Legionnaires' Disease Outbreak at the Aria Hotel, Las Vegas, NV, 2009-2011
Interim Report
July 28, 2011
John P. Middaugh, MD

BACKGROUND:

On June 15, 2011, the Centers for Disease Control and Prevention (CDC) Respiratory Diseases Branch, as part of the national surveillance system to detect cases of Legionnaire's Disease among travelers, informed the Southern Nevada Health District (SNHD) Office of Epidemiology (OOE) of 2 case reports of laboratory-confirmed Legionnaires' Disease (LD) in persons who had stayed at the Aria Hotel in Clark County during their incubation period. One of the cases had illness onset in February 2011 and the other in April 2011. At the time of the report, both cases had recovered.

On June 15, 2011 the SNHD OOE notified Environmental Health (EH) staff and the Nevada State Health Division, Office of Epidemiology, of the new case reports. There was only one room number provided on the original notification and no case names. OOE requested that CDC consult with the reporting states and request case names to enable cross matching with hotel guest lists to determine dates of stay and room numbers.

The Aria was previously associated with Legionnaire's Disease cases in late 2009 and in 2010. The first case had illness onset in December of 2009 and stayed at the hotel shortly after the grand opening. In 2010 two confirmed cases stayed at the facility, one in April and one in June during the incubation period. In June of 2010, SNHD Environmental Health staff conducted an environmental assessment of the building in response to the two cases being reported from the CDC. The environmental assessment was forwarded to CDC for their review and did not reveal any issues that would lead to an increase risk of contracting LD. At this time, the hotel's water management plan had not been fully implemented as there was no routine quarterly water testing at the hotel for the presence of Legionella. A case of LD was reported to the OOE in April 2011, but the time of symptom onset was slightly outside the normal incubation period for legionellosis. This case stayed at the Aria in January 2011 and had onset of illness February 8, 2011.

Based on the facility's previous history and the report from CDC on June 15, 2011 of two new cases associated with the facility, an epidemiologic and environmental investigation was initiated on June 16, 2011.

METHODS:

Environmental Investigation

SNHD staff visited the hotel on June 16, 2011 and collected samples from the bathtub, bar sink and shower head in a room that had been occupied by one of the cases. A total of six environmental samples

were taken. The sampling was done using CDC recommended procedures. Aerators were removed from each of the bar sink and shower head and a swab was taken of the aerator and inside the pipe supplying the aerator. A swab was taken only of the surface of the bathtub spout since the aerator could not be removed. Once the swab was taken it was placed into a sterile centrifuge tube and approximately 5 ml of water was added. After the swabs were taken, a 50 ml sample of the first draw of the hot water was taken at each of the three fixtures. All six samples were sent to a laboratory participating in the CDC ELITE program for isolation and serotyping of any *Legionella* species present. Once the sampling was complete the hot water temperature was taken and free chlorine residual was measured. The SNHD requested that facility managers provide a copy of their current water management plan and any sampling results that occurred during the past year.

A second visit was made on June 21, 2011. On this date SNHD staff cross checked a list of case names provided by CDC with hotel guest lists to obtain room numbers. The history of room occupancy of the six case rooms for a 2-week period prior to the cases' stay at the Aria was recorded. Environmental sampling was done in the same manner as on June 16, for the fixtures in five rooms along with the hot water return for the hot water system that served the rooms where the two most recent cases stayed. After the sampling of each fixture, a hot water temperature and free chlorine residual was measured. None of the rooms sampled on June 21 had a bar sink. Only the shower and one bathroom sink were sampled. All of the SNHD samples were submitted to Nalco, Naperville, IL.

On July 6, 2011, additional sampling was completed by a third party, Phigenics, Naperville, IL, a laboratory selected by the Aria facility management. Samples were taken of first draw after the water was hot and after flushing the water for 1 minute in the room where the highest concentration of *Legionella sp.* was identified. Also included in the sampling was a room above and below the room along with a room on the same floor served by the same hot water riser. The fixtures sampled included the wet bar sink, bathtub and shower. The samples were taken and analyzed using three tests. One test used molecular marking to determine the presence or absence of *Legionella sp.*, the second test used a proprietary method using a dipslide to capture viable *Legionella sp.* and determine their concentration in the water and the third used ISO 11731 to determine the concentration of *Legionella sp.* in 50 ml of sample water.

Case-finding

To enhance case-finding, on July 8, 2011 the SNHD posted on CDC's EPI-X a request to other state and local health departments to report to the SNHD cases of legionellosis with a travel history to Las Vegas since December 2009.

On Tuesday, July 12, 2011, the Aria Hotel sent a letter to more than 18,000 guests who stayed at the Aria between June 21 and July 4, 2011 notifying them of their potential exposure to Legionnaire's Disease. (Attachment B)

Call Center

The health district's help line (702) 759-INFO, is forwarded to Rocky Mountain Poison and Drug Center (RMPDC). Because high call volume was anticipated as a result of the Aria guest notification, on July 12, 2011, the SNHD provided updated information to the RMPDC regarding Legionnaires' disease and

developed frequently asked questions specific to this event. The RMPDC incorporated the materials and was ready to take calls relating to this event on July 13, 2011. (Attachments A)

The Nevada Helpline was established by the SNHD as an off-site call center through a contract with the Rocky Mountain Poison Control and Drug Center (RMPDC). The local telephone number is 759-INFO (4636), and the toll-free number is (866)-767-5038. During normal working conditions the line has a general outgoing message and a referral to specific health topics as well an operator to answer frequently asked questions (FAQs). The SNHD Public Information Office coordinates with RMPDC to maintain health topics or set up a special call center program for an incident or event.

Remediation

According to Aria staff, they began remediation of the hotel on July 5, 2011 when the bar sinks were taken out of service. This action was taken due to the possibility that the bar sinks were a source of contamination. Also, according to Aria staff, thermal treatment began on July 6, 2011 and repeated over a number of nights. SNHD staff did not observe these two steps but during various visits to the Aria did note that the bar sinks were taken out of service.

From July 11, 2011 until July 21, 2011, staff from the facility conducted a comprehensive remediation program to remove *Legionella sp.* from the hot water system. The rooms of each riser were removed from service and not rented for the night of the remediation. One zone was chlorinated and flushed during the night and tested on the subsequent day with the exception of zone 4 and zone 5, those were treated and flushed on the same night.

The remediation process began when facility's contractor injected a chlorine solution of 12.5% sodium hypochlorite into the hot water system at a point located after the water was heated and before the water was delivered to the first room on the subject riser. The most distal faucet was opened until a chlorine residual was detected in the water. Then each faucet on a floor was opened until the chlorine residual was detected using a chlorine test paper that measured total chlorine from 10 ppm to 200 ppm. After all of the faucets on the riser had been opened and flushed, a two hour soak time was started. During this time, each shower head served by the riser was soaked in a 2% chlorine bleach solution for ten seconds. After either the two hour soak period expired or after treatment of the showerheads occurred, whichever was longer, a chlorine residual was taken from the hot water loop. The hot water system was turned up to 170^{o}F and the loop was drained at the distal end while heated domestic water replaced the drained water. After the loop was drained and chlorine residuals returned to normal levels for the loop, each faucet was flushed with the temperature measured by Aria staff to ensure that the temperature exceeded 150^{o}F and no elevated chlorine residuals were detected by using chlorine test paper.

Once the entire system was flushed the hot water system was returned to its normal operating temperatures and two third-party contractors, Phigenics and Bureau Veritas, Downers Grove, IL., tested 4% of randomly selected rooms along with both the proximal and distal ends of the hot water loop. Each hot water zone was treated and tested over a 24 hour period. The rooms were permitted to be rented once the hot water flush was complete. Samples taken by Phigenics were analyzed using three tests. One test used molecular marking to determine the presence or absence of *Legionella sp.*, the second test used a dipslide to capture viable *Legionella sp.* and determine their concentration in the water and the third used ISO 11731 to determine the concentration of *Legionella sp.* in the sample water.

