A Deeper Dive into Legionella Outbreak Investigation for Local Health Departments

December 1, 2021
10-11:30am

NJ Department of Health-Communicable Disease Service
• Slides will be posted to the NJDOH-CDS Legionellosis (Legionnaires’ Disease and Pontiac Fever) webpage after the webinar.
Disclosure statement

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Presenter Slides

• Slides may be accessed in the “Handouts” while the webinar is “live”
• Slides will be posted to the NJDOH-CDS Legionella webpage after the webinar.
A Deeper Dive into Legionellosis Outbreak Guidance for Local Health Departments

Infection Control, Healthcare, & Environmental Epidemiology

Communicable Disease Service

New Jersey Department of Health

December 1, 2021
Meet the Team

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Agenda

Legionnaires’ Disease Overview
Etiology, Transmission, Risk Factors, Sources

Legionella
Ecology, Growth Promoting Factors

Outbreak Investigations
Definitions, Response, and Recommendations

Risk Communication
Notification Letters, Press Releases, Health Advisories
Disease Associated With *Legionella*

- **Legionellosis**: a bacterial disease caused by *Legionella* bacteria, that can present as either Legionnaires’ disease or Pontiac fever

1. **Legionnaires’ disease**: presents as pneumonia often requiring treatment in a hospital
2. **Pontiac fever**: a milder, self-limited illness

- Although extremely rare, *Legionella* can also cause infections at a body site outside of the lungs, for example, endocarditis or joint infections

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**Legionellosis vs Legionnaires’ disease**

For surveillance, NJDOH uses “legionellosis” to ensure all forms of clinical disease due to *Legionella* are included.

Other times, NJDOH refers to “Legionnaires’ disease” instead of “legionellosis” when describing cases and outbreaks.

- Majority of reported cases are Legionnaires’ disease
- Legionnaires’ disease is associated with higher mortality
Modes of Transmission

- **Most common**
  - Inhalation of aerosolized water containing *Legionella*
  - Devices such as sink faucets, shower heads, cooling towers, decorative fountains, hot tubs, humidifiers, misters, and respiratory equipment can produce aerosols

- **Less common**
  - Aspiration of drinking water

- **Generally, not person-to-person**
Risk Factors for Legionnaires’ Disease

- Most healthy people exposed to Legionella do not become ill
- Who is at increased risk for developing Legionnaires’ disease?
  - Age ≥50 years
  - Smoking (current or former)
  - Chronic lung disease
  - Underlying health conditions
  - Immunocompromised
What are *Legionella*?

- Bacterium discovered following an outbreak at a Legionnaires’ Convention in Philadelphia in 1976
- Over 60 species of *Legionella*
  - *Legionella pneumophila* accounts for ~90% of reported US cases
- Found in freshwater environments
  - Ground water and surface water
- Become a health concern in human-made systems
  - Allows for amplification and aerosolization
**Legionella are Smart!**

- **Use single-celled protozoa as hosts**
  - Provides *Legionella* with food and nutrients for growth and reproduction
  - Serves as a form of protection from adverse environmental factors (i.e., heat and disinfectants)

- **Associated with biofilms**
  - Communities of microorganisms embedded in slime
  - Found on any continually moist substrate
  - Provides shelter from harsh conditions such as heat and disinfectants
  - Extremely difficult to remove
  - Can break off in chunks and seed other areas downstream

*Biofilm in pipe*
Legionella in Building Water Systems

**SOURCE WATER**
- Wells + Aquifers
- Lakes
- Rivers
- Streams

**PUBLIC WATER SUPPLY**
- WQPS and disinfectant residual regulated by state and federal codes
- Chlorine or monochloramine
- Water is not sterile leaving the treatment plant

**BUILDING WATER SYSTEM**
- Building owner responsible for maintaining the water system
- Complex water systems
- Water may be filtered, conditioned, heated, stored, and distributed

**AMPLIFICATION**
- Warm water temperatures
- Water age & stagnation
- Sediment
- Low or no Disinfectant residual

**AEROSOLIZATION**
- Sink faucets
- Showerheads
- Hot tubs & hydrotherapy tubs
- Decorative fountains
- Cooling towers
- Humidifiers
- Medical devices
Legionella in Human-Made Water Systems

**Sediment**
- Provides shelter and nutrients for *Legionella*
- Contributes to disinfectant residual loss
- Areas prone to sediment include expansion tanks, storage tanks, dead legs

**Temperature**
- Can multiply between 68° - 120°F; optimal growth range is between 77° - 113°F
- As temperature increases, the time for *Legionella* to die becomes shorter
- Dormant below 68°F but still able to cause disease

**Water age**
- Promotes biofilm formation and sediment accumulation
- Can lead to water temperatures favorable for *Legionella* growth
- Contributes to disinfectant residual loss

**Disinfectant residual**
- Breaks down under certain conditions such as high temperatures or presence of organic matter
- Inadequate disinfectant residual allows *Legionella* to grow
Remember... *Legionella* are Smart!

*Legionella* can still be present in water even if conditions aren’t optimal for growth since they can be protected by protozoa and biofilm.
Surveillance and Case Investigations

• Single cases of Legionnaires’ disease are reportable within 24 hours of diagnosis to the Local Health Department (LHD)

• Prompt case investigations help to quickly identify epidemiological links between cases and the need for outbreak investigations

• The first step is to determine if a full investigation is needed
  • The setting of the outbreak can impact this decision

• NJDOH assists with outbreak investigations and provides technical expertise

How to Conduct a Legionnaires’ Disease Case Investigation Presentation: https://www.nj.gov/health/cd/topics/legion.shtml
What prompts an outbreak investigation?

Healthcare Facilities (e.g., acute-care, long-term care, psychiatric, outpatient)

• ≥ 1 presumptive healthcare-associated case
• ≥ 2 possible healthcare-associated cases within a 12-month period
• ≥ 3 possible healthcare-associated cases regardless of time frame
• ≥ 1 possible healthcare-associated case following a previously recognized outbreak at the same facility

Non-Healthcare Facilities (e.g., hotel, apartment complex, gym, casino)

• ≥ 2 cases associated with the same possible source within a 12-month period
• ≥ 3 cases associated with the same possible source regardless of time frame
• ≥ 1 case following a previously recognized outbreak at the same facility
What prompts an outbreak investigation?

Community-Associated Outbreaks
- An increase in Legionnaires’ disease cases in a certain geographic area beyond what one would normally expect for that time and place
- NJDOH conducts weekly analyses for unusual clustering of Legionnaires’ disease cases across the state

Special Considerations
- ≥ 1 case at an assisted living facility, correctional facility, group home, or other facility where people generally do not leave the premises is treated with the same considerations as a healthcare-associated outbreak
- If epidemiologic evidence is not strong enough to warrant a full investigation, consider at least conducting an environmental assessment to determine if conditions for Legionella growth exist in the facility
Outbreak Investigation Procedures

• LHD with jurisdiction over the affected facility's municipality is responsible for leading that outbreak investigation, in conjunction with NJDOH

• Responding to urgent public health issues requires balancing timeliness of response with the need for accurate data to support the implementation of control measures
  • Activities are typically not done linearly and sequentially
  • Every investigation is unique and requires careful planning and periodic reassessments
Initial Activities

• Conduct additional case finding
  • Perform a retrospective review of cases

• Work with healthcare partners to facilitate clinical testing for *Legionella*
  • Concurrent collect of lower respiratory specimen for *Legionella* culture and the *Legionella* urinary antigen test is considered the gold standard

• Obtain a detailed exposure history and identify patterns
  • Line lists are useful to summary case demographic, clinical, and exposure information when there are multiple outbreak-associated cases
Initial Activities (continued)

• Notify the facility manager or owner
• Coordinate a call with appropriate stakeholders
  • **Facility**: Management, Facility Engineer, Industrial Hygienist, Administration, Infection Preventionist
  • **LHD**: Health Officer, Disease Investigator, Public Health Nurse, Registered Environmental Health Specialist
  • **NJDOH**: *Legionella* Team
• Provide overview of *Legionella* ecology
• Review building characteristics
• Request a copy of the Water Management Program
• Provide recommendations and guidance
Immediate Control Measures

- Consider immediate control measures if a building’s potable water (i.e., water used for drinking and bathing) is thought to be the source of *Legionella* transmission.

