

# Legionnaires' disease outbreak associated with the North Carolina Mountain State Fair, 2019

## SUMMARY

### What is the Purpose of this report?

This report provides information on the NC Division of Public Health's (DPH) investigation into a large outbreak of Legionnaires' disease associated with the 2019 NC Mountain State Fair in Fletcher, NC. It describes the rapid and coordinated public health response involving state, local and federal agencies and provides conclusions regarding the source of the outbreak.

### What were the key findings?

- Hot tubs on display were the only significant source of aerosolized water to which people were exposed during the Mountain State Fair.
- People who got sick were more likely than other fair attendees to report entering the building where hot tubs were displayed, walking by hot tubs, and visiting the fair during the second half (September 11–15).

### What do these findings mean?

- This outbreak most likely resulted from exposure to *Legionella* bacteria in aerosolized water from hot tubs on display at the fair.
- *Legionella* bacteria were likely present in one or more of the hot tubs from the beginning of the fair and amplified over the course of the fair leading to more exposures as time went on.
- This investigation could not determine how *Legionella* bacteria were introduced into the hot tubs.
- This outbreak highlights the importance of properly maintaining equipment that aerosolizes water, including hot tubs on display.

### What was done about this?

In response to this outbreak and investigation, DPH and the U.S. Centers for Disease Control and Prevention (CDC) have developed and distributed guidance for vendors and public health practitioners on how to minimize risks from hot tubs and other display equipment that aerosolizes water at temporary events.

## BACKGROUND

Legionnaires' disease is a form of bacterial pneumonia (lung infection). A person may develop Legionnaires' disease when they breathe in mist or accidentally swallow water into their lungs that contains *Legionella* bacteria. In North Carolina, approximately 200 cases of Legionnaires' disease have been reported each year from 2014–2018. The number of reported cases has been on the rise in North Carolina and nationally over the past two decades ([NC Data](#)).

Symptoms typically begin two to 14 days (most often 5-6 days) after exposure and can include cough, shortness of breath, fever, muscle aches and headaches. Legionnaires' disease is a serious illness but can be treated effectively with antibiotics. *Legionella* bacteria can also cause a milder flu-like illness called Pontiac fever, which resolves without treatment.

Most healthy people exposed to *Legionella* bacteria do not get sick. The people at highest risk for Legionnaires' disease include individuals 50 years or older, current or former smokers, and those who have a chronic lung disease or a weakened immune system.

*Legionella* bacteria are commonly found in the natural environment, especially in fresh water and damp soils. These bacteria can become a health concern when they grow and spread in human-made building water systems like hot water tanks, cooling towers of large air conditioning systems, decorative fountains, and hot tubs or spas that aren't properly maintained. Warmer temperatures (especially from 77–107°F) can promote rapid growth of *Legionella* bacteria.

On September 23, 2019, the Buncombe County Department of Health and Human Services and Henderson County Health Department notified the North Carolina Division of Public Health (DPH) of multiple recent cases of Legionnaires' disease within their counties. By the end of the day, 14 confirmed and suspect cases had been identified. Early information gathered by local health departments and a Henderson County clinician indicated that most of these cases reported attending the NC Mountain State Fair, which ran from September 6–15 at the Western North Carolina Agricultural Center (WNC Ag Center) in Fletcher, NC. DPH began an investigation, working closely with the Department of Agriculture and

Consumer Services (NCDA) and local health departments, to determine the source of the outbreak and assure that there were no ongoing sources of exposure.

## **MATERIALS AND METHODS**

### **Public Health Response**

DPH immediately initiated an investigation and coordinated with local health departments, clinicians, hospitals, NCDA and CDC. After establishing through patient interviews that the NC Mountain State Fair appeared to be the only common exposure reported by these cases, public health officials notified the public, provided guidance to clinicians, and encouraged anyone who had attended the fair and felt sick to seek care right away. Coordination with local health departments and other state and local partners was achieved through regular and ad hoc calls and use of an incident command structure. Information and updates regarding the investigation were posted on the NC DPH website, which was updated daily for three weeks and then as needed when new information was obtained. Guidance for temporary fair vendors on reducing risks of *Legionella* exposure from aerosol producing devices was released on September 25 (Appendix 2). DPH released an interim outbreak report on October 10, 2019. Appendix 1 provides a timeline with additional information about the public health response.

### **Case finding**

On September 24 DPH issued a press release, notified local health departments and hospitals of a potential outbreak through the NC Health Alert Network (HAN), and notified other states through Epi X (CDC's Epidemic Information Exchange). Clinician guidance on diagnosis and reporting was issued on September 25 (Appendix 3). Potential cases were interviewed by local health departments and reported to DPH through the North Carolina Electronic Disease Surveillance System (NC EDSS).

The following outbreak case definition was developed on September 24 and used throughout the investigation:

**1. Clinical criteria**

**A. Legionnaire's Disease**

Pneumonia (clinical or radiologically confirmed) in an individual who attended or worked at the 2019 NC Mountain State Fair, with **symptom onset within 2–14 days** after fair attendance

or

**B. Pontiac Fever**

Fever, myalgia, headache, chills, nausea, vomiting or diarrhea **within 3 days** of attending or working at the 2019 NC Mountain State Fair.

**2. Laboratory Criteria**

laboratory confirmed *Legionella*

- By culture: isolation of any Legionella organism from respiratory secretions, lung tissue, pleural fluid, or other normally sterile site  
or
- By detection of Legionella pneumophila serogroup 1 antigen in urine using validated reagents  
or
- By seroconversion: fourfold or greater rise in specific serum antibody titer to L. pneumophila serogroup 1 using validated reagents on specimens collected 3–6 weeks apart

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**Confirmed Case:** Patient meets clinical criteria A or B **AND** laboratory criteria

**Suspect Case:** Patient meets clinical criteria A **WITHOUT** lab confirmed *Legionella*, and no other alternative diagnosis

Note: Only confirmed cases were included in daily case count updates on the website.

## **Environmental Investigation**

Beginning on September 23, DPH worked with local public health staff and NCDA to develop a comprehensive list of aerosolized water sources to which fair attendees may have been exposed and identify and address any sources of on-going exposure to aerosolized water at the WNC Ag Center. DPH, NCDA, and the Buncombe County Department of Health and Human Services conducted a joint site visit to the WNC Ag Center from September 25–27, with technical assistance provided by CDC. Six environmental samples (5 bulk water, 1 swab) were collected from water sources in the Davis Event Center, an exhibit hall located at the WNC Ag Center. Temperature, pH and free chlorine (mg/L) were also measured on the 5 bulk water samples from the Davis Event Center. DPH worked with fair operators and vendors to obtain samples from hot tubs that were on display during the fair and an evaporative cooling fan that was used at the fair, all of which had been removed from the WNC Ag Center and were in storage at other locations. All 27 environmental samples (6 from the Davis Event Center, 16 from hot tubs on display and 5 from the evaporative cooling fan in use at the fair) were submitted to CDC for testing. CDC conducted polymerase chain reaction (PCR), sequence-based typing (SBT) and bacterial cultures.

## **Clinical Laboratory investigation**

DPH recommends urinary antigen testing (UAT) and/or bacterial culture of lower respiratory secretions as the preferred diagnostic tests for Legionnaires' disease (see Appendix 3). Most cases are diagnosed based on UATs. However, bacterial cultures of respiratory secretions (such as sputum) are necessary to compare *Legionella* from one person to another or to *Legionella* from environmental samples. To facilitate these comparisons, DPH provided guidance to hospital laboratories on shipping and handling of sputum samples from patients with Legionnaires' disease (Appendix 4). Sputum specimens were collected from 14 patients with Legionnaires' disease in 5 western NC hospitals and sent to CDC for testing.

## **Case-Control Study**

On September 27, DPH initiated a case-control study to identify the exposure source. From September 28–October 1, DPH attempted to enroll 114 patients with illnesses meeting the suspect or confirmed outbreak case definition (case-patients). Patients who were identified after October 1 were not included in the case-control study. To serve as a comparison group for the case-control study, we selected a group

of people who went to the fair and did not get sick (controls). Controls were identified via a 2-stage process. Initially, a survey was emailed to 2,729 fairgoers who had purchased tickets online as well as vendors and NCDA employees who worked at the fair. Survey recipients were instructed to forward the email to others who had also attended the fair. 7,588 people responded before the first-stage survey was closed on October 1st. A second survey that matched the case survey was sent to 243 potential controls who were matched to case-patients by age. See Appendix 5 for a flow chart of survey responses, and Appendices 6–8 for surveys. The final study included 57 case-patients and 138 controls.

Surveys were conducted online via SurveyMonkey or via phone for individuals who preferred a phone call. Study participants provided information about underlying health conditions that might increase their risk for Legionnaires' disease and about many potential exposures. These included dates of fair attendance, places worked and/or visited at the fair, and exposure to sources of aerosolized water identified by the environmental investigation such as hot tubs, diffusers, evaporative cooling fan, rides, and hoses spraying water for dust reduction.

### **Statistical Analysis**

We used statistical models to compare exposures between cases and controls. We also assessed if the risk of getting sick changed based on the date of fair attendance. We used chi square tests to compare proportions. All data were analyzed using SAS v9.4 (Cary, NC).

## **RESULTS**

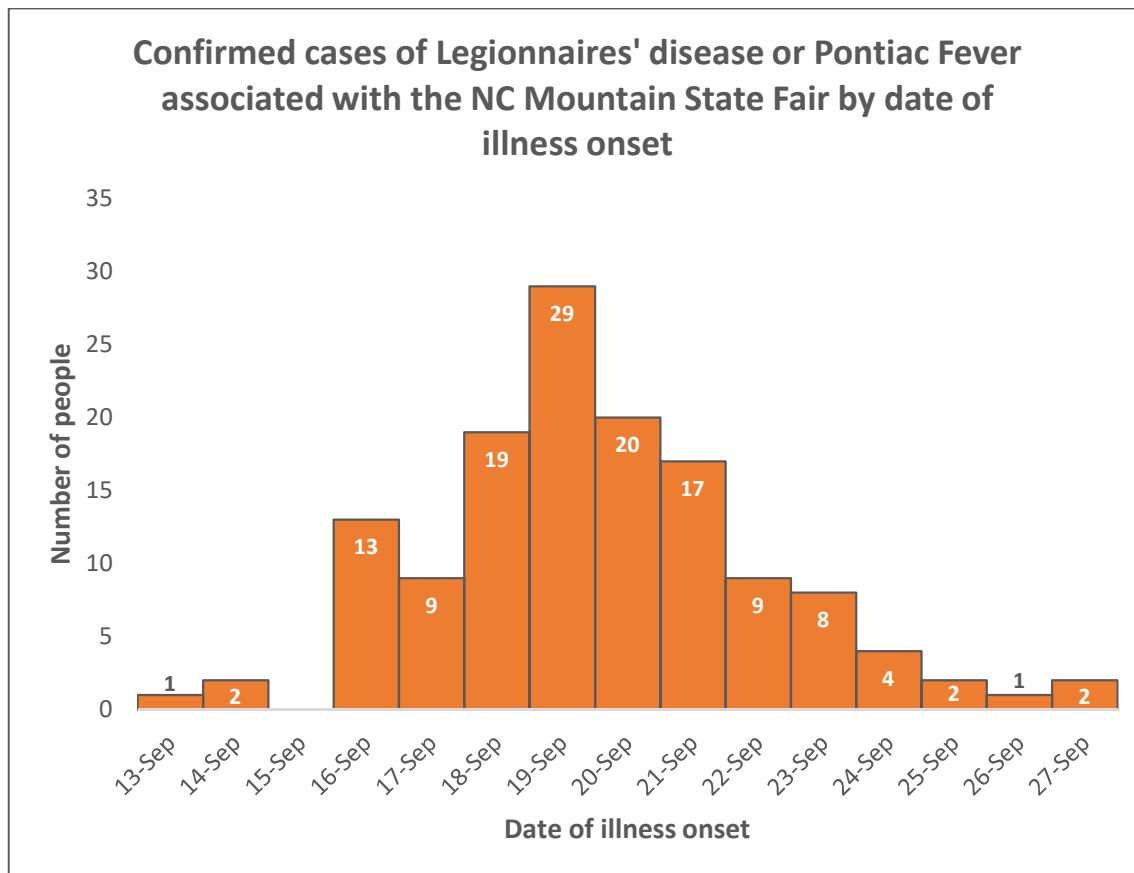
### **Description of Outbreak Associated Legionnaires' disease Patients**

The investigation identified 136 confirmed cases (135 Legionnaires' disease and 1 Pontiac Fever) and 35 suspect cases associated with the MSF outbreak. Confirmed outbreak-associated cases were residents of 17 North Carolina counties and 4 states outside NC. Ninety-six patients (71%) were hospitalized and 4 (3%) died. The median age was 61 years (range 24–91). Seventy-seven (57%) patients were male, 107 (79%) were white, and 103 (75%) were non-Hispanic. Ninety percent of people with confirmed Legionnaires' disease had an underlying condition or risk factor for Legionnaires' disease, including: age

50 years or older, smoking, chronic lung disease, immunosuppressive condition or therapy, kidney disease or liver disease.

Dates of fair attendance or work among confirmed patients ranged from September 5–19, 2019. Many patients (67) visited or worked at the fair on multiple days. In total, the 136 Legionnaires' disease patients had 223 visits to the fair; 69% of these visits were during the latter half of the fair (September 11–15).

Illness onsets ranged from September 13–27 (see Figure 1). The average time from fair visit to illness onset was 6.4 days (range 3–11 days) among 69 Legionnaires' disease patients who only attended the fair one day. The time from fair attendance to illness onset for one person with Pontiac Fever was 3 days. Most people were tested (55%) and reported to public health (87%) after a health alert and press communication were issued by DPH on September 24.



**Figure 1.** Number of confirmed cases of Legionnaires' disease or Pontiac Fever associated with the NC Mountain State Fair. N=136.

## **Environmental Investigation**

The environmental investigation included a review of all potential sources of aerosolized water that were present during the fair. Hot tubs on display in the Davis Event Center were identified as the only significant source of aerosolized water. Four hot tubs were on display in the Davis Event Center during the fair. Three were in use for the duration of the fair and one was displayed on its side. Complete hot tub maintenance records were not available, making it impossible to determine if the chemicals in the hot tubs were adequate to prevent bacterial growth for the duration of the fair.

Other potential sources of aerosolized water present during the fair included diffusers on display in the Davis Event Center, an evaporative cooling fan located outside the Davis Event Center (near the First Aid station), rides, and hoses used to spray the ground. Rides were determined to be low risk because none were confirmed to have aerosolized water. The diffuser display in the Davis Event Center and hoses spraying the ground were also determined to be low risk given the small amount of aerosols generated.

All environmental samples collected during this investigation tested negative for *Legionella*, with the exception of one sample of water from the women's restroom in the Davis Event Center. This one sample tested positive for *Legionella pneumophila* that was identified as sequence types (ST) 7 and ST8. It is important to note that environmental samples were not collected until 12–22 days after the end of the Mountain State Fair and might not represent conditions that were present during the fair.

## **Clinical Laboratory Investigation**

*Legionella pneumophila* was isolated from 10 of 14 clinical specimens (sputum). All ten isolates had a genetic profile consistent with *L. pneumophila* ST224. This means that all the patients from whom we obtained samples had *L. pneumophila* isolates that matched each other genetically but differed from the one positive environmental sample (ST7 and ST8).

## **Case-Control Study**

Out of 114 case-patients contacted, 69 (61%) responded; 57 (50%) had illnesses meeting the confirmed outbreak case definition and were included in the study. Of 243 controls surveyed, 138 (57%) responded and were included in the study. The majority of case-patients and control subjects were North Carolina



residents and were fair visitors (as opposed to workers). Case-patients and controls were similar ages<sup>1</sup> but case-patients were more likely to be male (Table 1). The models we used to compare exposures between case-patients and controls accounted for differences in the age and gender distributions between cases and controls.

**Table 1. Characteristics of case-patients and control in a case-control study to investigate the source of Legionnaires' disease outbreak associated with the NC Mountain State Fair, 2019**

Characteristic	Cases (N=57) N (%)	Controls (N=138) N (%)
<b>Age</b>		
0-39	3 (5)	3 (2)
40-49	11 (19)	26 (19)
50-59	9 (16)	32 (23)
60-69	14 (25)	31 (22)
70+	20 (35)	46 (33)
<b>Sex</b>		
Male	35 (61)	51 (37)
Female	22 (39)	86 (63)
<b>State of Residence</b>		
North Carolina	53 (93)	126 (91)
Outside North Carolina	4 (7)	12 (9)
<b>Type of attendance at MSF<sup>1</sup></b>		
Visitor	47 (82)	107 (78)
Worker	12 (21)	34 (25)

<sup>1</sup>Not mutually exclusive

Case-patients were much more likely than controls to report attending the fair during September 11-15, entering or spending more than one hour in the Davis Event Center, and walking by or spending time near the hot tubs. When the restrooms and café are included as part of the Davis Event Center, 100% of case-patients reported entering the Davis Event Center, in comparison to 72% of controls. Compared to controls, cases were 12 times more likely to report entering the Davis Event Center, and 10 times more likely to report walking by or spending time near the hot tubs. See Table 2.

The likelihood of getting sick increased as the fair went on. Almost all case-patients (98%) attended the fair during September 11-15 compared to 50% of controls. Those who visited the fair from September

<sup>1</sup> 16% of cases and 23% of controls were in the 50-59 year age group, but this difference was not statistically significant ( $p=0.25$ ).

11–15 and reported entering the Davis Event Center were 25 times more likely to get sick, compared to those who visited during the same time period but did not go into the Davis Event Center (OR=25.8; 95% CI: 6.8–98.1). In comparison, during the first half of the fair, entering the Davis Event Center was not associated with increased risk of illness (OR=0.35; 95% CI: 0.03–3.7). Figure 2 shows that people who had their last date of fair attendance during September 13–15 had the highest risk of getting sick, compared to those that attended from September 6–10 or 11–12.

Other exposures that were associated with illness in the case-control study are not considered likely sources for this outbreak. Reporting spending time near the evaporative cooling fan or feeling the water from it was associated with infection in our analysis, but only 6 of 57 case-patients reported this exposure. Likewise, the diffusers were associated with illness in our analysis, but only 5 of 57 people who were sick spent time looking at them. The associations for the cooling fan and the diffusers are likely due to their location inside (diffusers) or immediately outside (fan) the Davis Event Center, making it more likely that people who went in the Davis Event Center also happened to walk by or see these items. Visiting the Expo center, Virginia Boone building, and Heritage exhibits also showed an association with illness. However, the strength of association was less than that of the Davis Event Center, fewer people who got sick went into these areas, and there were no sources of aerosolized water identified in these locations. Legionnaires' disease was not associated with any rides<sup>1</sup> or exposure to hoses used to spray the ground. Other risk factors that were associated with Legionnaires' disease in the case-control study included use of immunosuppressants, a nebulizer or supplemental oxygen; diabetes; and cancer. Smoking was not associated with increased risk of illness. See Table 3.

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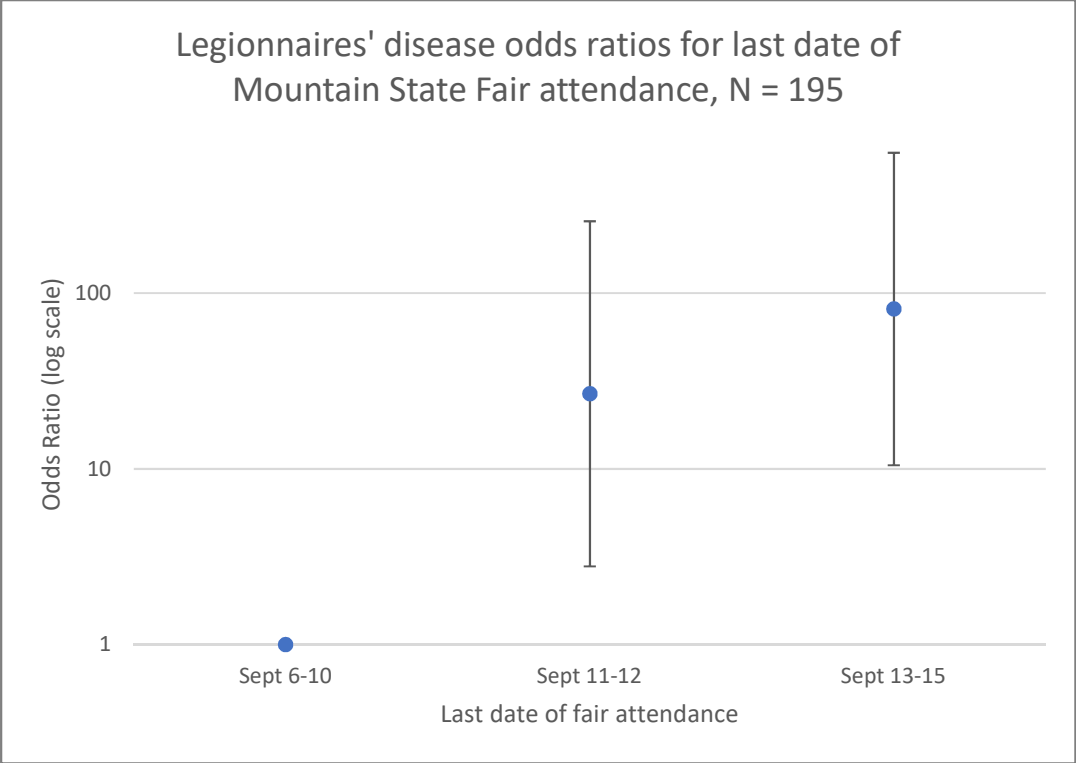
<sup>1</sup>Ten rides were investigated as exposures: Himalaya, Cyclops, X-Factory, Clown house, Wave Swinger, Black Forest, Carousel, Ferris Wheel, Pirate show and the chairlift.

