



Water Talk

Legionella – Suggested Actions in the Event of an Outbreak

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While many facilities are becoming more knowledgeable on how to control the growth of Legionella, there are still questions as to what actions to take in the event they get a positive result for Legionella in a cooling tower, or if they experience an outbreak of Legionellosis in their facility.

The Centers for Disease Control (www.cdc.gov) estimates that "Each year, between 8,000 and 18,000 people are hospitalized with Legionnaires' disease in the U.S. However, many infections are not diagnosed or reported, so this number may be higher." These numbers are of particular concern for the healthcare industry, due to the large populations of immuno-compromised patients that are within their facilities.

This Water Talk is an attempt to assist in developing protocol, while protecting the public and facility employees that may come into contact with the systems being treated with water treatment products

Background

Legionella are rod shaped, Gram Negative, Aerobic bacteria. These bacteria are the causative agent for the disease known as Legionellosis.

According to Section 3, Chapter 7 of the OSHA Technical Manual, Legionellosis is considered to be fairly common and serious, and the Legionella organism is considered to be one of the top three causes of sporadic, community acquired pneumonia.

Legionella was first identified in 1976, when 200 people attending an American Legion convention developed pneumonia caused by the organism later named *Legionella pneumophila*. This outbreak resulted in 34 deaths.

Definitions

Legionella – The name for a particular genus of bacteria. Within this genus, there are more than 40 species. Within these species, there are multiple serogroups, each having multiple subtypes.

Legionella pneumophila – A species of *Legionella*. This particular species is the causative agent for more than 90% of the legionellosis cases. More than 70% of these cases are attributed to a particular serogroup...*Legionella pneumophila serogroup 1*.

Pneumophila – Lung Loving. When referring to the Legionella bacteria, this indicates that the bacteria can thrive and cause Legionella when inoculated in a person's lungs.

Legionellosis – The name used to describe the illness caused by exposure to the bacteria pathogen *Legionella*. **This is acquired by inhalation or aspiration into the lungs.**

Legionella Disease - LD

LD Exposure – most likely occurs via:

- Inhalation – of fine sprays, mists or microscopic droplets of water. Direct lung access.
- Aspiration – When choking as could occur during drinking, swallowing (You are drinking and it goes down the wrong pipe).

LD Sources – Any warm water system or device that contains water in aerosols/mists, and that provides favorable conditions for Legionella growth. Common sources include humidifiers, showerheads, faucets, whirlpool baths & spas, grocery store misters, cooling towers.

LD Susceptibility – Most at risk are the elderly and those with suppressed immune or respiratory systems. This includes heavy smokers, alcoholics, HIV patients, organ transplant patients. The most common risk factor found in LD patients is heavy cigarette smoking, along with chronic lung disease.

LD Symptoms – Flu-like symptoms (high fever, chills, headache, muscle pain), cough & difficulty breathing, diarrhea/vomiting, delirium/confusion.

LD Treatment – Requires the use of antibiotics (especially azithromycin and quinolones (ciprofloxacin, levofloxacin and others)). When treated at the outset, the outcome is usually excellent. Some symptoms can linger for several months, with complete recovery taking up to a year.

Controlling the Growth of Legionella

Controlling the growth of Legionella relies, necessarily, upon controlling the conditions which promote Legionella growth and amplification. These include:

- Stagnant water conditions as found in dead-leg piping.
- Warm water temperatures between 68°F to 122°F.
- Bulk water pH between 5.0 and 8.5.
- Sediment, scale, deposits and biofilms.
- Microbiota, including algae that supply essential nutrients for the growth of Legionella.
- Certain amoeba, and other protozoa that harbor Legionella as endosymbionts, allowing them to thrive, resist harsh conditions (including biocides) and to significantly amplify.

The primary objective in controlling the growth and amplification of Legionella is to avoid conditions which would allow Legionella bacteria to proliferate. For the water treatment industry, this would mean we should ensure that our customers are aware of:

- The need to keep their systems clean and free of sediment which may harbor bacteria.
- Our customers should be trained in the use of the biocides including contact times and feed rates.
- The health and safety data for storage, handling and use of the water treatment chemicals.
- The system control parameters and tolerances for biological and chemical levels, including the measurement methods, sampling locations, test frequencies, and procedures.

- Remedial measures to be taken in the event that the control levels are exceeded.
- Cleaning and disinfection procedures.

Routine Monitoring

Most of the professional and governmental agencies that have issued Legionella position statements and guidelines do not recommend testing for Legionella on a routine basis. Routine Legionella monitoring is only recommended under a limited set of circumstances, because as ASHRAE explains:

- An infectious dose level for Legionella has not been established. Differences in strain virulence, and differences in individual susceptibility makes the idea of an infectious dose misleading. Since there has not been a “danger” level assigned, no *one* level of the organism can be assumed to be safe. Thus tests showing low levels may lead to a false sense of security.
- Legionella may be undetectable in bulk water on one day, but detectable the next, as they are released from biofilms or other hosts.
- Legionella are capable of rapid proliferation, in even well maintained systems.
- Interpreting the results is confounded by the wide variations in the different bacteriologic methods employed in various laboratories and by the differing counts frequently found at different sample sites within the same system.
- The detection of Legionella in a cooling system, does not necessarily mean there is a risk of the disease, as not all species of Legionella are associated with the disease.
- Current CDC accepted testing methods require incubation over several days before results are reported. This time period for the results to become available, is too long for this type of monitoring to be used the sole tool for control.
- Therefore, many experts feel the best technique is to establish a routine evaluation of the system cleanliness and the effectiveness of microbial control.
- Typical methods would include the use of dipslides or ATP to monitor total heterotrophic bulk water (planktonic) and surface (sessile) microbiological populations.

