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## LEGIONELLA TECHNICAL BULLETIN

### OVERVIEW

Legionnaire's disease caused *Legionella pneumophila* is one of the most challenging building acquired diseases in the industrial hygiene community. According to CDC, over a year 8000 - 18,000 cases are estimated to be caused by *Legionella*. Most of the cases reported are sporadic and nosocomial infections.

### THE ORGANISM

*Legionella* are gram-negative rods and require selective media to grow. These are mesophilic bacteria (35- 37°C). To date, there is 48 known species of *Legionella* and about 70 serogroups have been recognized to causes diseases in humans. The most common species of legionella that causes legionnaire's disease is *Legionella pneumophila* serogroup 1.

### OCCURRENCE

The natural habitats of *Legionella* are environmental waters like lakes, streams and rivers. They thrive in warm waters. Natural rubber, plastics and wood influence the growth of *Legionella* while copper inhibits the growth.

*Legionella sp.* may be isolated from:

- ❖ Surface water, mud and from thermally polluted lakes and stream.
- ❖ Hot water tanks, cooling towers, evaporative condensers, humidifiers, and holding tanks.
- ❖ Decorative fountains, ultrasonic mist machines, whirlpool bath.
- ❖ Spas, respiratory therapy equipment, showers, water faucets, technical-medical equipment.
- ❖ Fire sprinkler systems, safety showers, and industrial process equipment.
- ❖ Damp potting soil.

### INFECTION AND TRANSMISSION

- ❖ *Legionella* causes the disease Legionellosis. The most common clinical types are the ***Legionnaire's disease and the Pontiac fever.***
- ❖ Disease transmission occurs mainly by inhalation of the infectious aerosols from work place, hospitals or industrial settings.
- ❖ Not spread by person to person

## **PREVENTION**

Use of control measures like:

- Industrial hygiene practices and maintenance procedures.
- Routine environmental monitoring
- Effective disinfecting methods that include chlorination, ozonation, use of ultra violet, heat-flush (heat shock) method and copper silver ion systems.

## **SAMPLING PROCEDURE**

### **Water Samples**

Water samples are the practical way to sample for *Legionella*. *Legionella* counts will be more accurate in water than air and testing will indicate the potential risk for exposure. When sampling for *Legionella* always use a sterile container containing sodium thiosulfate. Samples should be kept cool and received at the laboratory no later than 72 hours from sampling.

### ***Non-Potable Water Systems***

#### **Cooling Towers and Evaporative Condensers**

Samples can be collected in a sterile 100 mL bottle containing sodium thiosulfate. When collecting from the reservoir the bottle should be inverted under the water and moved in a single direction. Try not to collect excess sediment in the water samples.

#### **Decorative Fountains, Hot Tubs, Fire Sprinkler Systems, Cisterns, and Humidifiers**

Samples should be collected in a 250 mL bottle containing sodium thiosulfate.

Include water from the bottom and near the sides of the reservoir.

### ***Potable Water Systems***

#### **Hot Water Systems**

Two samples should be taken when sampling a hot water system. A **pre flush** sample and a **post flush** sample. When collecting the pre flush sample, turn the hot water tap on immediately collect the first 250 mL of water containing sodium thiosulfate. Sinks, showerheads, hoses, or bottom of hot water tank are all places samples can be taken. When collecting the post flush sample, allow the water to run for 1 full minute or until water sample is hot then collect sample in a 250 mL bottle containing sodium thiosulfate. By pulling two samples you can determine if the contamination is at the fixture or from the supplied water in the plumbing lines.

#### **Cold Water Systems**

Cold water systems can be analyzed by collecting the **first draw** sample. Drinking fountains, faucets and showerheads are the appropriate outlets to sample. Collect 250 mL of water in sterile container containing sodium thiosulfate.