**Table 2. Multivariable analysis of exposures for Legionnaires' disease among NC Mountain State Fair attendees, 2019**

<b>Exposure</b>	<b>Cases N=57</b>	<b>Controls N=138</b>	<b>Missing</b>	<b>Adjusted OR<sup>1</sup> (95% CL)</b>
<b>Date of Fair attendance</b>				
Attendance from the 11 <sup>th</sup> – 15 <sup>th</sup>	56	68	0	66.4 (8.7, 505.6)
<b>Davis Event Center</b>				
Any Davis Event Center visit (including restroom or café)	57	99		NA <sup>2</sup>
Reported entering the Davis Event Center	54	91	0	12.0 (3.2, 44.3)
Davis Restrooms	40	74	2	2.5 (1.2, 5.0)
Went into or sat down in café	14	17	2	2.7 (1.2, 6.4)
<b>Time spent in the Davis Event Center</b>				
None	3	47	13	Ref
1 hour or less	26	58	13	8.7 (2.3, 33.6)
More than 1 hour	25	23	13	21.7 (5.4, 87.5)
<b>Hot tubs</b>				
Hot Tub – walked by or spent time	47	56	3	10.1 (4.2, 24.2)
Walked By	47	56	4	10.0 (4.2, 24.1)
Spent time	14	13	3	4.2 (1.7, 10.4)
<b>Areas of Fair</b>				
Expo Center	40	73	0	2.4 (1.2, 4.7)
Virginia Boone Building	38	62	0	2.8 (1.4, 5.5)
Animal Barns	29	82	0	0.7 (0.4, 1.4)
Animal Exhibits	21	50	0	1.0 (0.5, 2.0)
Heritage Exhibit	27	44	0	2.6 (1.3, 5.3)
Midway	37	109	0	0.5 (0.2, 1.1)
First Aid Station	4	5	0	1.8 (0.4, 7.4)
<b>First aid station evaporative cooling fan</b>				
Saw fan	15	14	6	3.2 (1.4, 7.5)
Spent time or felt water	6	3	6	7.0 (1.6, 31.0)
<b>Other fans blowing mist</b>				
Walked by fans blowing mist	9	13	6	1.9 (0.8, 5.0)
<b>Diffuser display</b>				
Saw diffusers	17	9	4	7.4 (2.9, 19.1)
Spent time looking at diffusers	5	2	4	7.9 (1.3, 46.9)

<sup>1</sup>Adjusted for age group and gender.

<sup>2</sup>Odds ratios for the “any Davis Event Center” variable, indicating entering the building or using the restrooms or café, cannot be calculated because 100% of cases reported doing this.



**Figure 2.** Odds ratios for Legionnaires’ disease comparing last date of fair attendance to a referent category (September 6-10<sup>th</sup>). Results are from multivariable logistic regression models, adjusted for age group and gender. N = 195

**Table 3. Multivariable analysis of risk factors for Legionnaires’ disease among NC Mountain State Fair attendees, 2019**

Risk Factors	Cases N=57	Controls N=138	Missing	Adjusted OR <sup>1</sup> (95% CL)
<b>Smoking</b>				
Current smoker	3	7	3	1.7 (0.4, 7.4)
Former smoker	13	35	3	0.8 (0.3, 1.7)
<b>Medical Treatment</b>				
No treatment	30	120	10	0.2 (0.1, 0.4)
Nebulizer	4	2	10	6.3 (1.1, 37.1)
CPAP	8	11	10	1.6 (0.6, 4.4)
Supplemental Oxygen	9	3	10	9.2 (2.3, 36.9)
Immunosuppressants	5	3	10	7.7 (1.6, 36.4)
<b>Predisposing Conditions</b>				
No Predisposing Conditions	32	101	3	0.4 (0.2, 0.8)
Diabetes	11	14	3	2.4 (1.0, 5.9)
Cancer	12	16	3	2.5 (1.0, 6.1)
Liver Disease	2	0	3	Undefined
Kidney Disease	3	3	3	1.8 (0.3, 10.1)
Chronic Lung Disease	3	6	3	1.5 (0.3, 6.7)

<sup>1</sup>Adjusted for age group and gender.

## Discussion

Our results indicate that this outbreak most likely resulted from exposure to *Legionella* bacteria in aerosolized water from hot tubs on display in the Davis Event Center at the fair. *Legionella* bacteria were likely present in one or more of the hot tubs from the beginning of the fair and amplified over the course of the fair leading to more exposures as time went on. Hot tubs are a well-established source of aerosolized water exposure and have been associated with previous Pontiac Fever<sup>1-4</sup> and Legionnaires' disease<sup>5-7</sup> outbreaks, both nationally and internationally.

Although environmental sampling and laboratory testing did not isolate *Legionella* from hot tubs, these samples were not collected until two to three weeks after the fair ended — after the hot tubs had been cleaned and dried — and did not represent conditions in existence during the fair. The lack of consistency between the clinical samples and the single positive environmental sample from the Davis Event Center does not allow us to draw a conclusion as to how *Legionella* bacteria came to be present in the hot tubs. It is possible that *Legionella* were present in the water from the Davis Event Center that was used to fill the hot tubs, and conditions were ideal for the growth of ST224. It is also possible that *Legionella* were already present in the hot tubs or related equipment (e.g. filters or hoses) prior to being filled at the Davis Event Center, and then amplified once conditions were favorable to support their growth.

It is likely that aerosolized water containing *Legionella* bacteria may have been dispersed throughout the Davis Event Center via regular air flow within the building. As the bacteria amplified during the fair, potential dispersion throughout the building may have exposed anyone who went into the Davis Event Center, including the hallway, restrooms or café. As shown by the case-control study, individuals did not necessarily need to go near the hot tubs to become sick, but 100% of cases from the study did report going into the Davis Event Center, the restrooms, or the café. It is important to note that the Davis Event Center does not have a cooling tower but used a high efficiency ventilation system that recirculates air.

Legionnaires' disease generally has a fatality rate of almost 10%.<sup>8</sup> This outbreak only had a 4% fatality rate. Although the reasons for this are not known, increased awareness among the public and clinicians following public notification of the outbreak may have resulted in patients receiving testing, diagnosis and

treatment earlier than they might have otherwise, or to identification of less severe infections, thus contributing to a lower mortality rate.

### **Conclusion and Mitigation Strategies**

A rapid, coordinated public health investigation determined that this large outbreak of Legionnaires' disease was likely caused by exposure to *Legionella* bacteria in aerosolized water from hot tubs on display at the Mountain State Fair. Although this investigation did not determine how *Legionella* were introduced into the hot tubs, our findings suggest that a lack of proper hot tub maintenance allowed for amplification of the bacteria over the course of the fair. This outbreak highlights the importance of properly maintaining equipment that aerosolizes water, including hot tubs on display. On September 25 DPH released new guidance for temporary event vendors on hot tubs and whirlpools and other misting equipment (Appendix 2). On November 15, CDC released a health advisory (based in part on the findings of this investigation) with guidance for environmental and public health practitioners on minimizing risks for hot tub displays at temporary events, such as fairs (Appendix 9).

This investigation was conducted in collaboration with multiple local and state health departments, the North Carolina Department of Agriculture and Consumer Services, and with technical assistance from the Centers for Disease Control and Prevention. A special thanks to the Buncombe and Henderson County Health Departments for their early detection and response efforts.

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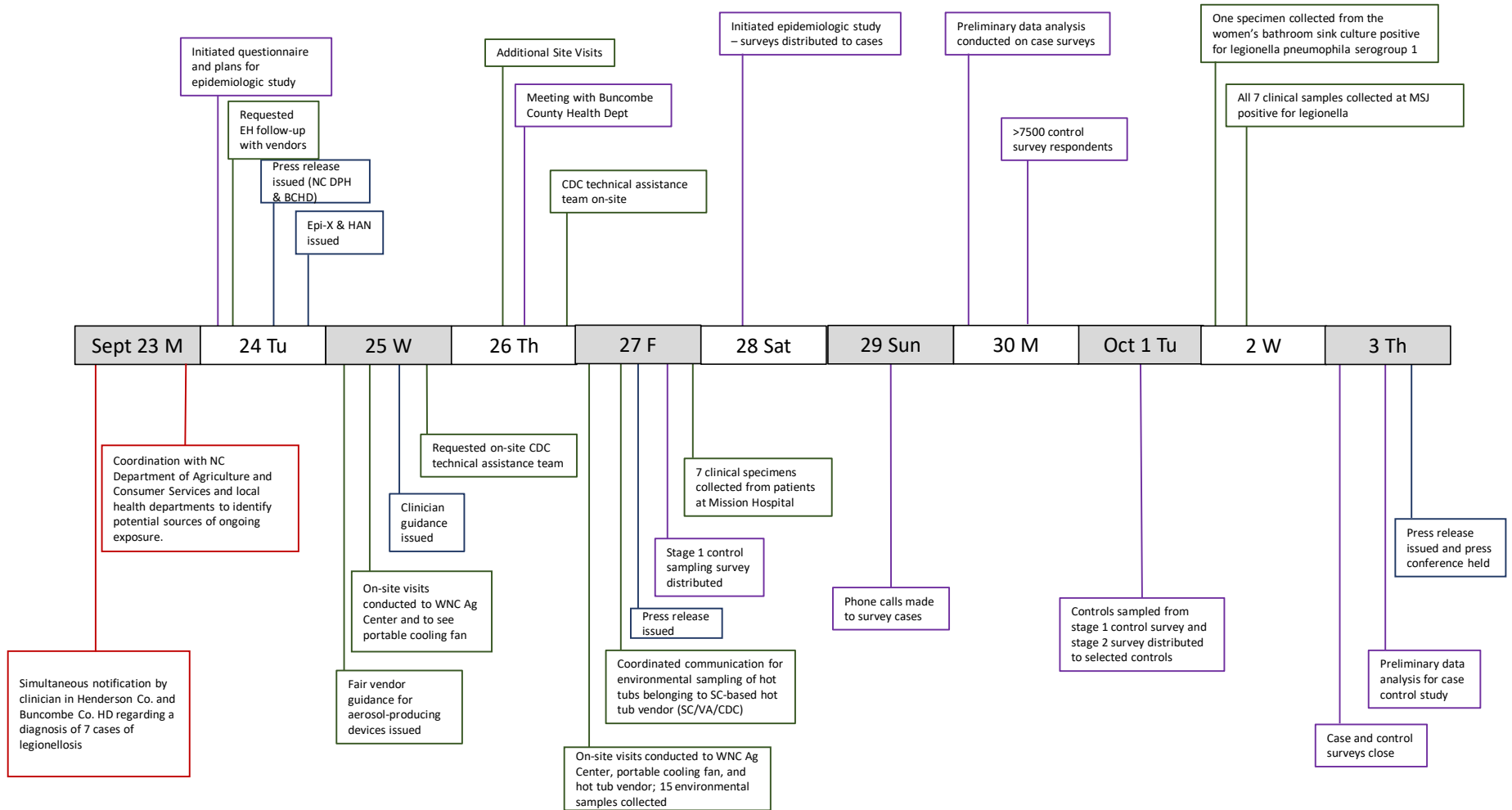
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# Appendix 1: Timeline of public health outbreak investigation





## Legionellosis Risk Mitigation for Temporary Event Vendors

Certain activities at outdoor temporary events may pose a risk for Legionnaire's disease, a potentially serious respiratory illness caused by inhaling tiny water droplets contaminated with *Legionella* bacteria. As a vendor, there are precautions that can be taken to help reduce the risk of exposure to *Legionella* bacteria. Please contact the local health department for questions regarding Legionnaire's disease and *Legionella* exposure risk.