- The system should be evaluated to determine the presence or absence of factors that contribute to biofouling.
- The frequency with which general microbial monitoring is performed will depend upon a variety of factors. The factors that should be considered are:
 - o biological loading
 - o microbial growth rates and equipment susceptibility to fouling
 - o In some cases monthly checks of biological activity can suffice, while other systems might require more frequent intervals.
- As a general guideline, under normal circumstances, Legionella testing can be performed in order to demonstrate reasonable diligence in addressing any health risk concerns (ie quarterly, semi-annually etc).
- The simple fact is that, there can be no risk for Legionella Disease, if there is no Legionella.
- The only practical way to know if you have Legionella is to test for it.
- Additionally it would seem that the only logical, necessary and proactive choice is to maintain a routine monitoring regimen that includes Legionella testing.

Non-Routine Actions

So all that is well and good, but what actions do you recommend to your customer in the event of an outbreak, or positive Legionella test?

In the event of an outbreak, or in the event of a positive finding of Legionella in a treated water system, the most important thing is to have a set plan of action or response, This response and plan should adhere to the requirements that can be found in many of the references cited in this discussion. Most Importantly...Don't Wing It!

Many experts recommend that a water treatment company should:

- Refer the customer to the actions as indicated in their own written protocols.

- It might be helpful to review their protocols, and ensure that the steps they are taking, at least meet the standards as set by the OSHA Tech Manual.
- If they do not have a written protocol, refer them to the actions as indicated in:
 - **OSHA Technical Manual, Section 3, Chapter 7**
- Stand by to assist in recommendations on the means to procure the chemicals and expertise needed to complete the steps outlined by the Technical Manual. This may include:
 - Sourcing sanitizing chemicals
 - Sourcing tanks and pumps
 - Sourcing Legionella test facilities/labs
 - Any technical assistance needed.

- They are intended to apply only to water systems being used by healthy individuals and are not necessarily protective for persons who are immune-compromised.
- The levels requiring action vary for the source of exposure based on the assumption that some routes or exposure result in a greater dose to the lung.
- For this reason, humidifiers and similar devices such as misters and evaporative condensers which produce an aerosol mist that can be directly inhaled should be controlled to lower levels.
- Remember that these numbers are only guidelines, and the goal is zero detectable Legionella in a water source.
- Levels of Legionella equal to or greater than the values in the table constitute a need for action.

OSHA Tech Manual, Sect III, Chapter 7

This reference can be found on the internet at the OSHA web site
 - www.osha.gov

This reference explains all of the various actions to take, and the conditions under which the actions need to be taken.

Especially important are the steps to take in the event of a positive Legionella test in a cooling tower or other water system.

OSHA Tech Manual: APPENDIX III:7-3. WATER SAMPLING GUIDELINES.

Table III:7-1. Colony forming units (CFU) of Legionella per milliliter

Action 1: Prompt cleaning and/or biocide treatment of the system.

Action 2: Immediate cleaning and/or biocide treatment. Take prompt steps to prevent employee exposure.

Note:

- Use the guidelines to assess the effectiveness of water system maintenance.
- These guidelines are based on limited data and are subject to change.

Cleaning

Acceptable cleaning procedures include those described in the Wisconsin Protocol.

Wisconsin Protocol.

- Calls for an initial shock treatment with 50 ppm free residual (total) chlorine.
- Addition of detergent to disperse bio-fouling
- Maintenance of 10 ppm chlorine for 24 hours.
- Repeat the cycle until there is no visual evidence of biofilms.
- To prevent exposure during cleaning and

Action	Cooling Tower	Domestic Water	Humidifier
1	100	10	1
2	1000	100	10

maintenance, wear proper personal protective equipment:

- Tyvek-type suit with a hood, protective gloves, and a
- Properly fitted respirator with a high-efficiency particulate (HEPA) filter or a filter effective at removing one-micron particles.

Legionella Testing

There are a number of CDC accredited test labs. One of these that performs testing at reasonable prices is:

Aerobiology Laboratory Associates

www.aerobiology.net

Costs: Sample bottles are free, \$60.00 for a negative test result, and \$ 100 for a positive test result.

Legionnaires' Disease, The control of legionella bacteria in water systems, Approved Code of Practice and Guidance

Legionella References

Some of the references that can be particularly helpful include:

OSHA Technical Manual (OTM): *Section 3, Chapter 7, Legionnaires' Disease*

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE): *ASHRAE Guideline 12-2000, Minimizing the Risk of Legionellosis Associated with Building Water Systems*

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE): *ASHRAE Standard 188P Proposed New Standard 188, Prevention of Legionellosis Associated with Building Water Systems*

Association of Water Technologies (AWT): *An Update and Statement by the Association of Water Technologies*

Cooling Technology Institute (CTI): *Legionellosis Guideline: Best Practices for the Control of Legionella*

PathCon Laboratories: *Technical Bulletin 1.5 Legionella Bacteria in Environmental Samples: Hard Analysis and Suggested Remedial Actions*

Health and Safety Executive of the UK: