AT HOME
by Matthew R. Freije

HOW TO AVOID Legionnaires’ Disease AT HOME

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How to avoid Legionnaires' disease at home

In a 1980s survey, mostly of apartments in a large building (87 apartment units and eight houses) in the Chicago area, *Legionella* was found in 30 of 95 residences (32%). In various surveys, *Legionella* has been found in single-family houses and duplexes, but, as expected, at a lower prevalence than in large buildings (see table).

<table>
<thead>
<tr>
<th>Area</th>
<th>Homes Surveyed</th>
<th>Homes with Legionella</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pittsburgh (USA)</td>
<td>55</td>
<td>6 (11%)</td>
</tr>
<tr>
<td>Quebec City (Canada)</td>
<td>54</td>
<td>11 (20%)</td>
</tr>
<tr>
<td>Germany, Netherlands, Austria</td>
<td>63</td>
<td>5 (8%)</td>
</tr>
<tr>
<td>Pittsburgh</td>
<td>218</td>
<td>14 (6.4%)</td>
</tr>
<tr>
<td>Quebec City</td>
<td>211</td>
<td>69 (33%)</td>
</tr>
</tbody>
</table>

People have contracted Legionnaires' disease from the water in their homes but having *Legionella* in your home plumbing does not mean you will get sick. None of the people who lived in the 30 Chicago residences (see first paragraph) or 14 Pittsburgh homes (see table) in which *Legionella* was found contracted Legionnaires' disease during the study period. If you are a nonsmoker in generally good health, your risk of contracting Legionnaires' disease at home is probably low unless the *Legionella* levels are high.
Nevertheless, everyone should consider taking risk reduction measures that cost little or nothing. The more costly measures probably do not make sense for young and healthy nonsmokers but may be prudent for immunocompromised persons.

Bear in mind that the following strategies are specifically for home plumbing systems. Steps that minimize *Legionella* bacteria in homes (small plumbing systems) may not be effective in large buildings.

**SETTING YOUR WATER HEATER TEMPERATURE**

Set your water heater high enough to deliver 60°C (140°F) water to all taps but be aware that scalding is a risk at this temperature. **Do not use a high temperature setting if the house is occupied by children or others who may open a hot water faucet unaware of the risk of scalding.**

*Legionella* bacteria will die within about 32 minutes in a pot of water at 60°C (140°F) but they can survive these temperatures in some large, complex piping networks.

Keeping water at 60°C (140°F) will not always control *Legionella* in large buildings but has been effective in single-family residences. Water temperature was found to be a significant factor in at least four residential *Legionella* studies. In the Chicago study discussed above, all 30 samples in which *Legionella* was found were collected from water systems at temperatures under 60°C (140°F).

To check your hot water temperatures, simply place a thermometer in the stream of water flowing from a faucet. Faucets farthest from the water heater generally have the
lowest temperatures, so check those to ensure that the water temperature remains sufficiently high (at or near 60°C/140°F) as it travels through the system. Be sure to check faucets nearest to the water heater as well to make sure that the water is not too hot—temperatures should not exceed 62°C (144°F).

Use a waterproof thermometer with a probe that is made for liquids. A digital thermometer will be faster and easier to read. In the United States, you can probably get one for under US$30 from Davis Instruments (www.davis.com), Foster and Smith Aquatics (www.fosterandsmithaquatics.com), or Hach Company (www.hach.com).

Don't assume that raising your water heater setting will increase energy costs. It may not. Further research is needed to make reliable calculations, and even then, the temperature-cost relationship will vary from house to house.

HOW TO PERFORM A HOT WATER FLUSH

Consider monthly flushes with superheated water if you keep your hot water lower than 60°C (140°F). Even if you maintain a higher temperature setting, flushes can provide added disinfection.

**To conduct the hot water flush procedure:**

a. Turn the water heater to its hottest setting.

b. Flush every tap for at least 30 minutes with 70°C (158°F) water. If your water heater doesn't have the
capacity to flush all taps simultaneously (most home water heaters don't), flush one or two taps at a time for 15 minutes, beginning with those closest to the water heater and ending with the farthest taps. For maximum protection, also run the dishwasher and washing machine on the hottest setting.

If your piping is old or in poor condition, consult a plumber about potential damage that the flushing procedure may cause. You may need to heat the water to 60°C (140°F) instead of 70°C (158°F), or not conduct the procedure at all.

c. Lower your water heater temperature to a safe setting after the hot water flush is completed.

Take these **important precautions** during each heat flush. Be sure that:

- Only nonsmokers in generally good health do the water flushing.
- Run the faucets at low to medium flow (no splashing) to minimize the release of potentially contaminated water droplets into the air.
- Immunocompromised persons are not in the house.
- Children or other potential scald victims are not in the house.
- Every person in the house is aware of the scalding risk.
WHAT TO DO AFTER RETURNING FROM A VACATION

Stagnant water promotes _Legionella_ growth.