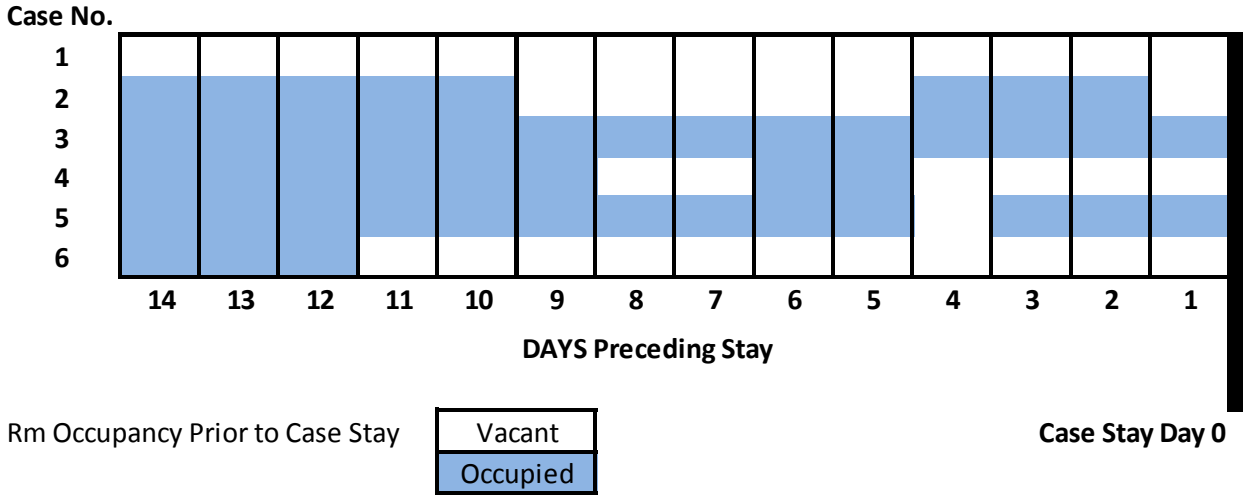
Rooms sampled by Bureau Veritas were only tested for the presence of Legionella sp. using ISO 11731 and 1 liter of water from the fixture.

RESULTS:

Environmental and Epidemiology Investigation:

The results of the case-room occupancy study are illustrated in Table 1.

Table 1. Room Occupancy Prior to Case-Stay



Survey Results:

On June 16 and June 21, 2011, SNHD staff measured both the hot water temperature and free chlorine residual. The free chlorine residual for each room ranged from a low of 0.02 ppm to a high of 1.01 ppm. The mean was 0.18 ppm. The hot water temperature for the rooms ranged from a low of 113^{o}F to a high of 132^{o}F. The mean was 124^{o}F. Both the water sampling results and water management plan were provided to SNHD.

Laboratory Results:

The sample results from June 16 and June 21, 2011 indicated that seven samples from four rooms had some *Legionella* growth. Eleven samples had no detectable growth of *Legionella* and five samples were not tested because their contents leaked during transport. The one sample taken directly from the terminal end of the hot water return had no detectable growth. Six of the seven samples containing *Legionella* had *Legionella pneumophila* serotype 1. Two of the seven samples had fluorescent *Legionella* growth that was not serotype 1. One of the seven samples had both *Legionella pneumophila* serotype 1 and fluorescent *Legionella*.

Third Party Laboratory Testing Results:

On July 6, 2011 samples were taken from the one room that SNHD tested along with three nearby rooms by the Aria's consultant. Using the three tests, the third party laboratory detected *Legionella sp.* in 11 of the 24 samples using their molecular marker tests. Only one of the 24 samples taken indicated

Legionella pneumophila serogroup 1. The concentration was 10 cfu/ml and was not a sample with *Legionella sp.* detected with the molecular marker test. The third test, using the culture method, found

Legionella sp. present in three samples, one sample had a concentration of 59 cfu/ml of *Legionella sp* not *L. pneumophila* Serogroup 1-14. The molecular marker test for this sample was also *Legionella sp.* not detected. Both this test and the proprietary second test was from the bar sink in the same room that SNHD sampled. The other two results were from a bar sink in the room on the same floor. These two samples found *L. pneumophila* Serogroup 1 and were from the wet bar. The samples contained 1cfu/ml for the first draw and 2cfu/ml after the one minute flush. The molecular marker test detected *Legionella sp.* but the proprietary dipslide did not detect any *Legionella sp.* 10 cfu/ml or more.

Remediation Results:

During the room by room remediation that took place over four nights from July 11 to July 21, 2011, the chlorine residual detected ranged from 100 to 200 ppm at each fixture during the chlorine flush. The chlorine residual in the loop ranged from 3.0 to 50 ppm chlorine just before the temperature of the water was raised and flushing of the system commenced. The rinse temperature of the flush ranged from a low of 150^{o}F to a high of 170^{o}F. The follow up testing results are pending.

Call Center Results:

Initial call volume totaled 95 calls between July 14 and July 17, immediately following distribution of guest letters and media coverage. Of the 95 calls, RMPDC initiated more in-depth questions based on caller questions for 21 callers. Caller contact information was forwarded to OOE for follow up.

Case Finding Results:

The Epi-X posting did not result in identification of any additional legionellosis cases. The Aria guest letter and the ensuing media coverage generated several self-reports of illness. Callers were referred to their physician for diagnosis and testing.

Callers referred by RMPCD and callers who called OOE directly were interviewed by the OOE staff. The following case definition was utilized to determine if any of the persons reporting illness should be classified as outbreak-related cases:

Confirmed Case:

A person who stayed overnight at the Aria and became ill between two days after arriving and fourteen days after leaving, had positive laboratory testing for *Legionella pneumophila* serogroup 1, including isolation (by culture) of any *Legionella* organism (from respiratory secretions, lung tissue, pleural fluid, or other normally sterile fluid), by detection of *L. pneumophila* serogroup 1 antigen in urine using validated reagents, or by seroconversion (fourfold or greater rise in specific serum antibody), and met one of the following clinical criteria:

- Received care (as an inpatient or outpatient) for one or more symptoms consistent with pneumonia (fever equal or greater than 101◦ F, chills, cough, fatigue or weakness) OR
- Received antimicrobial treatment that is effective against *Legionella* and another pneumonia causing organism was not isolated such as *S. pneumoniae* OR
- Had radiographically-confirmed pneumonia.

If any criteria for the definition are unknown (e.g., receipt of antibiotics) and the case otherwise meets the definition, assume that the missing criteria exists for investigation purposes.

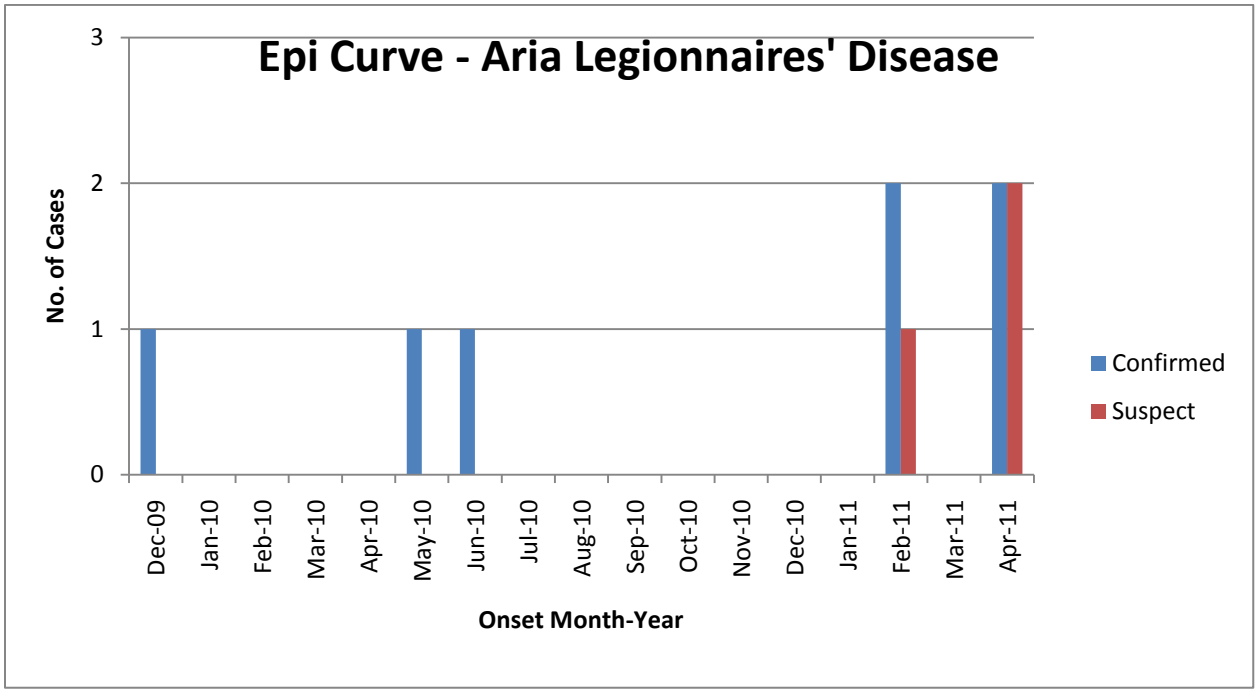
Suspect Case:

A person who stayed overnight at Aria and became ill between two days after arriving and fourteen days after leaving, had no laboratory testing for *L. pneumophila* serogroup 1, AND met the following clinical criteria:

- Received care (as an inpatient or outpatient) for one or more symptoms consistent with pneumonia (fever equal or greater than 101 F, chills, cough, fatigue or weakness) and received antimicrobial treatment that is effective against *Legionella* and another pneumonia causing organism was not isolated s/a *S. pneumoniae* OR
- Had radiographically-confirmed pneumonia.

Interviews resulted in identification of three suspect cases of Legionnaires' disease. A local resident who had been formerly diagnosed with laboratory-confirmed Legionnaires' disease informed OOE of a stay at Aria during the incubation period. This was confirmed through hotel receipts. All four of these cases occurred in February and April of 2011. The epidemiological curve for this outbreak is illustrated in Figure 1.

Figure 1. Epidemiological Curve Legionnaires' Disease, Aria Hotel and Casino, 2009-2011



DISCUSSION:

On July 1, 2011 some of the final and preliminary results of the environmental samples taken by the SNHD on June 16, 2011 and June 21, 2011 were received from Nalco. These results documented the presence of Legionella sp. in the water system with high levels present in the wet bar from one room. The EH program staff developed recommendations for remediation and appropriate guest notification

and sent them to the Hotel on July 5, 2011. The hotel responded by proposing further environmental sampling and an interim immediate remediation effort.

On July 6, 2011, the SNHD arranged a teleconference with the Centers for Disease Control and Prevention and the hotel management and representatives. During the discussion, the following key points were
specifically addressed and confirmed.

- All six patients reported to CDC who had stayed at the Aria during the incubation period of Legionnaire's Disease were laboratory confirmed through urine testing and had the same serogroup, LP1, the same serogroup found in the water at the Aria hotel.
- The identification of 6 associated cases is very unusual and indicative of an outbreak of Legionnaire's disease at the Aria.
- The most likely source of exposure was showering by the guests.
- The identification of these cases and the water sample results indicate a systemic contamination problem throughout the hotel water system, and a comprehensive water management and remediation program will be needed to disinfect the system and maintain disinfection on an ongoing basis.

On July 8, 2011 SNHD leadership met with the CEOs from the hotel, City Center, and MGM to finalize a remediation plan and guest notification. At that meeting, the hotel representatives shared information of their remediation efforts to date. According to the Aria management, the hotel initiated the following measures beginning on July 5, 2011 -- they had taken all wet bars out of service, super heated the water to 165 degrees, cleaned all shower heads and begun to remove the plastic water restriction devices from all shower heads. Following these measures, they had taken additional environmental samples and expected results by noon on July 9, 2011.