- Control measures should be tailored to the building and circumstances of the outbreak, examples include:
  - Implementing water restrictions (e.g., taking a bath instead of showers)
  - Installing 0.2-micron biological point-of-use filters
  - Providing bottled drinking water for anyone at risk for aspiration
  - Distributing notification letters to appropriate audiences

- If a device such as a hot tub, cooling tower, or decorative fountain is thought to be the source of *Legionella* transmission, ensure that it is turned off, but not drained.
Recommendations

- Hire a consultant who has experience with Legionella and large water systems
- Conduct an onsite environmental assessment with the LHD and NJDOH
- Perform environmental sampling for Legionella
- Perform an emergency chemical shock remediation
- Assess the efficacy of the emergency remediation by conducting post-remediation sampling
- Develop and implement a Water Management Program (WMP)
Recommendations

- Clean showerheads and aerators to remove biofilm and scale
- Ensure hot water tanks are properly maintained and the temperature is set correctly
- Flush both cold and hot water at minimum on a weekly basis (twice a week for healthcare facilities)
- Assess the building for dead legs
- Adhere to manufacturer’s instructions for all respiratory equipment and devices
- Conduct active clinical surveillance for new cases
Environmental Assessment Form

- Enables public health officials to **gain a better understanding** of the facility’s water system:

  - **Facility Characteristics**
  - **Water Supply Source**
  - **Premise Plumbing System**
  - **Water System Devices**

- **Identifies areas that may be hazardous** and promote *Legionella* growth

- Aids in developing a **comprehensive sampling plan**
Facility Characteristics

• Year built
• Size of facility
  • Number of buildings on campus
  • Number of floors and rooms
• Type of facility (e.g., healthcare, hotel, residential)
• Type of population
  • Immunocompromised
  • Older (i.e., ≥50 years)
• History of *Legionella* colonization
Water Age & Stagnation

• **Operational Dead Leg** (infrequent use):
  • Fluctuations in occupancy
  • Infrequent use pattern

• **Non-Operational Dead Leg** (no flow):
  • Renovations
  • Expansion
  • Improvement

• Dead legs should be *removed* or, where unavoidable, be *made as short as possible*

• Routine flushing helps reduce water age and purge build-up of sediment
  • *At least once a week*
  • *At least twice a week for healthcare facilities*
Emergency Water Systems

• **Safety showers and eye wash stations**
  • Associated with increased water age (i.e., operational dead leg)
  • Should be flushed at least weekly

• **Fire sprinkler system**
  • Promotes stagnation due to infrequent use
  • Cross connections can introduce *Legionella* into the potable water system
  • Appropriate backflow prevention is required to separate the potable water system from nonpotable uses
Water Supply Source

• Source of the water
  • Municipal water supply
  • Private well

• Disruptions to incoming water quality:
  • Pressure drops
  • Water main breaks
  • Water line construction

• Monitoring for incoming water
  • Temperature
  • Disinfectant residual
  • pH
Premise Plumbing System

- Heating
- Filtration & Conditioning
- Storage
- Treatment
Recirculation System

- A system that keeps the water continuously moving and returns unused water to be reheated.
- Aids in preventing water stagnation, favorable growth temperatures, decreased disinfectant residual, and sediment build-up.
- Monitoring at points of use
  - Temperature
  - Disinfectant residual
Hot Water Tanks & Expansion Tanks

- **Hot Water Tanks**
  - Install date, tank size, average temperature, maintenance, areas served
  - Sediment accumulation
  - Temperature stratification
  - Perform regular maintenance (e.g., flushing and draining) and store water $\geq 140 \, ^\circ F$

- **Expansion Tanks**
  - Sediment accumulation
  - Water stagnation
  - Designed and located to minimize sediment build-up, heat gain, and stagnant water
    - Flow through design
    - Placed as close as practical to pipe runs
    - Facilitate manual or automatic flushing
Thermostatic Mixing Valves

