

Legionella in My Water:

Important Factors for Assessing Risk

Is there a regulatory limit for *Legionella* in water systems?

Cooling Towers

Neither the Centers for Disease Control and Prevention (CDC) nor the Environmental Protection Agency (EPA) define an enforceable regulatory limit for *Legionella* in cooling towers. Outbreak investigations have documented both low (<100 Colony Forming Units /mL) and high (>1000 CFU/mL) levels of *Legionella* in water samples from cooling towers. There are no evidence-based guidelines for establishing risk criteria for *Legionella* recovery from cooling towers. Although guidelines have been suggested from a few groups, the data used to establish action levels and disease risk is very limited. Therefore, these guidelines are overly restrictive (recommending remediation at lower levels) and should be interpreted with caution.

Other countries have adopted guidelines for actions based on the concentration of *Legionella* cultured from cooling water. The Australian guidelines are pragmatic in their approach and do not recommend high level (50 ppm) hyperchlorination when low levels of *Legionella* are detected (See Appendix 1).

For more information on water treatment options for cooling towers, go to www.specialpathogenslab.com and see *Legionella* guidelines under SPL Advantage.

Healthcare Drinking Water Systems

Healthcare facilities include hospitals, clinics, dental offices, out-patient surgery centers, birthing centers and nursing homes. Legionnaires' disease is a well-recognized public health problem in hospitals. Nursing homes are a growing area for concern based on the increasing number of reported cases from long-term care facilities.

In contrast to the situation for cooling towers, evidence-based data is available for interpretation of culture results from hospital water distribution systems. Risk assessment should not be based on the concentration of *Legionella* recovered from a given water outlet; quantitation (CFU/ml) has not been shown to correlate with incidence of disease (Kool-1999). On the other hand, risk for *Legionella* infections increases as the extent of colonization increases (i.e., a high percentage of water outlets yield *Legionella*). In two studies, Legionnaires' disease did not occur unless 30% or more of water outlets were positive with *L. pneumophila* (Kool-1999, Stout-2007). The locations and method of sample collection is critical, so consult with a microbiologist knowledgeable in *Legionella* monitoring before collecting samples.

The use of percent positivity as a risk threshold was first adopted in Pennsylvania by the Allegheny County Health Department in their 1993 *Legionella* prevention guideline (available at www.legionella.org). This approach has now been adopted by the national network of hospitals of the Veterans Affairs Healthcare System. To view the VA *Legionella* Directive, go to www.specialpathogenslab.com and click "*Legionella* Guidelines" on the Home Page. An example of the simple action plan in the VA Directive is provided in Appendix 2. The Directive is a simple PROACTIVE approach to protecting patients and building occupants.

Complete elimination of *Legionella* from a hospital water system has not been shown to be necessary to prevent the majority of cases of Legionnaires' disease.

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Which *Legionella* Species/Serogroups Cause Disease?

It is not unusual to find multiple *Legionella* species and serogroups in a water sample. The presence of one species has not been shown to correlate or predict the presence of another species.

There are more than 50 species of *Legionella*, with approximately half implicated in human disease. The majority (>90%) of cases of Legionnaires' disease reported in the U.S. are caused by *Legionella pneumophila*. There are more than 15 serogroups of *Legionella pneumophila*, but serogroup 1 is responsible for the overwhelming majority of cases (see table below). Other serogroups have caused disease, however this is rare by comparison to serogroup 1. The data in the table remains consistent with more recent data from Europe and the U. S.

L. anisa is frequently isolated from environmental specimens but very rarely causes disease. Disease caused by other *Legionella* species, like *L. anisa*, occurs almost exclusively in immunocompromised individuals. Only a handful of cases attributed to *L. anisa* have been reported. We consider this species nonpathogenic, and would NOT disinfect your water supply if *L. anisa* is present. Please see our *Legionella* Fact Sheet on "Blue-white *Legionella* species" at www.specialpathogenslab.com for more information.

Proportion of Legionnaires' disease caused by each serogroup and species of *Legionella* reported to the Centers for Disease Control and Prevention, United States, 1980-1998.

Legionella pneumophila is responsible for > 90% of all reported cases.

Species, serogroup	All isolates, % (n = 2340)	Community-acquired infections, % (n = 1259)	Hospital infections, % (n = 890)
<i>Legionella pneumophila</i>	91.4	90.7	93.6
1	50.5	49.6	52.5
Serogroup unknown	32.1	33.9	28.2
2	1.2	1.4	1.1
3	2.0	1.5	2.9
4	1.1	1.0	1.3
5	1.1	0.8	1.7
6	2.9	1.7	5.2
7-14	0.5	0.8	0.7
<i>L. bozemanii</i>	1.3	1.3	1.2
<i>L. dumoffii</i>	1.5	1.4	1.0
<i>L. gormanii</i>	0.2	0.2	0.2
<i>L. micdadei</i>	2.8	2.8	2.8
<i>L. feeleii</i>	0.2	0.2	0.2
<i>L. longbeachae</i>	2.2	3.3	0.7
<i>L. jordanis</i>	0.3	0.2	0.1

Note: Only isolates identified by culture are included.