### Hot Tub and Whirlpool Vendors

To minimize the risk of exposure to *Legionella*, please follow these recommendations when setting up whirlpool or hot tub displays containing water at temporary events, **even if the hot tub or whirlpool is for display only**. Full cleaning protocol is included in the CDC reference below.

1. Fill and hyperchlorinate using 20 ppm free chlorine. Keep the hydrotherapy jets off and let the hyperchlorinated water circulate for one hour in all components of the hot tub including the compensation/surge tank, filter housing, and piping. Turn on the hydrotherapy jets to circulate the hyperchlorinated water for nine additional hours. Maintain 20 ppm of free chlorine in the system for the entire 10 hours.
2. Flush the system before refilling with water and maintain at least two ppm free chlorine during display. Maintain records of free chlorine and pH of water as well as disinfection and cleaning records.
3. Between vendor events, drain the hot tub or whirlpool, removing as much stagnant water in the system as possible. Filters should be removed and left to dry and cleaned before reuse. The hot tub or whirlpool should be kept as dry as possible between events.

### Outdoor Misters and other Spray Cooling Equipment

Cooling equipment such as misters or other spray devices are used at events when outdoor temperatures are high. Follow these recommendations to keep this equipment clean and minimize the risk of exposure to *Legionella*.

1. Water sprayed in a mister should be drinking water quality.
2. Never allow the water in the sprayer system to be stagnant for more than six hours.
3. Water reservoirs should be drained at least once every 24 hours.
4. Cleaning of misting systems should include soaking all aerators and sprayers in a chlorinated solution for 10 minutes. Chlorine disinfectant can be made by mixing 1/3 cup of household bleach with one gallon of water (1,000 ppm chlorine). Hoses should also be flushed, dismantled and kept clean.
5. Misters and cooling equipment should be stored dry and cleaned as described above before reuse.

### Display Fountains, Small Water Features or Other Display Products with Water Spray

1. It is recommended that display fountains, small water features or other spray reservoirs be drained and cleaned weekly and disinfected with 3-5 ppm free chlorine (or equivalent) for one hour each day. Free chlorine concentration should be verified with pool and spa water test strips.
2. Between displays, or when water features have been inactive for more than three days, thoroughly scrub and disinfect water features or display fountains with 3-5 ppm free chlorine. Ensure fountains are stored completely dry.
3. If water becomes cloudy, the display fountain or water feature should be drained, scrubbed and disinfected.
4. Maintain cleaning and disinfection records for any display fountain or small water feature.

Sources:

<https://www.cdc.gov/legionella/downloads/hot-tub-disinfection.pdf>

<https://www.specialpathogenslab.com/perch/resources/2014finallegionellaguidelinesforwesternpa.pdf>

<https://www.condair.com/m/0/water-misting-system-for-adiabatic-outdoor-cooling-in-hot-and-dry-areas-general.pdf>



## Appendix 3



### NC DEPARTMENT OF HEALTH AND HUMAN SERVICES

**ROY COOPER** • Governor  
**MANDY COHEN, MD, MPH** • Secretary  
**MARK T. BENTON** • Assistant Secretary for Public Health  
Division of Public Health

September 25, 2019

To: North Carolina Clinicians  
From: Zack Moore, MD, MPH, State Epidemiologist

#### **Subject: Increase in Legionnaires' disease cases in western North Carolina**

This memo provides clinicians with information regarding the increase in reported Legionnaires' disease cases in western North Carolina and recommendations for diagnosis and reporting.

#### **Background:**

State and local health agencies are investigating cases of Legionnaires' disease in individuals who attended the NC Mountain State Fair held in Fletcher, NC, Sept. 6–15, 2019. Public health officials are currently investigating whether and how people might have been exposed to *Legionella* bacteria at this event.

#### **Recommendations:**

Clinicians should consider Legionellosis in patients who attended the NC Mountain State Fair and present with symptoms consistent with Legionnaires' disease **within 2-10 days** or Pontiac fever **within 1-3 days of their last visit to the NC Mountain State Fair**.

- **Legionnaires' disease** is pneumonia caused by *Legionella* bacteria and is very similar to other types of pneumonia, with symptoms that include cough, shortness of breath, fever, muscle aches or headaches. Patients at highest risk include those aged  $\geq 50$  years, current or former smokers, and those with chronic lung disease (such as emphysema or COPD) or a weakened immune system.
- **Pontiac fever** is a milder, self-resolving infection caused by the same bacteria. Primary symptoms include fever and muscle aches.

#### **Diagnosis:**

- **The preferred diagnostic tests for Legionnaires' disease are the Legionella urinary antigen test and culture of lower respiratory secretions (e.g., sputum, bronchoalveolar lavage) on selective media.** Sputum should ideally be obtained prior to antibiotic administration, but antibiotic treatment should not be delayed to facilitate this process. The urinary antigen test can detect *Legionella* infections in some cases for days to weeks after treatment.
- Testing is not recommended for individuals who attended the fair but do not have symptoms of Legionnaires' disease or Pontiac fever.
- Serological assays can be nonspecific and are not typically recommended.

#### **Reporting:**

Physicians are required to report all suspected Legionnaires' disease cases to public health. Cases can be reported to the NC Communicable Disease Branch at 919-733-3419 or your local health department (<https://www.ncdhhs.gov/divisions/public-health/county-health-departments>).

Additional information about Legionnaires' disease is available at <https://www.cdc.gov/legionella/index.html> or <https://epi.dph.ncdhhs.gov/cd/diseases/legionellosis.html>.

#### **NC DEPARTMENT OF HEALTH AND HUMAN SERVICES • DIVISION OF PUBLIC HEALTH**

LOCATION: 225 North McDowell St., Raleigh, NC 27603  
MAILING ADDRESS: 1902 Mail Service Center, Raleigh, NC 27699-1902  
www.ncdhhs.gov • TEL: 919-733-7301 • FAX: 919-733-1020

AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

## Appendix 4



### NC DEPARTMENT OF **HEALTH AND HUMAN SERVICES**

**ROY COOPER** • Governor  
**MANDY COHEN, MD, MPH** • Secretary  
**MARK T. BENTON** • Assistant Secretary for Public Health  
Division of Public Health

September 27, 2019

To: North Carolina Hospital Laboratories  
From: Zack Moore, MD, MPH, State Epidemiologist  
Scott Shone, PhD, HCLD(ABB), Director, NC State Laboratory of Public Health

#### **Subject: Increase in Legionnaires' Disease cases in western North Carolina**

This memo provides laboratories with information regarding the increase in reported Legionnaires' disease cases in western North Carolina and requests for specimen submission to the State Laboratory of Public Health.

#### *Background:*

State and local health agencies are investigating cases of Legionnaires' disease in individuals who attended the NC Mountain State Fair held in Fletcher, NC, Sept. 6–15, 2019. Public health officials are currently investigating whether and how people might have been exposed to *Legionella* bacteria at this event.

#### *Request for clinical specimens:*

**We are asking that laboratories submit available clinical respiratory specimens obtained between Sept. 7–30, 2019 from patients with confirmed or suspected Legionnaires' disease who attended the Mountain State Fair.**

If there are patients with confirmed or suspected Legionnaires' disease who are still hospitalized and attended the Mountain State Fair and do not have respiratory specimens available, we request that clinicians consider ordering a lower respiratory or sputum culture for *Legionella* (regardless of antibiotic exposure) and the laboratory forward the specimen to the State Laboratory of Public Health.

#### *Specimen submission instructions:*

##### Clinical Specimens and Isolates

Please complete all fields on the attached form ([DHHS-4121](#)). Ensure two of the identifiers match the labels on the primary specimen container.

##### Specimen Handling

All clinical specimens and isolates must be shipped using at least two cold packs within an insulated shipping container. *Legionella* isolates must be shipped on Buffered Charcoal Yeast Extract (BCYE) or equivalent slants.

##### Specimen Shipping

Ship completed form and specimens or isolates overnight Monday through Thursday in accordance with DOT/IATA requirements to:

North Carolina State Laboratory of Public Health  
Attn: Special Bacteriology Laboratory  
4312 District Drive  
Raleigh, NC 27607

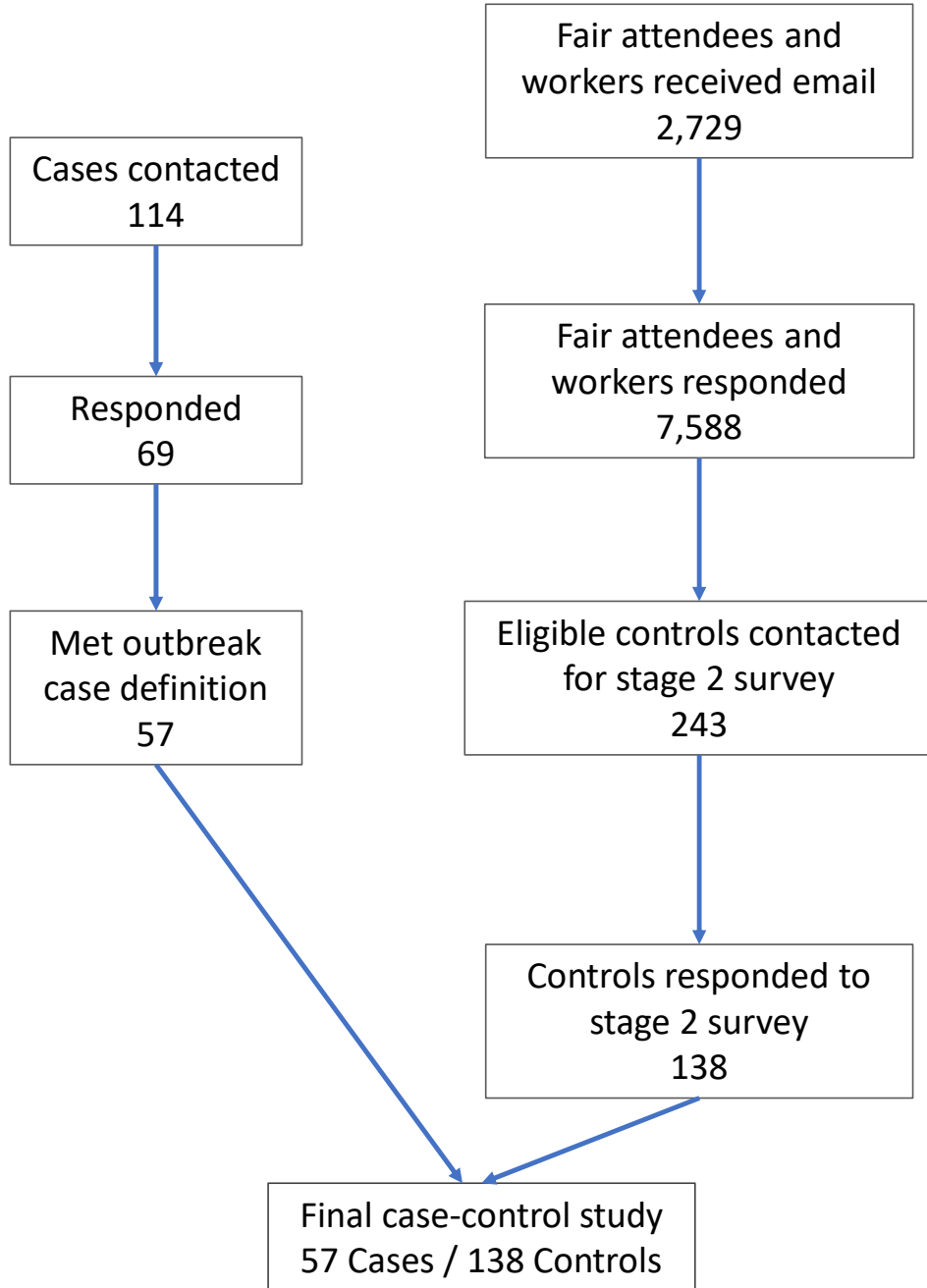
For shipping labels or specimen handling questions, please contact Tom Lawson (919-807-8803) or Joanne Touchberry (919-807-8793) at the North Carolina State Laboratory of Public Health.

#### **NC DEPARTMENT OF HEALTH AND HUMAN SERVICES • DIVISION OF PUBLIC HEALTH**

LOCATION: 225 North McDowell St., Raleigh, NC 27603  
MAILING ADDRESS: 1902 Mail Service Center, Raleigh, NC 27699-1902  
www.ncdhhs.gov • TEL: 919-733-7301 • FAX: 919-733-1020

AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

**Flow chart of case and control data collection for the NC Mountain State Fair Legionnaires' Disease Investigation, 2019**



## Legionnaires' Disease Outbreak Survey

**Thank you for completing this survey. Your response will help us learn more about the Legionnaires' disease outbreak in Western North Carolina and prevent outbreaks like this in the future. Your answers will be kept confidential and the information will be used for public health purposes only. This survey should take about 10-15 minutes to complete.**

**State and local health officials are investigating multiple cases of Legionnaires' disease reported in individuals who attended the NC Mountain State Fair in Fletcher, NC, Sept. 6–15, 2019. We would like to know more about what you did at the fair in order to understand what caused this outbreak.**

**Legionnaires' disease is a form of bacterial pneumonia (lung infection). Symptoms typically begin two to 10 days after exposure and can include cough, shortness of breath, fever, muscle aches and headaches. Legionnaires' disease is a serious illness but can be treated effectively with antibiotics.**

**A person may develop Legionnaires' disease when they breathe in mist or accidentally swallow water into the lungs that contains Legionella bacteria. This survey focuses on possible sources of aerosols (mists or vapors) and does not include all activities or events at the fair.**

\* 1. What is your name?

2. What is your date of birth? (mm/dd/yyyy)

\* 3. How old are you?

- 0-9
- 10-19
- 20-29
- 30-39
- 40-49
- 50-59
- 60-69
- 70-79
- 80-89
- 90 and above

4. What is your gender?

Male


Female

Other

5. What state do you live in?

6. What county do you live in?

7. What is your email address?



To begin, we are going to ask you some questions about your experiences at the NC Mountain State Fair.

\* 8. Did you attend the fair as a visitor, volunteer, or employee/vendor? Check all that apply.

- Visitor
- Volunteer
- Employee/Vendor



\* 9. On what dates did you work at the Mountain State Fair?

- Friday September 6th, 2019
- Saturday September 7th, 2019
- Sunday September 8th, 2019
- Monday September 9th, 2019
- Tuesday September 10th, 2019
- Wednesday September 11th, 2019
- Thursday September 12th, 2019
- Friday September 13th, 2019
- Saturday September 14th, 2019
- Sunday September 15th, 2019

\* 10. Were you at the fairgrounds on days before the fair started or after the fair ended, for example to help with setup?

- Yes
- No

11. What time(s) of day were you working at the fair on Friday September 6th?

- Morning
- Afternoon
- Evening

12. What time(s) of day were you working at the fair on Saturday September 7th?

- Morning
- Afternoon
- Evening

13. What time(s) of day were you working at the fair on Sunday September 8th?

- Morning
- Afternoon
- Evening

14. What time(s) of day were you working at the fair on Monday September 9th?

- Morning
- Afternoon
- Evening

15. What time(s) of day were you working at the fair on Tuesday September 10th?

- Morning
- Afternoon
- Evening

16. What time(s) of day were you working at the fair on Wednesday September 11th?

- Morning
- Afternoon
- Evening

17. What time(s) of day were you working at the fair on Thursday September 12th?

- Morning
- Afternoon
- Evening

18. What time(s) of day were you working at the fair on Friday September 13th?

- Morning
- Afternoon
- Evening

19. What time(s) of day were you working at the fair on Saturday September 14th?

- Morning
- Afternoon
- Evening

20. What time(s) of day were you working at the fair on Sunday September 15th?

- Morning
- Afternoon
- Evening

**\* 21. On what date(s) were you at the fair before it started or after it ended?**

Monday September 2, 2019

Tuesday September 3, 2019

Wednesday September 4, 2019

Thursday September 5, 2019

Monday September 16, 2019

Tuesday September 17, 2019

Wednesday September 18, 2019

Other (please specify)

22. Who were you working for/volunteering with at the fair?

- Fair operator/Department of Agriculture
- Vendor
- EM/Police/EMS
- Other (please specify)

23. What was your job title or volunteer responsibilities at the fair?

24. Where was your job located?

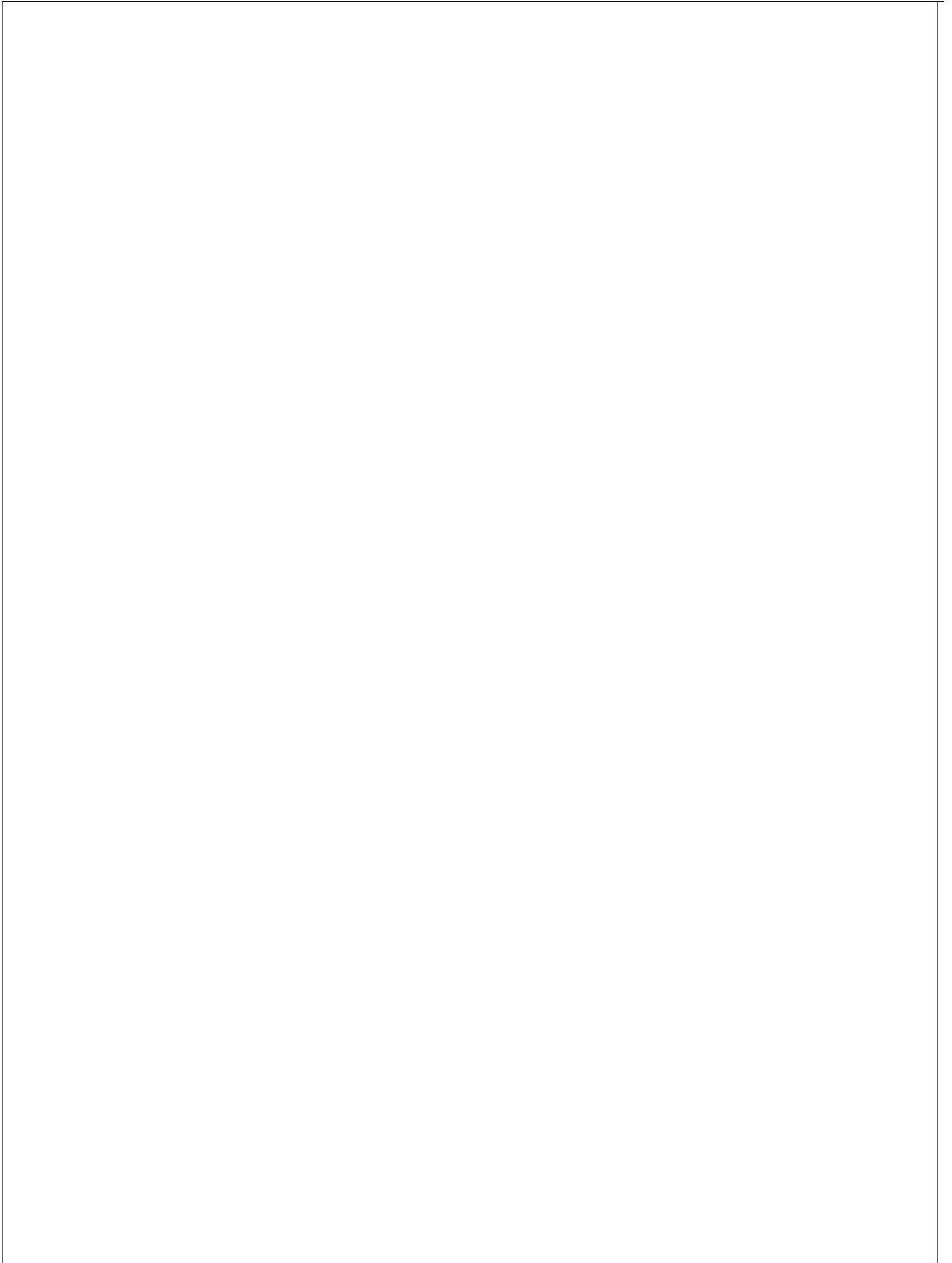
- Davis Event Center (large building at the center of the fairgrounds with cafe and vendor exhibits)
- Expo Center (building farthest from the parking lots with quilt exhibits)
- Virginia Boone Building (smaller brown building with craft exhibits near the midway)
- Animal barns/stalls (permanent buildings closest to the airport and toward the back of the fairgrounds)
- Animal exhibit areas (white tents near the ticket booths)
- Heritage exhibit area (between the Virginia Boone Building and Davis Event Center, had traditional crafts such as molasses making)
- Midway (carnival games and rides)
- First aid station
- Other (please specify)

25. Were you ever present at the fair before it opened in the morning and/or after it closed for the night?

- Before it opened
- After it closed
- None of the above

26. Did your job/volunteer work involve working with or using water in any way?

- Yes
- No



27. Please explain how you used water in your job/volunteer work.

\* 28. On what dates did you visit the Mountain State Fair?