- Controls the mix of hot and cold water
- Serves as a safety mechanism to prevent scalding due to high water temperatures
- Allows hot water to be stored at a higher temperature (e.g., >140°F)
- Should be installed as close as practical to the point of use (e.g., sinks, showerheads).
- For centralized mixing valves, the blended water temperature should be high enough to maintain a minimum of 120°F, or highest temperature allowable by local regulations and codes.
Filtration & Conditioning

- **Water Softeners**
  - Exchanges mineral ions with sodium ions
  - Reduces the high mineral content (e.g., calcium, magnesium) dissolved in water
  - Does not protect against protozoa, bacteria, and viruses
  - Prevents scale buildup
  - May reduce the disinfectant residual

- **Activated Carbon Filters**
  - Point of entry (POE) and point of use (POU)
  - Useful in removing natural organic matter, volatile organic compounds (VOCs), synthetic compounds (SOCs), and more
  - Can deplete disinfectant residual
  - Filter media can provide nutrients for *Legionella*
Supplemental Disinfection

• Intended to maintain a disinfectant residual throughout the potable water system
  • Water received from a water utility may not contain a consistent, measurable disinfectant residual
  • Water quality, organic matter, water age, pH, plumbing materials, and water temperature may affect the disinfectant residual
• Consult with a water treatment professional
  • Improper use may be ineffective, harmful to occupants, and damaging to equipment
• Contact watersupply@dep.nj.gov to determine current requirements
Water System Devices
Hot Tubs & Whirlpool Spas

- Temperatures within **favorable growth range**
- Build-up of **organic matter**
- Loss of **biocide residual**
- Produces aerosols
- Routine cleaning and maintenance:
  - Monitor and maintain **disinfectant residual and pH levels**
    - N.J.A.C 8:26 Public Recreational Bathing
  - **Scrub surfaces after drainage**
  - **Replace the water based on bather use**
    - (Spa volume in gallons/3)
    - Average # users per day

APPENDIX D. Chemical water quality standards for hot tubs and spas

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<th></th>
<th>Minimum</th>
<th>Ideal</th>
<th>Maximum</th>
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<td>Free chlorine residual (parts per million (ppm))</td>
<td>2.0</td>
<td>3.0-5.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Combined chlorine (ppm)</td>
<td>None</td>
<td>None</td>
<td>0.2</td>
</tr>
<tr>
<td>Bromine (ppm)</td>
<td>2.0</td>
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<tr>
<td>pH</td>
<td>7.2</td>
<td>7.4-7.6</td>
<td>7.8</td>
</tr>
</tbody>
</table>
Decorative Fountains

- Light features and hot climates can increase water temperatures
- Limited hours of operation can facilitate microbial growth
- Subject to contamination
- Produces aerosols
- Routine cleaning and maintenance:
  - Maintain water temperatures outside of the favorable growth range for Legionella
  - Avoid idling periods
  - Monitor and maintain disinfectant residual
  - Immediately clean and disinfect if cloudy water, visible debris, algae, biofilm, or foul odor are present

CDC Controlling Legionella in Decorative Fountains
Cooling Towers

• Serve as an evaporative heat rejection device
• Part of the **centralized air-cooling system** of large buildings or used for **industrial processes**.
• Made up of a **fan**, open **basin of water**, water **pipes leading in and out of the basin**.
• Prone to **scaling, sediment build-up, and favorable temperatures**
• Can spread aerosolized water **many miles**
• **Implicated in many outbreak investigations**
• Needs **regular maintenance** to prevent *Legionella* growth
  • Use automated chemical system
  • Flush dead legs at least weekly
  • Perform an annual off-line cleaning and disinfection **at least annually**
  • Follow manufacturer’s instructions before startup, when idling, and after shutdown
Environmental Sampling

- To identify potential sources of exposure as well as characterize the extent of *Legionella* colonization

- Sampling locations based on available data
  - Central distribution points
  - Hazardous areas (i.e., cooling towers, decorative fountains, dead legs)
  - Areas ill individuals were exposed to aerosolized water
  - Representative number of samples throughout the building

- Sampling procedures
  - First draw sample collection
  - Treat samples with 0.1N solution of sodium thiosulfate
  - Collect 1-liter (1000 mL) bulk water samples
  - Collect biofilm swabs from fixtures in visibly poor condition
  - Perform a culture test at a CDC Elite Member Laboratory
  - Characterized for speciation and serogroup
  - Collect water quality parameters (i.e., temperature, disinfectant residual, pH)
Remediation