#### **SWAB, AIR AND BULK**

##### **Swab Samples**

Swab sampling is a method recommended done alongside water samples. Results from surface samples may show *Legionella* but will not reflect the concentration of *Legionella* in the water under normal conditions. Swabs of biofilm from faucet aerators and

showerheads can yield *Legionella* on culture from potable water systems. Samples should be taken from both the hot and cold-water faucets before running the water for sample collection. HVAC systems can be checked for the presence of the *Legionella* by swabbing the condensate pan, cooling coils and humidifier.

Sterile swabs can be obtained from the laboratory free of charge. Swabs should be rubbed vigorously over the surface being sampled and returned to sterile tube. Keep swabs cool when transporting to the laboratory. Swabs should be returned to the laboratory within 24 hours of collection.

### Air Samples

Air sampling is not recommended as a stand-alone test due to fact that the bacterium has a short lifespan in air. Air samples can demonstrate the presence of *Legionella* in aerosol droplets but can produce false negative results. A quantitative air culture can be obtained by using an impactor type sampler, such as the Surface Air Sampler (SAS), Andersen and rotary vane pump, BioCulture or other studied impactors. When air samples are taken a three-plate protocol is recommended consisting of Buffered Charcoal Yeast Extract Agar (BCYE), BCYE with antibiotics and Blood Agar.

### Bulk Samples

Bulk samples can be tested for *Legionella*. Often samples are sludge from the bottom of a condensate pan or scraped off a cooling coil. Samples should be collected in a sterile container, kept cool and transported to the laboratory within 24 hours of collection.

### Test Codes

Analysis	Matrix	Test code	Requirement
<b>Legionella</b>	Air	1016	BCYE, DGVP & BAP plates
	Water	1015	Sterile bottle w/Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>
	Wipe	1017	Sterile swab
	Bulk	1063	Bulk Sample

### INTERPRETATION OF RESULTS

Legionella cfu/ml	Cooling Towers & Evaporative Condensers	Potable Water	Non-potable Water
Detectable but <1	1	2	3
1-9	2	3	4
10-99	3	4	5
100-999	4	5	5
1000 +	5	5	5

#### Key:

**1** = Low level of concern and recommend assessment of routine maintenance program.

**2** = Little concern and recommend resampling in a few weeks to determine *Legionella* amplification.

**3** = Increased level of concern and disinfection should be considered based on review of the site.

**4** = Disinfection is indicated, uncommonly high levels of *Legionella*. Elevated levels may cause outbreaks.

**5** = Disinfection should be preformed immediately. Very high levels indicate outbreak potential. Post treatment analysis should be preformed to ensure complete disinfection.

## **REFERENCES AND INFORMATIVE WEBSITES**

- ◆ Field guide for the determination of biological contaminants in environmental samples.
- ◆ [www.cdc.gov/ncidod/dbmd/diseaseinfo/legionellosis\\_g.htm](http://www.cdc.gov/ncidod/dbmd/diseaseinfo/legionellosis_g.htm)
- ◆ Guidelines for Prevention of Nosocomial Pneumonia  
<http://www.cdc.gov/mmwr/preview/mmwrhtml/00045365.htm>
- ◆ Occupational Safety & Health Administration  
OSHA standards, hazard recognition, possible solutions  
[http://www.osha.gov/pls/oshaweb/searchresults.category?p\\_text=legionnaire's%20disease&p\\_title=&p\\_status=CURRENT](http://www.osha.gov/pls/oshaweb/searchresults.category?p_text=legionnaire's%20disease&p_title=&p_status=CURRENT) (exit site)
- ◆ Legionnaires' Disease Associated with Cooling Towers – MA, MI, RI  
<http://www.cdc.gov/mmwr/preview/mmwrhtml/00031925.htm>
- ◆ Legionnaires' Disease Associated with Potting Soil – CA, OR, WA, May-June 2000  
<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4934a1.htm>
- ◆ “Reducing Risks Associated with Legionella Bacteria in Building Water Systems.” B.G. Shelton, G. K. Morris and G.W. Gorman. *Pathcon Laboratories*, Norcross, GA 30092