- Friday September 6th, 2019
- Saturday September 7th, 2019
- Sunday September 8th, 2019
- Monday September 9th, 2019
- Tuesday September 10th, 2019
- Wednesday September 11th, 2019
- Thursday September 12th, 2019
- Friday September 13th, 2019
- Saturday September 14th, 2019
- Sunday September 15th, 2019



29. What time(s) of day did you visit the fair on Friday September 6, 2019?

- Morning
- Afternoon
- Evening

30. What time(s) of day did you visit the fair on Saturday September 7, 2019?

- Morning
- Afternoon
- Evening

31. What time(s) of day did you visit the fair on Sunday September 8, 2019?

- Morning
- Afternoon
- Evening

32. What time(s) of day did you visit the fair on Monday September 9, 2019?

- Afternoon
- Evening

33. What time(s) of day did you visit the fair on Tuesday September 10, 2019?

- Afternoon
- Evening

34. What time(s) of day did you visit the fair on Wednesday September 11, 2019?

- Afternoon
- Evening

35. What time(s) of day did you visit the fair on Thursday September 12, 2019?

- Afternoon
- Evening

36. What time(s) of day did you visit the fair on Friday September 13, 2019?

Morning

Afternoon

Evening

37. What time(s) of day did you visit the fair on Saturday September 14, 2019?

Morning

Afternoon

Evening

38. What time(s) of day did you visit the fair on Sunday September 15, 2019?

Morning

Afternoon

Evening

39. Which areas of the fair did you visit?

- Davis Event Center (large building at the center of the fairgrounds with cafe, vendor exhibits, and restrooms)
- Expo Center (building farthest from the parking lots with quilt exhibits)
- Virginia Boone Building (smaller brown building with craft exhibits near the midway)
- Animal barns/stalls (permanent buildings closest to the airport and towards the back of the fairgrounds)
- Animal exhibit areas (white tents near the ticket booths)
- Heritage exhibit area (between the Virginia Boone Building and Davis Event Center, had traditional crafts such as molasses making)
- Midway (carnival games and rides)
- First aid station
- Other (please specify)


40. Approximately how much total time did you spend in the Davis Event Center (large building at the center of the fairgrounds with a cafe, vendor exhibits, and restrooms) throughout all your visits to the fair? Include time spent in the cafe or restrooms. (Please specify minutes or hours.)

41. On what dates did you enter the Davis Event Center, including the cafe and restrooms?

- Friday September 6th, 2019
- Saturday September 7th, 2019
- Sunday September 8th, 2019
- Monday September 9th, 2019
- Tuesday September 10th, 2019
- Wednesday September 11th, 2019
- Thursday September 12th, 2019
- Friday September 13th, 2019
- Saturday September 14th, 2019
- Sunday September 15th, 2019

42. Did you enter the Davis Event Center on any of the dates you were at the fair before it started or after it ended?

- Monday September 2, 2019
- Tuesday September 3, 2019
- Wednesday September 4, 2019
- Thursday September 5, 2019
- Monday September 16, 2019
- Tuesday September 17, 2019
- Wednesday September 18, 2019
- Other (please specify)



43. Did you walk by the hot tub display in the Davis Event Center?


Yes

No

44. Did you spend time around the hot tubs (more than just walking by)?

Yes

No




45. What did you do when you were near the hot tubs? (Check all that apply.)

- Looked at the hot tubs
- Leaned over the hot tubs
- Talked to the hot tub vendors
- Purchased a hot tub
- None of the above

46. Did you see the Rainbow diffuser display in the Davis Event Center? The diffusers were round glass bowls with water in them and a black plastic top.

Yes

No



47. Did you spend time looking at the diffusers?

Yes


No



48. Did you see the café at the Davis Event Center? The café was called "Davis Café - Choo Choo BBQ" and served food and drinks.

Yes

No



49. Did you go into the café?


Yes

No

50. Did you sit down in the café?

Yes


No



51. Did you use the restrooms at the Davis Event Center?

Yes


No



52. Did you see the cooling fan by the first aid station?

Yes

No



53. Did you spend time in front of the cooling fan by the first aid station?


Yes

No

54. Could you feel water or mist coming from the cooling fan by the first aid station?

Yes


No



55. Did you see fair employees using hoses to spray the ground to reduce dust?

Yes

No



56. Were you close enough that you could feel the spray from the hoses?

Yes

No

57. Where in the fairgrounds were the employees spraying?

58. Did you ride any of the following rides? Check all that apply.

- Himalaya (sleigh cars go in circles up and down hills)
- Cyclops (claw-shaped ride that swings up into the air)
- X-Factory (superhero-themed ride where you are swung in circles)
- Clown House (house of mirrors)
- Wave Swinger (swings that lift into the air and spin in a circle)
- Black Forest (German-themed fun house)
- Carousel
- Ferris wheel
- Chair lift
- None of the above

59. Did you watch the pirate show?

- Yes
- No

60. Did you walk past any fans that were blowing mist?

- Yes
- No



61. In what area(s) of the fair did you see fans blowing mist?


- In an animal area
- On a ride
- At a food booth
- At an exhibit
- Other (please specify)

62. Please describe where you saw the fans blowing mist.

\* 63. Did a doctor diagnose you with pneumonia since your visit(s) to the fair?

Yes

No



\* 64. On what date did you start feeling sick?

Date / Time


\* 65. Have you experienced any of the following symptoms since your visit(s) to the fair?

- Fever
- Muscle aches and pains
- Headache
- Chills
- Vomiting
- Diarrhea
- None of the above

\* 66. On what date did your symptoms begin?

Date / Time

MM/DD/YYYY




Now we are going to ask you some questions about other things you did in the 14 days before you got sick.

67. During the 14 days before you got sick, did you spend time at a hospital, doctor's office, dentist, or long-term care facility?

Yes

No



68. What was your reason for the visit(s)?

Inpatient


Outpatient

Visitor

Employee

Resident of long-term care facility

69. Please list the name, city, and state of the facilities.



70. During the 14 days before you got sick, did you spend any nights away from home, such as at a hotel or on a cruise?

Yes

No



71. Please list the name, city, and state of any places you stayed overnight. Include your room number or floor if possible.

72. What day did you check in?

Date / Time

73. What day did you check out?

Date / Time

74. Have you ever, or do you currently, smoke or vape?

- Yes, currently
- Yes, in the past
- No

75. Has a doctor ever diagnosed you with any of the following conditions?

- Diabetes
- Cancer
- Liver disease
- Kidney disease
- Chronic lung disease
- Any immunosuppressive condition (ex. HIV)
- None of the above

76. Are you currently receiving any of the following treatments?

- Medications that suppress your immune system, such as chemotherapy or systemic steroids
- Nebulizer treatments
- CPAP/BiPAP
- Supplemental oxygen
- Other respiratory therapy
- None of the above

77. During the 14 days before you got sick, were you exposed to any of the following **outside of the fair?**

Misters near a swimming pool or wading pool

Hot tub

Fountain

Cooling tower

Humidifier

Dental water lines

Gardening

Landscaping

None of the above

78. Is there anything else you think we should know about this event?

Thank you!

**Thank you for completing this survey! The information you provided will help us understand this outbreak and learn how to prevent Legionnaires' Disease outbreaks in the future. If you have concerns about your health, please contact your doctor. If you have any questions about this survey or investigation, you can contact the Epidemiologist on Call at 919-733-3419. More information about Legionnaires' disease can be found at the following sites:**

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

**<https://epi.dph.ncdhhs.gov/cd/diseases/legionellosis.html>**

**Thank you for participating in this survey. Your response will help us learn more about the Legionnaires' Disease outbreak in Western North Carolina and prevent outbreaks like this in the future. Your answers will be kept confidential and the information will be used for public health purposes only. The survey should take less than five minutes to complete.**

**Legionnaires' disease is a form of bacterial pneumonia (lung infection). Symptoms typically begin two to 10 days after exposure and can include cough, shortness of breath, fever, muscle aches and headaches. Legionnaires' disease is a serious illness but can be treated effectively with antibiotics. A person may develop Legionnaires' disease when they breathe in mist or accidentally swallow water into the lungs that contains Legionella bacteria.**

**To learn more about Legionnaires' disease, please follow the links at the end of the survey.**

1. Did you attend the Mountain State Fair in Fletcher, NC between 9/6/19 and 9/15/19?

Yes

No

2. On what date(s) did you attend the Mountain State Fair?

- Friday September 6, 2019
- Saturday September 7, 2019
- Sunday September 8, 2019
- Monday September 9, 2019
- Tuesday September 10, 2019
- Wednesday September 11, 2019
- Thursday September 12, 2019
- Friday September 13, 2019
- Saturday September 14, 2019
- Sunday September 15, 2019


3. Were you at the fairgrounds before the fair started or after the fair ended, for example to help with setup?

- Yes
- No

4. On what date(s) were you at the fairgrounds before the fair started or after it ended?


- Monday September 2, 2019
- Tuesday September 3, 2019
- Wednesday September 4, 2019
- Thursday September 5, 2019
- Monday September 16, 2019
- Tuesday September 17, 2019
- Wednesday September 18, 2019
- Other (please specify)





5. How old are you?

- 0-9
- 10-19
- 20-29
- 30-39
- 40-49
- 50-59
- 60-69
- 70-79
- 80-89
- 90 and above



6. Did a doctor diagnose you with pneumonia since your visit(s) to the fair?

Yes

No

7. On what date did you start to feel sick?

Date / Time



8. Since your visit(s) to the fair, did you experience any of the following symptoms?

- Fever
- Muscle aches and pains
- Headache
- Chills
- Vomiting
- Diarrhea
- None of the above

9. On what date did your symptoms begin?

Date / Time

10. Based on your responses, we may like to ask you a few additional questions. Can we contact you for further information?

Yes

No

11. What is your name?

12. What is your email address?

13. What is your phone number?

14. What is your preferred method for us to contact you?

Email


Phone call

Thank you for completing this survey! If you know anyone else who attended the Mountain State Fair, please forward the email with the link to this survey to them.

Please note: Most people who are exposed to legionella don't get sick. If you feel healthy, you do not need to worry about having been exposed to legionella. If you are concerned about your health, please contact your doctor. If you have any questions about this investigation or survey, you may contact the Epidemiologist on Call at 919-733-3419. For more information about Legionnaires' disease, please visit the following websites:

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

<https://epi.dph.ncdhhs.gov/cd/diseases/legionellosis.html>



Thank you for completing this survey! If you know anyone who did attend the Mountain State Fair, please forward the email with a link to this survey to them.

Please note: Most people who are exposed to legionella don't get sick. If you feel healthy, you do not need to worry about having been exposed to legionella. If you are concerned about your health, please contact your doctor. If you have any questions about this investigation or survey, you may contact the Epidemiologist on Call at 919-733-3419. For more information about Legionnaires' disease, please visit the following websites:

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

<https://epi.dph.ncdhhs.gov/cd/diseases/legionellosis.html>

## Legionnaires' Disease Outbreak Survey

**Thank you for completing this survey. Your response will help us learn more about the Legionnaires' disease outbreak in Western North Carolina and prevent outbreaks like this in the future. Your answers will be kept confidential and the information will be used for public health purposes only. This survey should take about 10-15 minutes to complete.**

**State and local health officials are investigating multiple cases of Legionnaires' disease reported in individuals who attended the NC Mountain State Fair in Fletcher, NC, Sept. 6–15, 2019. We would like to know more about what you did at the fair in order to understand what caused this outbreak.**

**Legionnaires' disease is a form of bacterial pneumonia (lung infection). Symptoms typically begin two to 10 days after exposure and can include cough, shortness of breath, fever, muscle aches and headaches. Legionnaires' disease is a serious illness but can be treated effectively with antibiotics.**

**A person may develop Legionnaires' disease when they breathe in mist or accidentally swallow water into the lungs that contains Legionella bacteria. This survey focuses on possible sources of aerosols (mists or vapors) and does not include all activities or events at the fair.**

\* 1. What is your name?

2. What is your date of birth? (mm/dd/yyyy)

\* 3. How old are you?

- 0-9
- 10-19
- 20-29
- 30-39
- 40-49
- 50-59
- 60-69
- 70-79
- 80-89
- 90 and above



4. What is your gender?

Male


Female

Other

5. What state do you live in?

6. What county do you live in?

7. What is your email address?



To begin, we are going to ask you some questions about your experiences at the NC Mountain State Fair.