From Benin A.L., Benson R.F., Besser R.E. Clin Infect Dis 2002; 35:1039-46.

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What Kind of Exposure Poses the Greatest Risk?

Most of us have been exposed to *Legionella* without incident. This is because healthy individuals are at little risk of illness even if exposed.

Direct exposure to very high concentrations of *Legionella pneumophila* serogroup 1 represents the greatest risk for acquiring disease in an otherwise healthy individual. An example of direct and intense exposure occurred in Louisiana when shoppers were exposed to *Legionella pneumophila* serogroup 1 from a misting device at a grocery store.

Hospitalized individuals are at greater risk due to impaired health status and greater chance of exposure during procedures. Aspiration of contaminated water can cause Legionnaires' disease in these patients.

What is the Goal for Risk Assessments and When Should Disinfection be performed?

The goal of a risk assessment is to identify conditions that increase the probability of Legionnaires' disease as a result of exposure to water systems colonized with disease-causing *Legionella* bacteria. Remediation is not always necessary and should be discussed with professionals knowledgeable in the area of Legionnaires' disease and its prevention and control.

References

Air-handling and water systems of buildings-microbial control. Part 3: Performance-based maintenance of cooling water systems. AS/NZS 3666.3:2000. Standards Australia International Ltd. Sydney NSW.

Kool, J.1999. "Hospital characteristics associated with colonization of water systems by *Legionella* and risk of nosocomial Legionnaires' disease: a cohort study of 15 hospitals." *Infect. Cont. Hosp. Epid.* 20:798-805.

Stout JE, Muder RR, Mietzner S, Wagener MM, et al. "Role of environmental surveillance in determining risk for hospital-acquired Legionellosis: a national surveillance study with clinical correlations." *Infect. Cont. Hosp. Epid.* 2007;28:818-824.

Disclaimer: The information contained in this "Fact Sheet" is provided for informational purposes only and not for the purpose of providing legal or medical advice. You should contact your physician or attorney to obtain advice with respect to any particular issue or problem.

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Appendix 1. Example of recommended actions based on concentration-based targets for cooling towers. This information is based on the control strategies from the Australia/New Zealand Standard.

