alabama, some cold water samples were collected in addition to hot water samples.
        - Desalination may elevate cold water temperature.
        - Cold water could be warm due to lack of insulation between hot and cold water pipes.
        - The results of the environmental assessment (if done properly/completely) can help to determine if cold water samples should be collected.

Number of Samples to Collect:

- The number of samples to be collected should be based on a plan (to limit the expense and time associated with sample collection and testing)
    - The sampling plan should be based on the findings of the environmental assessment and available epidemiologic data (i.e., water sources and locations where patients may have been exposed)
- The number of samples to collect may depend on:
    - The size and design of the facility (e.g., number of floors, wings, rooms, buildings, etc.)
    - The design and configuration of the water system including the presence of dead legs, number and type of components, types of heating systems, etc.
    - The facility's sources of possible aerosolized or aspirated water (e.g., cooling towers, air handling systems, showers, faucets, decorative fountains, ice machines, whirlpools, etc.)
    - The number of Legionellosis cases associated with the facility and their reported exposures in/near the facility
    - The facility's patient population
    - Other factors specific to the facility

- In the smallest facilities, at least 10 environmental samples should be collected; however, in most cases 10 samples will not be sufficient for representative sampling. In larger or more complex facilities, 100+ samples may need to be collected in order to be representative and increase the odds of detection of *Legionella* that may be in the water system.
- See CDC's "Sampling Procedure and Potential Sampling Sites": https://www.cdc.gov/legionella/downloads/cdc-sampling-procedure.pdf.
- If samples will be collected by the health department, central office staff and CDC can offer assistance in determining the number of samples and locations of sample sites.

Collection Recommendations and Procedures:

- Environmental sampling should be a joint effort by the facility (particularly building systems staff/facilities engineers), the facility's *Legionella* consultant, the testing laboratory, and the local health department (epidemiologist and public health environmentalist).
- Environmental sampling should be well planned in advance to ensure that all required staff and supplies are present.
- For sample collection procedures, please refer to CDC's "Sampling Procedure and Potential Sampling Sites" document (https://www.cdc.gov/legionella/downloads/cdc-sampling-procedure.pdf). This document covers:
    - Materials (required and optional)
    - Safety precautions
    - Sampling procedures:
        - Potable water at the points of use
            - Additional note on collection of water from handheld showerheads:
                - Handheld showerheads differ from traditional fixed showerheads because water may stagnate in the tubing increasing the risk for Legionella growth.
                - If the facility has handheld showerheads, collect a sample from the handheld showerhead tubing before collecting the bulk water sample. Collect a swab sample (if feasible) from the tubing and collect a water sample by capturing the water from the tubing.
                - Sampling from handheld showerheads will result in additional samples (2 biofilm swabs [1-flexible tubing, 1-water pipe], 2 bulk water [1-tubing residual, 1-bulk water from pipe]).
        - Potable water at the hot water heaters
        - Whirlpool spas
    - List of potential sampling sites (from potable water, cooling towers, whirlpool spas, and other sources)
- Collection of 1 (one) liter (1 L) of water is preferred.
    - If a liter cannot be collected from a sample source, the **minimum acceptable sample size during an active investigation is 250 ml**.
    - Larger volumes of water (1 to 10 liters) are needed to detect legionellae in water that has very low concentrations of these bacteria such as municipal water supplies.
- In addition to water samples, biofilm swabs should be taken from most sites, when possible.
- The sampling team should also test the water quality (i.e., residual chlorine, temperature and pH) at sampling sites.
- All samples should be transported to the laboratory in insulated coolers as protection against extreme heat or cold.
    - Samples that will not reach the laboratory within 72 hours should be refrigerated before shipping.
    - Samples that reach the laboratory but cannot be processed within 72 hours of collection should be refrigerated.
- Recommended minimum frequency of (environmental) retesting, in an outbreak setting:
    - Once interventions are in place, culture water to detect any legionellae:

        - Every 2 weeks for 3 months; if cultures are negative, then
        - Once per month for the next 3 months
    - If legionellae are detected the 6 month process must be restarted.