• Potable water systems colonized by *Legionella* may need a remedial treatment
  • *When control measures are ineffective*
  • *Routine results indicate poor Legionella control*
  • *Outbreak or illness suspected by the Local or State Health Department*
• Uses chemical disinfectants for a relatively short period frequently at concentrations well above maximum levels permitted for potable water
  • Precautions must be taken to prevent occupants from being exposed to water
• Considered a temporary measure
  • *Recolonization likely to occur if root causes are not addressed*
Post-Remediation Sampling Schedule

1. A licensed professional performs a chemical shock remediation.

2. Sample from positive sample locations until that location has 3 consecutive rounds with non-detectable levels.

3. Collect water samples 3 to 7 days post-remediation and then at 2-week intervals for 3 months.

4. Collect monthly water samples for 3 months once the system has non-detectable results at 2-week intervals for 3 months.
Risk Communication

• Every Legionnaires’ disease outbreak investigation is unique

• Public health officials may need to quickly communicate through multiple channels to different stakeholders throughout the duration of an outbreak investigation
  • May be challenging given the high-profile, fast-moving nature of some outbreaks

• The goal is to provide accurate and timely information about health threats that can people can use to improve their health and the health of their communities
  • Develop messaging strategies and tools in advance of outbreaks to be prepared for the next event

“The right message at the right time from the right person can save lives”

For More Information….
See The CDC Field Epidemiology Manual chapter “Communicating During an Outbreak or Public Health Investigation” for detailed guidance on developing messaging and working with the media
Notification Letters

• Must be **tailored to fit the target audience** (e.g., hotel guests, tenants, patients and families, staff)

• Key public health messages:
  - Provide information on **how those at risk can protect themselves**
  - Provide information about the **suspected source and implemented control measures** (e.g., remediating the hot water system, water restrictions, installation of point-of-use filters)
  - Encourage anyone who has symptoms of Legionnaires’ disease to **see a healthcare provider who can evaluate their symptoms and provide testing and treatment, if indicated**

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**Dear Neighbor,**

[Building Name] has been notified that [if applicable] tenants of the building became sick with Legionnaires’ disease, a type of pneumonia. In response, [Building Name] is working with the [Local Health Department Name] and New Jersey Department of Health to test the water in your building for the bacteria (Legionella) that cause Legionnaires’ disease. We wanted to notify you right away about this testing and we will keep you informed once we have the results.

Legionnaires’ disease is a type of pneumonia caused by bacteria called Legionella. People can get Legionnaires’ disease by breathing in aerosolized (small droplets of water containing Legionella bacteria). Aerated water can come from showers, faucets, hot tubs, humidifiers, and decorative fountains. Legionnaires’ disease is not spread from person to person.

The risk of getting sick from a building’s water system is very low, especially for healthy people. The most important thing you can do is get medical attention right away if you start having symptoms such as fever, chills, muscle aches, and cough. This is even more important if you are aged 50 or older (especially if you smoke cigarettes), have chronic lung disease, have a weakened immune system, or take medicines that weaken your immune system. While Legionnaires’ disease is serious, it can be treated with antibiotics.

If you have one of the health issues above, take these extra steps as a precaution:

- Consider taking a bath instead of a shower, since a shower could create a water mist. Try to minimize your time in the bathroom while the tub is filling.
- If it is fine to brush your teeth, wash your hands, or wash dishes, but fill the sink slowly to avoid creating mist.
- It is fine to drink cold water from the tap but start with cold water when heating water for tea, coffee, or cooking. You cannot get Legionnaires’ disease by drinking water.

We will continue to update you on important information about your building. If you have questions about Legionnaires’ disease, please contact the [Local Health Department point of contact at [phone number]]. Be sure to include your name and contact information. Additional information about Legionnaires’ disease can be found at the Centers for Disease Control and Prevention (CDC) website at: [https://www.cdc.gov/legionnaires/index.html](https://www.cdc.gov/legionnaires/index.html).