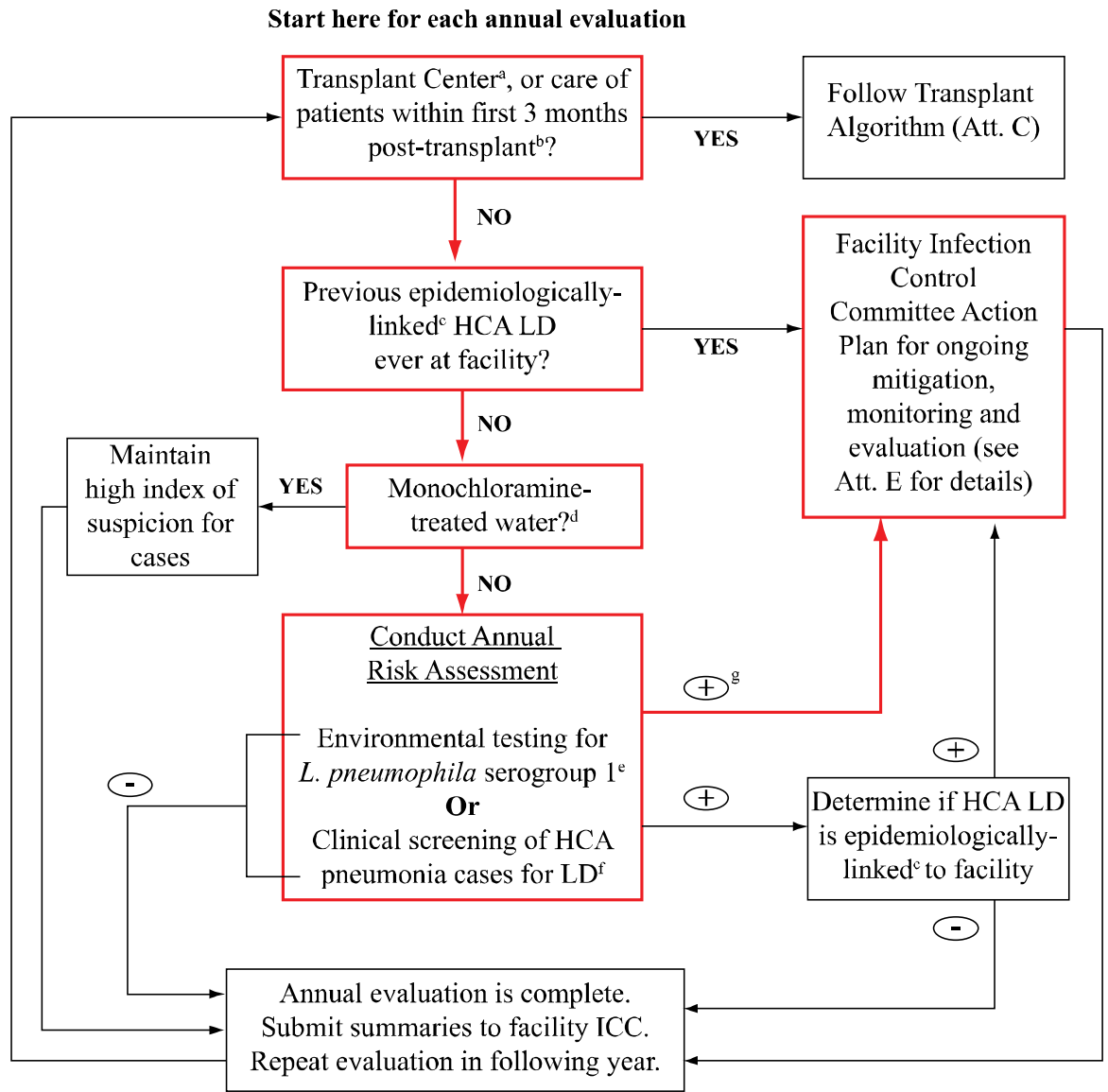
Test Result (cfu/mL)	Control Strategy – Cooling Towers
Not Detected**	<p>Maintain <i>Legionella</i> monitoring **</p> <p>Maintain water treatment program</p>
<p>Detected at ≥ 10 but < 1000 cfu/mL</p>	<p>Investigate</p> <ol style="list-style-type: none"> 1. Review water treatment program 2. Take necessary remedial action including immediate <u>on-line disinfection</u> and undertake control strategy described in footnotes below <p>Retest water within 3 to 7 days of plant operation:</p> <ol style="list-style-type: none"> 1. If not detected, continue to retest water every 3 to 7 days until two consecutive samples return readings of not detected and return to maintenance strategy 2. If detected at < 100 cfu/mL repeat control strategy with <u>on-line disinfection</u> and retest 3. If detected at $\geq 100 < 1000$ cfu/mL investigate problem and review water treatment program, immediately carry out <u>on-line decontamination</u>, retest and repeat control strategy 4. If detected at ≥ 1000 cfu/mL undertake control strategy with <u>on-line decontamination</u> and retest
<p>Detected at ≥ 1000 cfu/mL</p>	<p>Investigate</p> <ol style="list-style-type: none"> 1. Review water treatment program 2. Take necessary remedial action including immediate <u>on-line decontamination</u> and undertake control strategy <p>Retest water within 3 to 7 days of plant operation:</p> <ol style="list-style-type: none"> 1. If not detected, continue to retest water every 3 to 7 days until two consecutive samples return readings of not detected and return to maintenance strategy 2. If detected at < 100 cfu/mL repeat control strategy with <u>on-line disinfection</u> 3. If detected at $\geq 100 < 1000$ cfu/mL investigate problem and review water treatment program, immediately carry out <u>on-line disinfection</u>, retest and repeat control strategy 4. If detected at ≥ 1000 cfu/mL investigate problem and review water treatment program, immediately carry out <u>system decontamination</u>, retest and repeat control strategy. See footnote for on-line and system disinfection information

** Limit of detection < 10 cfu/mL. Monthly monitoring required in Australia, not in U.S. **On-line Disinfection** = Dose the cooling water system with either a different biocide or similar but increased concentration to that of the regular water treatment program. **On-line decontamination** = dose recirculating water with chlorine-based compound equivalent to at least 5 mg/L free residual chlorine for at least one hour (maintain pH at 7.0- 7.6). **System decontamination** = maintain 5-10 mg/l free residual chlorine for minimum of one hour, drain and flush with disinfected water, clean wetted surfaces, refill and dose to 1-5 mg/L of free residual chlorine at pH 7.0-7.6 and circulate for 30 min.[See Australian/ New Zealand Standard AS/NZ S 3666.3:1998 for process details]

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Appendix 2: Example of a Simple Legionella Risk Assessment for Healthcare Facilities

Excerpt from VHA Directive 2008-010



*NCHU=Nursing home care unit

HCA LD=Health care acquired Legionnaires' disease

See the complete VA Directive at www.specialpathogenslab.com.