\* 8. Did you attend the fair as a visitor, volunteer, or employee/vendor? Check all that apply.

Visitor

Volunteer

Employee/Vendor

\* 9. On what dates did you work at the Mountain State Fair?

- Friday September 6th, 2019
- Saturday September 7th, 2019
- Sunday September 8th, 2019
- Monday September 9th, 2019
- Tuesday September 10th, 2019
- Wednesday September 11th, 2019
- Thursday September 12th, 2019
- Friday September 13th, 2019
- Saturday September 14th, 2019
- Sunday September 15th, 2019

\* 10. Were you at the fairgrounds on days before the fair started or after the fair ended, for example to help with setup?

- Yes
- No

11. What time(s) of day were you working at the fair on Friday September 6th?

- Morning
- Afternoon
- Evening

12. What time(s) of day were you working at the fair on Saturday September 7th?

- Morning
- Afternoon
- Evening

13. What time(s) of day were you working at the fair on Sunday September 8th?

- Morning
- Afternoon
- Evening

14. What time(s) of day were you working at the fair on Monday September 9th?

- Morning
- Afternoon
- Evening

15. What time(s) of day were you working at the fair on Tuesday September 10th?

- Morning
- Afternoon
- Evening

16. What time(s) of day were you working at the fair on Wednesday September 11th?

- Morning
- Afternoon
- Evening

17. What time(s) of day were you working at the fair on Thursday September 12th?

- Morning
- Afternoon
- Evening

18. What time(s) of day were you working at the fair on Friday September 13th?

- Morning
- Afternoon
- Evening

19. What time(s) of day were you working at the fair on Saturday September 14th?

- Morning
- Afternoon
- Evening

20. What time(s) of day were you working at the fair on Sunday September 15th?

- Morning
- Afternoon
- Evening

**\* 21. On what date(s) were you at the fair before it started or after it ended?**

Monday September 2, 2019

Tuesday September 3, 2019

Wednesday September 4, 2019

Thursday September 5, 2019

Monday September 16, 2019

Tuesday September 17, 2019

Wednesday September 18, 2019

Other (please specify)

22. Who were you working for/volunteering with at the fair?

- Fair operator/Department of Agriculture
- Vendor
- EM/Police/EMS
- Other (please specify)

23. What was your job title or volunteer responsibilities at the fair?

24. Where was your job located?

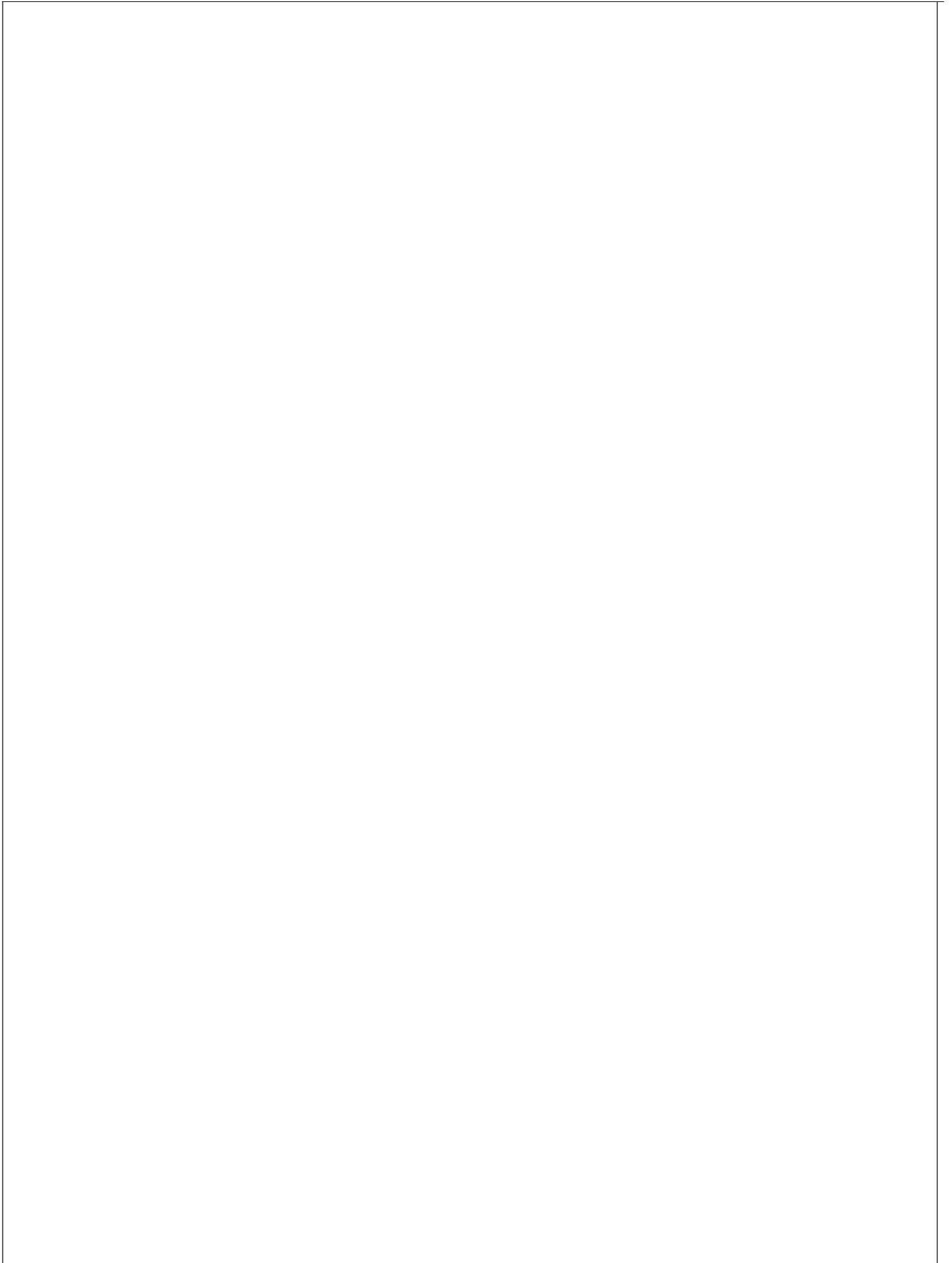
- Davis Event Center (large building at the center of the fairgrounds with cafe and vendor exhibits)
- Expo Center (building farthest from the parking lots with quilt exhibits)
- Virginia Boone Building (smaller brown building with craft exhibits near the midway)
- Animal barns/stalls (permanent buildings closest to the airport and toward the back of the fairgrounds)
- Animal exhibit areas (white tents near the ticket booths)
- Heritage exhibit area (between the Virginia Boone Building and Davis Event Center, had traditional crafts such as molasses making)
- Midway (carnival games and rides)
- First aid station
- Other (please specify)

25. Were you ever present at the fair before it opened in the morning and/or after it closed for the night?

- Before it opened
- After it closed
- None of the above

26. Did your job/volunteer work involve working with or using water in any way?

- Yes
- No





27. Please explain how you used water in your job/volunteer work.

\* 28. On what dates did you visit the Mountain State Fair?

- Friday September 6th, 2019
- Saturday September 7th, 2019
- Sunday September 8th, 2019
- Monday September 9th, 2019
- Tuesday September 10th, 2019
- Wednesday September 11th, 2019
- Thursday September 12th, 2019
- Friday September 13th, 2019
- Saturday September 14th, 2019
- Sunday September 15th, 2019

29. What time(s) of day did you visit the fair on Friday September 6, 2019?

- Morning
- Afternoon
- Evening

30. What time(s) of day did you visit the fair on Saturday September 7, 2019?

- Morning
- Afternoon
- Evening

31. What time(s) of day did you visit the fair on Sunday September 8, 2019?

- Morning
- Afternoon
- Evening

32. What time(s) of day did you visit the fair on Monday September 9, 2019?

- Afternoon
- Evening

33. What time(s) of day did you visit the fair on Tuesday September 10, 2019?

- Afternoon
- Evening

34. What time(s) of day did you visit the fair on Wednesday September 11, 2019?

- Afternoon
- Evening

35. What time(s) of day did you visit the fair on Thursday September 12, 2019?

- Afternoon
- Evening

36. What time(s) of day did you visit the fair on Friday September 13, 2019?

Morning

Afternoon

Evening

37. What time(s) of day did you visit the fair on Saturday September 14, 2019?

Morning

Afternoon

Evening

38. What time(s) of day did you visit the fair on Sunday September 15, 2019?

Morning

Afternoon

Evening

39. Which areas of the fair did you visit?

- Davis Event Center (large building at the center of the fairgrounds with cafe, vendor exhibits, and restrooms)
- Expo Center (building farthest from the parking lots with quilt exhibits)
- Virginia Boone Building (smaller brown building with craft exhibits near the midway)
- Animal barns/stalls (permanent buildings closest to the airport and towards the back of the fairgrounds)
- Animal exhibit areas (white tents near the ticket booths)
- Heritage exhibit area (between the Virginia Boone Building and Davis Event Center, had traditional crafts such as molasses making)
- Midway (carnival games and rides)
- First aid station
- Other (please specify)


40. Approximately how much total time did you spend in the Davis Event Center (large building at the center of the fairgrounds with a cafe, vendor exhibits, and restrooms) throughout all your visits to the fair? Include time spent in the cafe or restrooms. (Please specify minutes or hours.)

41. On what dates did you enter the Davis Event Center, including the cafe and restrooms?

- Friday September 6th, 2019
- Saturday September 7th, 2019
- Sunday September 8th, 2019
- Monday September 9th, 2019
- Tuesday September 10th, 2019
- Wednesday September 11th, 2019
- Thursday September 12th, 2019
- Friday September 13th, 2019
- Saturday September 14th, 2019
- Sunday September 15th, 2019

42. Did you enter the Davis Event Center on any of the dates you were at the fair before it started or after it ended?

- Monday September 2, 2019
- Tuesday September 3, 2019
- Wednesday September 4, 2019
- Thursday September 5, 2019
- Monday September 16, 2019
- Tuesday September 17, 2019
- Wednesday September 18, 2019
- Other (please specify)



43. Did you walk by the hot tub display in the Davis Event Center?

Yes

No

44. Did you spend time around the hot tubs (more than just walking by)?


Yes

No

45. What did you do when you were near the hot tubs? (Check all that apply.)

- Looked at the hot tubs
- Leaned over the hot tubs
- Talked to the hot tub vendors
- Purchased a hot tub
- None of the above






46. Did you see the Rainbow diffuser display in the Davis Event Center? The diffusers were round glass bowls with water in them and a black plastic top.

Yes

No



47. Did you spend time looking at the diffusers?


Yes

No

48. Did you see the café at the Davis Event Center? The café was called "Davis Café - Choo Choo BBQ" and served food and drinks.