Sincerely,

[Building point of contact]
Press Releases

• During community-associated outbreaks, sometimes it is necessary to reach a larger audience (e.g., all people who live in or visited a specific geographic area)
  • On-going risk and no source has been identified
  • Potential sources of Legionella exposure have been identified and could impact the surrounding community (e.g., cooling tower, water utility company)
Health Advisories

- To alert area clinicians about the outbreak and provide information about appropriate diagnostic testing and treatment
- Request that clinicians maintain a high index of suspicion for *Legionella* when evaluating patients for community-acquired and healthcare-associated pneumonia
- **Support clinical testing** for individuals who may be an outbreak-associated case of Legionnaires’ disease

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Call for Enhanced Surveillance and Testing for Legionellosis in Essex County

**Date:** July 29, 2021

**Public Health Message Types:**
- Alert
- Advisory
- Update
- Information

**Intended Audience:**
- All public health partners
- Healthcare providers
- Infection preventionists
- Local health departments
- Schools/child care centers
- ACOs
- Animal health professionals
- Other:

**Key Points or Updates:**
- The New Jersey Department of Health (NJDH) is investigating a suspected cluster of Legionnaires’ disease cases being reported in Essex County, New Jersey.
- Healthcare providers are being asked to have a high index of suspicion for *Legionella* when evaluating patients for community-acquired and healthcare-associated pneumonia, particularly if SARS-CoV-2 testing is negative.
- NJDH is requesting that respiratory specimens are collected and held for patients who test positive for *Legionella* by a urinary antigen test and who reside/work in or visited Essex County.
- All suspected or confirmed cases of legionellosis (Legionnaires’ disease and Pontiac fever) should be promptly reported to the local health department where the patient resides. If the patient residence is unknown, report to your own local health department. Contact information is available at: localhealth.nj.gov.
When is an Outbreak Investigation Over?

- Before considering to conclude an outbreak investigation, an effective Water Management Program must be in place.

Possible considerations include:

- No new cases of Legionnaires’ disease during a period of careful monitoring for new cases.
- No new cases of Legionnaires’ disease following implementation of long-term Legionella control strategies as part of a Water Management Program.
- No detection of *Legionella* during post-remediation environmental monitoring.

Extend enhanced environmental & clinical surveillance upon identification of:

- *Legionella* culture (+) environmental samples.
- New cases of Legionnaires’ disease.
- Suboptimal performance of the Water Management Program.

Did You Know?

NJDOH provides LHD with a template letter to notify the facility manager/owner that the outbreak investigation has been officially concluded.
Standards & Guidelines

- **ASHRAE Guideline 12-2020**: Managing the Risk of Legionellosis Associated with Building Water Systems
- **Cooling Technology Institute (GDL) 159**: Practices to Reduce the Risk of Legionellosis from Evaporative Heat Rejection Equipment Systems
- **VHA Directive 1061**: Prevention of Healthcare-Associated Legionella Disease and Scald Injury from Water Systems
- **Centers for Medicare and Medicaid Services Memo**: Requirement to Reduce Legionella Risk in Healthcare Facility Water Systems to Prevent Cases and Outbreaks of Legionnaires’ Disease
**Additional Environmental Resources**

- **CDC Sampling Procedure and Potential Sampling Sites**
  - Provide guidance on sampling materials, sampling protocols, and what locations to sample.

- **CDC Legionella Water Management Program (WMP) Toolkit**
  - Translate ASHRAE Standard 188-2021 into plain language
  - Step-by-step guide to creating a WMP

- **CDC Toolkit for Controlling Legionella in Common Sources of Exposure**
  - Compliment ASHRAE Guideline 12-2020
  - Evaluate hazardous conditions associated with building water systems and what control measures to implement
Questions and Contact Information

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PreventLD@doh.nj.gov
REMINDER....

• Please look for evaluation link post-webinar in your in-box.
• If you are seeking Public Health credits, you must complete the evaluation.
• Public Health credits will be awarded AFTER the evaluation link closes.
• The evaluation link closes seven (7) days after the webinar (December 8, 2021).
• If you do not receive the link by the end of the day today, please contact Laura Taylor at laura.taylor@doh.nj.gov