The SNHD and hotel management agreed that a comprehensive, aggressive water system disinfection program would be implemented beginning July 11 through July 21. The hotel management also agreed to notify all guests who had been exposed during the incubation period prior to the initiation of the remediation plan on July 5. Letters were sent out notifying guests beginning Tuesday, July 12, 2011. (Attachment B) Because the immediate initial remediation program of thermal heating, chlorination, and cleaning plus taking the wet bars out of service was completed, incoming guests should not be at increased risk of exposure. Therefore, notification of incoming guests was not required.

Discussions between the hotel management and the SNHD continue to develop a long term water system management and monitoring plan. The epidemiology investigation is also ongoing to identify additional possible cases of Legionnaires' Disease associated with exposure at the Aria and to conduct ongoing surveillance to assure that the remediation program has been totally successful in stopping any further transmission of Legionnaires' Disease at the hotel.

ARIA Q&A/July 13, 2011

Following is some Q&A developed regarding the ARIA Resort & Casino.

Are the six cases/patients part of the at-risk group or do any of them have underlying medical conditions?

- The patients were between the ages of 40 and 71. (*We have provided this type of generic info in the past)*

How come you're not notifying people who were at the hotel before the June 21 date, or people who stayed there last year?

- Because of the health district's 2011 water sampling, we know that the water system had *Legionella* bacteria during the two week notification period. At the time of testing in 2010, we found nothing to indicate an increased risk for *Legionella*. If former guests become symptomatic it is important that they advise their health care provider about travel history.
- The health district recommends that if anyone has been diagnosed with Legionnaires' disease or any other pneumonia-type illness and have a history of travel to the hotel, they should contact their health care provider.
- The health district has also set up a monitoring plan with the property and our recommendations will be re-evaluated based on ongoing test results.

Is it possible there could have been people infected in 2010 or at any other time than the two weeks from June 21-July 4?

- Because of the health district's 2011 water sampling, we know that the water system had *Legionella* bacteria during the two week notification period. At the time of testing in 2010, we found nothing to indicate an increased risk for *Legionella*. If former guests become symptomatic it is important that they have this information so they can provide it to their health care provider.

But, isn't it really possible that on June 19 the water was contaminated?

- The dates of stay were identified due to the incubation period of the illness. If anyone who stayed at the hotel prior to June 21 has developed symptoms, they should contact their health care provider and discuss their risk factors and travel history. If they are diagnosed with Legionnaires' disease, the information would be included as part of any updated reporting to the CDC and later to the health district.

Is Aria providing information to guests as they check in?

- Currently, the hotel is not. The notification is for guests who were at the property during the period when the positive water samples were taken. This time period represents the incubation period for the illness. The property immediately began remediation as well as additional precautionary measures and its most recent samples found no detectable levels of the bacterium. The health district will continue to monitor the sampling and testing program. Based on our review, our recommendations, including recommendations about guest notifications, could change.

Are there more cases?

- Legionnaires' disease is a form of pneumonia and unless specific testing is completed, it is difficult to determine for certain if a patient has it. Because of this, it is possible there are more cases but we cannot be certain about that.

Are other properties at CityCenter affected by this?

- At this time, the health district has not received any reports of illness at other CityCenter properties.

Are you going to check the water systems at the other CityCenter properties?

- The health district conducts an investigation and testing if it has received reports of illness, and at this time, fortunately, we have not received any additional illness reports. However, we would encourage all properties to review their water monitoring systems and make appropriate changes if necessary.
- The environmental health division provided information to area properties about steps they should take when they reactivate water systems that were shut down for a period of time due to room closures, etc. Staff from the special projects program would be happy to meet with any resort or hotel to discuss the steps that should be taken.

How come SNHD doesn't inspect water systems regularly?

- Public accommodations are required to provide potable water to customers by a public water system. The Nevada Department of Environmental Protection has been given the responsibility to regulate public water systems to ensure that these systems meet the requirements of the U.S. Safe Drinking Water Act. Although the act does not specifically mention *Legionella*, it does have requirements on the bacteriological quality of the water and they should, for the most part, prevent *Legionella*.