Yes

No



49. Did you go into the café?


Yes

No

50. Did you sit down in the café?

Yes


No



51. Did you use the restrooms at the Davis Event Center?

Yes


No



52. Did you see the cooling fan by the first aid station?

Yes

No



53. Did you spend time in front of the cooling fan by the first aid station?


Yes

No

54. Could you feel water or mist coming from the cooling fan by the first aid station?

Yes

No




55. Did you see fair employees using hoses to spray the ground to reduce dust?

Yes

No





56. Were you close enough that you could feel the spray from the hoses?

Yes

No

57. Where in the fairgrounds were the employees spraying?

58. Did you ride any of the following rides? Check all that apply.

- Himalaya (sleigh cars go in circles up and down hills)
- Cyclops (claw-shaped ride that swings up into the air)
- X-Factory (superhero-themed ride where you are swung in circles)
- Clown House (house of mirrors)
- Wave Swinger (swings that lift into the air and spin in a circle)
- Black Forest (German-themed fun house)
- Carousel
- Ferris wheel
- Chair lift
- None of the above

59. Did you watch the pirate show?

- Yes
- No

60. Did you walk past any fans that were blowing mist?

- Yes
- No

61. In what area(s) of the fair did you see fans blowing mist?

- In an animal area
- On a ride
- At a food booth
- At an exhibit
- Other (please specify)

62. Please describe where you saw the fans blowing mist.

Almost done! To finish, we'd like to ask you a few questions about your health history.

63. Have you ever, or do you currently, smoke or vape?

- Yes, currently
- Yes, in the past
- No

64. Has a doctor ever diagnosed you with any of the following conditions?

- Diabetes
- Cancer
- Liver disease
- Kidney disease
- Chronic lung disease
- Any immunosuppressive condition (ex. HIV)
- None of the above

65. Are you currently receiving any of the following treatments?

- Medications that suppress your immune system, such as chemotherapy or systemic steroids
- Nebulizer treatments
- CPAP/BiPAP
- Supplemental oxygen
- Other respiratory therapy
- None of the above

66. Is there anything else you think we should know about this event?

Thank you!

**Thank you for completing this survey! The information you provided will help us understand this outbreak and learn how to prevent Legionnaires' Disease outbreaks in the future. If you have concerns about your health, please contact your doctor. If you have any questions about this survey or investigation, you can contact the Epidemiologist on Call at 919-733-3419. More information about Legionnaires' disease can be found at the following sites:**

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

**<https://epi.dph.ncdhhs.gov/cd/diseases/legionellosis.html>**

**This is an official**  
**CDC HEALTH ADVISORY**

Distributed via the CDC Health Alert Network  
November 15, 2019, 1430 ET (2:30 PM ET)  
CDCHAN-00422

**Hot Tub Displays and *Legionella* Risk—Guidance for Environmental  
and Public Health Practitioners**

**Summary**

Hot tub displays at temporary events may pose a risk for Legionnaires' disease, a type of pneumonia caused by inhaling mist containing *Legionella* bacteria. The Centers for Disease Control and Prevention (CDC) is alerting environmental and public health practitioners about the public health need to maintain, clean and disinfect hot tubs properly to reduce potential exposure to *Legionella*. This Health Advisory provides guidance for environmental and public health practitioners to minimize risk for *Legionella* exposure from hot tub displays at temporary events (e.g., fairs, home and garden shows, conventions). Environmental health practitioners should work with event planners and hot tub vendors to minimize the risk of *Legionella* exposure even if the hot tub is only for display.

**Background**

*Legionella* grows best in warm water (77°F-108°F), like the water temperatures used in hot tubs. Warm temperatures also make it hard to keep disinfectants, such as chlorine, at the levels needed to kill bacteria like *Legionella*. Disinfectant and other chemical levels in hot tubs should be checked regularly. Hot tubs should be cleaned as the manufacturer recommends.

A hot tub that is not adequately maintained can expose people to *Legionella* bacteria even if they do not get in it. This makes display hot tubs at temporary events a risk for Legionnaires' disease if they contain *Legionella* bacteria. People with symptoms of *Legionella* exposure who have recent exposure to a hot tub filled with water should be encouraged to seek medical care.

Exposure to *Legionella* via aerosol or aspiration of water containing *Legionella* can lead to Legionnaires' disease or Pontiac fever. Legionnaires' disease is a severe type of pneumonia. Signs and symptoms can include cough, shortness of breath, muscle aches, headache, and fever.[1] Most people get sick within 10 days of exposure, though the incubation period can be as long as 14 days. Pontiac fever symptoms are primarily fever and muscle aches; it is a milder illness than Legionnaires' disease, and pneumonia is absent. Symptoms begin between a few hours to three days after being exposed to the bacteria and usually last less than a week. Diagnostic and treatment information for clinicians can be found at:

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

Hot tubs have been associated with large outbreaks of Legionnaires' disease.[2,3] The North Carolina Department of Health and Human Services investigated an outbreak of Legionnaires' disease associated with a state fair in September 2019. As of November 13, 2019, 139 confirmed cases (134 Legionnaires' disease and 5 Pontiac fever) have been identified, resulting in 96 hospitalizations and 4 deaths.[4] Interim conclusions from the investigation suggest that exposure to *Legionella* bacteria occurred in an events center building where vendors were displaying hot tubs.[5] Their findings highlight the importance of proper operation and maintenance of devices that aerosolize water.

**Recommendations for Environmental and Public Health Practitioners**

1. Contact organizers of temporary events where hot tubs may be on display and operating in a public setting. Provide information about Legionnaires' disease and proper hot tub maintenance.
2. When investigating a suspected case of Legionnaires' disease associated with hot tubs—

- a. Immediately turn off the hot tub and prevent its use to minimize exposure through aerosolization of water.
- b. If requested by outbreak lead investigator, collect water and swab samples for *Legionella* testing.
- c. Disinfect the hot tub using CDC's recommended best practices.[6]
- d. Close the display and remove it from public access.

### Recommendations for Hot Tub Owners and Operators

1. Event planners and hot tub vendors should know about the risk that hot tubs pose when not maintained adequately, even if the hot tub is for display only. At vendor events where a hot tub is on display, the equipment vendor, display manager, or operator should—
  - a. Obtain operator and chemical handling training, if required by state or local authorities. National training courses are listed at CDC's Pool/Spa Inspector Training website (<https://www.cdc.gov/healthywater/swimming/public-health-professionals/pool-spa-inspector-training.html>).
  - b. Ensure trained vendor staff are available at the display during operational hours.
  - c. Maintain free chlorine (2–4 parts per million or ppm) or bromine (4–6 ppm) levels continuously.
  - d. Maintain the pH level of the water at 7.2–7.8.
  - e. Test pH and disinfectant levels at least twice per day.
  - f. Maintain accurate records of disinfectant and pH measurements and maintenance activities.
2. At the end of each event, hot tub vendors should (in accordance with manufacturer recommendations, where applicable)—
  - a. Clean the hot tub.
  - b. Apply a biocidal shock treatment.
  - c. Drain it, removing as much water from the system as possible.
  - d. Remove filters.
  - e. Leave filters to dry.
  - f. Clean filters before reuse.
  - g. Replace filters when recommended by the manufacturer.
  - h. Protect the hot tub from external water sources (e.g., condensation drip, rain, humidity, moisture).
  - i. Keep the hot tub as dry as possible between events.

### For More Information

Centers for Disease Control and Prevention (CDC). About Legionnaires' Disease. <https://www.cdc.gov/legionella/about/index.html>

CDC *Vital Signs*. Legionnaires' Disease: Use water management programs in buildings to prevent outbreaks. [www.cdc.gov/vitalsigns/legionnaires/index.html](http://www.cdc.gov/vitalsigns/legionnaires/index.html)

Developing a Water Management Program to Reduce *Legionella* Growth & Spread in Buildings: A Practical Guide to Implementing Industry Standards. <https://www.cdc.gov/legionella/downloads/toolkit.pdf>

Legionnaires' Disease Fact Sheet. <https://www.cdc.gov/legionella/downloads/fs-legionnaires.pdf>

Facts about *Legionella* and Hot Tubs/Spas.

<https://www.cdc.gov/healthywater/pdf/swimming/resources/legionella-factsheet.pdf>

Operating Public Hot Tubs. <https://www.cdc.gov/healthywater/pdf/swimming/resources/operating-public-hot-tubs-factsheet.pdf>

Disinfection of Hot Tubs that Contain *Legionella*. [www.cdc.gov/legionella/downloads/hot-tub-disinfection.pdf](http://www.cdc.gov/legionella/downloads/hot-tub-disinfection.pdf)

Model Aquatic Health Code (MAHC) Tools and Information. <https://www.cdc.gov/mahc/editions/current.html>



Decoding the MAHC. [www.cdc.gov/mahc/infographic-decoding-lg.html](http://www.cdc.gov/mahc/infographic-decoding-lg.html)

Reducing Legionnaires' Disease in Public Spas. <https://www.cdc.gov/nceh/ehs/docs/reducing-legionnaires-in-spas-508.pdf>

Model Aquatic Health Code Aquatic Facility Inspection Report. [www.cdc.gov/mahc/pdf/mahc-aquatic-facility-inspection-report.pdf](http://www.cdc.gov/mahc/pdf/mahc-aquatic-facility-inspection-report.pdf)

## References

1. Centers for Disease Control and Prevention. *Legionella*: Signs and symptoms. <https://www.cdc.gov/legionella/about/signs-symptoms.html> [accessed 1 Nov 2019].
2. Den Boer, et al. A large outbreak of Legionnaires' disease at a flower show, the Netherlands, 1999. *Emerg Infect Dis* 2002;8(1). <https://www.ncbi.nlm.nih.gov/pubmed/11749746/>
3. Coetzee, et al. An outbreak of Legionnaires' disease associated with a display spa pool in retail premises, Stoke-on-Trent, United Kingdom, July 2012. *Euro Surveill* 2012;17(37). <https://www.ncbi.nlm.nih.gov/pubmed/22995431>
4. North Carolina Department of Health and Human Services. Investigation of an outbreak of Legionellosis in Western North Carolina. <https://epi.dph.ncdhhs.gov/cd/legionellosis/outbreak.html>
5. North Carolina Department of Health and Human Services. Interim Report: Outbreak of Legionnaires' disease associated with the NC Mountain State Fair, September–October 2019. [https://epi.dph.ncdhhs.gov/cd/legionellosis/InterimReportLegionnairesDiseaseOutbreak\\_101819rev.pdf](https://epi.dph.ncdhhs.gov/cd/legionellosis/InterimReportLegionnairesDiseaseOutbreak_101819rev.pdf)
6. Centers for Disease Control and Prevention. Disinfection of hot tubs that contain *Legionella*. <https://www.cdc.gov/legionella/downloads/hot-tub-disinfection.pdf>.

*The Centers for Disease Control and Prevention (CDC) protects people's health and safety by preventing and controlling diseases and injuries; enhances health decisions by providing credible information on critical health issues; and promotes healthy living through strong partnerships with local, national, and international organizations.*

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### Categories of Health Alert Network messages:

**Health Alert** Requires immediate action or attention; highest level of importance  
**Health Advisory** May not require immediate action; provides important information for a specific incident or situation  
**Health Update** Unlikely to require immediate action; provides updated information regarding an incident or situation  
**HAN Info Service** Does not require immediate action; provides general public health information

##This message was distributed to state and local health officers, state and local epidemiologists, state and local laboratory directors, public information officers, HAN coordinators, and clinician organizations##