Laboratory Testing of Environmental Samples

- Testing of environmental samples should be performed by an ELITE-certified laboratory capable of culturing *Legionella* species. A list of ELITE-certified laboratories is available at https://wwwn.cdc.gov/elite/public/memberlist.aspx
- Inform the testing laboratory that the testing is being performed as part of an outbreak investigation. (Some laboratories have different protocols for collecting and testing specimens for non-outbreak purposes.)
- The traditional ISO spread plate method should be used for testing during outbreak investigations (i.e., during initial detection and throughout remediation and repeat testing cycles).
- *Legionella* isolates from environmental testing related to clusters or outbreaks should be speciated, serotyped and retained for future studies.
    - If isolates cannot be retained by the testing laboratory, they may be forwarded to the state lab once approval is received from the BCL.
- The state lab will accept isolates (for speciation and serogrouping) from environmental sources if there is also an isolate available from a human case associated with the facility for comparison.
- Molecular typing of *Legionella* isolates is available from CDC (contact the BCL to request this testing) and can be helpful to:
    - Confirm that isolates from cases are identical (i.e., case-patients were exposed to the same source)
    - Compare clinical to environmental isolates to narrow down the list of potential environmental sources

ADDITIONAL RESOURCES

Training and Informational Videos

- CDC's *Legionella* Environmental Investigation Videos (https://www.cdc.gov/legionella/videos.html):
    - *Legionella* Ecology and an Introduction to Environmental Health and Engineering
    - Conducting and Interpreting the Environmental Assessment
    - How to Make a Sampling Plan
    - How to Sample Potable Water
    - How to Sample Cooling Towers
    - How to Sample Spas and Fountains
- CDC's "Preventing Legionnaires' Disease: A training on *Legionella* Water Management Programs" available via your LCMS account.
    - Log in and select 'Courses' under the Professional Development section.
    - Select 'Environmental' under Program Area.
    - Navigate to the second training option as titled above and click 'Go To Course'. Read the instructions and proceed to register for the training course.

National Guidance for Environmental and Laboratory Investigation

- Additional resources for environmental sampling and testing are available from CDC's *Legionella* Epidemiologist Investigation Tools website at https://www.cdc.gov/legionella/health-depts/epi-resources/outbreak-investigations.html.
- Occupational Safety and Health Administration (OSHA) Technical Manual (OTM) for Legionnaires' disease: https://www.osha.gov/legionnaires-disease
- Procedures for Identifying Cooling Towers: https://www.cdc.gov/legionella/health-depts/environmental-inv-resources/id-cooling-towers.html

Water System Maintenance

- CDC's Water System Maintenance website: https://www.cdc.gov/legionella/wmp/index.html
- Model Aquatic Health Code (for swimming pools, hot tubs/whirlpool spas, interactive fountains, waterparks): https://www.cdc.gov/mahc/index.html
- American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)- Guidance on Reducing the Risk of *Legionella*: https://www.ashrae.org/technical-resources/standards-and-guidelines/guidance-on-reducing-the-risk-of-legionella
- CDC's FAQ for ASHRAE 188- 2015: http://www.cdc.gov/legionella/health-depts/ashrae-faqs.html
- CDC's toolkit -- Developing a Water Management Program to Reduce *Legionella* Growth and Spread in Buildings: A Practical Guide to Implementing Industry Standards: https://www.cdc.gov/legionella/downloads/toolkit.pdf
- Operating Public Hot Tubs: https://www.cdc.gov/healthywater/pdf/swimming/resources/operating-public-hot-tubs-factsheet.pdf
- Disinfection of Hot Tubs Contaminated with *Legionella*: http://www.cdc.gov/legionella/downloads/hot-tub-disinfection.pdf
- Other public aquatic facilities recommendations: https://www.cdc.gov/healthywater/swimming/aquatics-professionals/operation-maintenance.html

- EPA's -- Technologies for *Legionella* Control in Premise Plumbing Systems: Systematic Review: https://www.epa.gov/ground-water-and-drinking-water/technologies-legionella-control-premise-plumbing-systems
- Controlling *Legionella* in Decorative Fountains: https://www.cdc.gov/legionella/downloads/Control-Toolkit-Decorative.pdf
- CDC Toolkit for Controlling *Legionella* in Common Sources of Exposure https://www.cdc.gov/legionella/downloads/Control-Toolkit-All-Modules.pdf
- Considerations When Working with a *Legionella* Consultant: https://www.cdc.gov/legionella/wmp/consultant-considerations.html

General

- Legionnaires' Disease Fact Sheet: https://www.cdc.gov/legionella/downloads/fs-legionnaires.pdf
- CDC Communications Resources: https://www.cdc.gov/legionella/health-depts/communications- resources.html