Can you get Legionnaires' disease at home? How could you prevent it?

- Many people who develop the disease are exposed at large venues or facilities, like a hotel. However, it is possible to be exposed at home if you have tubs, showers, misters, or sinks that are not used very often. It is recommended that you run those regularly to keep *Legionella* from growing in your own water systems.

Is there *Legionella* in the Valley's water system?

- For specific information, you would need to contact the water district.
- *Legionella* is found in surface water and the Southern Nevada Water Authority uses filtration, a state -of-the-art disinfection system called ozonation and disinfection contact time to meet water quality standards for organisms found in source water, including *Legionella*.
- The Las Vegas Water District, upon learning of the outbreak has increased its monitoring and sampling program to assure visitors and residents that the local water system remains bacteria and disease free.
- The Southern Nevada Water Authority monitors the raw and finished water at its treatment plants as well as the Las Vegas Wash and has not detected any *Legionella*.

Can you get Legionnaires' disease by drinking the water?

- You cannot get sick from brushing your teeth or drinking the water. Most people who are exposed to *Legionella* do not get sick; the illness itself is a respiratory disease. For those who are at a higher risk, exposure occurs from inhaling vapors or droplets. The most common exposure among those who do get sick is from showering.

How many cases of Legionnaires' disease do we get each year?

- We received reports of Legionnaires' disease in Southern Nevada residents throughout the year. In 2010, we had 16 reported cases in local residents.

How many other hotels have had Legionnaires' disease issues?

- *Legionella* bacteria are found in the environment and it is not uncommon in facilities or venues here or other places across the countries. The CDC has a nationwide tracking system and what the Aria is experiencing is not uncommon.
- The environmental health division provided information to area properties about steps they should take when they reactivate water systems that were shut down for a period of time due to room closures, etc. Staff from the special projects program would be happy to meet with any resort or hotel to discuss the steps that should be taken.

Aria
RESORT & CASINO

Dear Valued Guest:

In cooperation with the Southern Nevada Health District, ARIA Resort is contacting recent guests who may have stayed with us from June 21 to July 4 at a time when water tests detected elevated levels of Legionella bacteria in several of our guest rooms.

Health officials have recently notified us of a few reported instances of guests who visited Aria, were diagnosed with, treated for, and recovered from Legionnaires' disease (a form of pneumonia caused by Legionella bacteria). In an abundance of caution, we are attempting to notify guests who may have been exposed to these bacteria during this short period. Legionella is a common naturally occurring bacteria that exists in most water supplies and in some circumstances can cause illness. People often receive low-level exposure in the environment without getting sick. Illness usually occurs when someone who is susceptible receives direct concentrated exposure to the bacteria when breathed in as a mist or vapor.

The illness is not contagious; you cannot catch it from other people. Most cases are successfully treated with antibiotics. Symptoms of illness caused by Legionella bacteria include high fever, chills, cough, fatigue, muscle aches and headaches. These symptoms usually begin 2 to 14 days after being exposed. If you have developed any combination of these symptoms, we encourage you to see your doctor, especially if you are at higher risk of infection due to a chronic illness, respiratory disease, or compromised immune system or if you are a smoker or elderly.

Legionella is a concern for all large buildings and ARIA has a comprehensive water management program in place, which includes regular testing. Following the recent elevated test result, our facilities team immediately implemented additional precautionary measures, and our most recent test results indicate that no detectible level of active Legionella bacteria was present in any of the locations tested. We will continue to monitor our water quality on an ongoing basis to ensure the safety of the water system and our guests.

If you have questions regarding this notice, please call 1-877-326-ARIA (2742) to speak directly with our staff about this issue. Also, please share this letter with others who stayed in your room during your visit to the ARIA Resort.

Additional information on Legionella is available on the Southern Nevada Health District website, www.SNHD.info, or by calling the Health District's information line, (702) 759-INFO (4636) or toll free (866) 767-5038.

Sincerely,

[redacted]

Paul Berry
Vice President Hotel Operations