If you have been gone for a week, run all hot and cold water outlets for at least two minutes and flush all toilets. Only nonsmokers in generally good health should do the flushing. Run the faucets at low to medium flow (no splashing).

If you have been away for more than a week, or if the home is occupied by immunocompromised persons, then consider performing a hot water flush (described above).

BEFORE MOVING INTO A HOME

Before occupying a home that has been vacant for a week or longer, at a minimum perform a hot water flush (described above), run all cold water outlets for at least four minutes (including hose bibbs if the outdoor temperatures are above freezing), and flush all toilets. The flushing should be performed only by nonsmokers in generally good health. Run the faucets at low to medium flow (no splashing).

If you are moving into a single family house that has been vacant for several weeks or more, then consider injecting chlorine into the hot and cold water piping for disinfection. If you are renting rather than buying, you will obviously need to get approval from your landlord.

A chlorination procedure can take between 3 and 24 hours, depending on the concentration of chlorine. You won’t be able to use the heavily chlorinated water so plan to have
the procedure performed while the house is still vacant (but ideally no more than three days before you move in) or while you will be away from home.

Details about chlorinating plumbing systems are purposely omitted here because you should not do it yourself. Hire a plumbing contractor or water treatment specialist who has expertise and significant experience in chlorinating plumbing systems. Before agreeing to the procedure, have the specialist examine your piping to determine that the chlorine will not cause leaks or other damage.

After the chlorination, flush the system until the chlorine concentrations are at the levels in the public water supply.

The level of precaution you take will depend on your health, budget, and the condition of the home. An immunocompromised person preparing to occupy a home that has been vacant for months should certainly consider having the plumbing system chlorinated. For a healthy 20-year-old nonsmoker moving into a home that's been vacant for two weeks, hot and cold water flushing should be more than adequate.

**GUEST BATHS**

Tiefenbrunner’s research group found that homes with low water consumption were more likely to have *Legionella*-contaminated plumbing systems. At least once a week, run cold and hot water at all infrequently used faucets and showers for at least two minutes at low to medium flow (no splashing), and flush infrequently used toilets. The flush should be performed only by nonsmokers in generally good health.
AFTER MINOR PLUMBING WORK

A study of 146 adults showed a higher risk of contracting Legionnaires' disease shortly after home-plumbing alterations or repairs were made. Repair work can loosen biofilm from piping and fixtures, releasing high levels of Legionella bacteria into the water.

After plumbing repairs are made, a nonsmoker who is in generally good health should run hot and cold water for at least five minutes at taps in the vicinity of the repairs.

If the plumbing work is extensive or involves significant vibration of the piping, consider performing a hot water flush to further reduce the risk, especially if the home is occupied by immunocompromised persons.

IF YOUR WATER BECOMES DISCOLORED

Outbreaks of Legionnaires' disease have occurred after events (water main repairs) that let dirt into the water supply or dislodge Legionella-laden biofilm and sediment from piping, often resulting in brownish colored water. If the water flowing out of your household faucets becomes discolored, run all hot and cold water outlets for at least two minutes and flush all toilets.

If the home is occupied by immunocompromised persons, then consider also performing a hot water flush as described above.
Remember that only nonsmokers in generally good health should do the flushing, and at low to medium flow (no splashing).

**BEFORE YOU BUY YOUR NEXT WATER HEATER**

When you purchase a water heater, consider gas instead of electric. Studies indicate that homes with gas water heaters are less likely to have *Legionella* than homes with electric water heaters.

Of 211 homes surveyed in the Quebec City area, *Legionella* was found in none of the 33 houses with gas water heaters but in 69 (33%) of the 178 houses with electric water heaters. The Pittsburgh study of 55 homes also showed a significant association between electric water heaters and *Legionella*.

Of the residential surveys discussed at the beginning of this chapter, the lowest *Legionella* positivity (6.4%) was found in the 218 Pittsburgh homes, 207 of which had gas water heaters.

The burner in gas water heaters is below the water tank, so the bottom of the tank, where sediment accumulates, is more likely to be sufficiently hot to prevent *Legionella* growth. In contrast, most electric units have heating elements on the side of the tank so the sediment at the bottom is at a lower temperature that is more favorable for *Legionella*.

Although data is not available to prove it, tankless water heaters may be less prone than tank-type heaters to
Legionella contamination, particularly if the tank-type heaters are kept below 60°C (140°F).

Tankless water heater. Picture courtesy Eemax Inc.

MAINTAINING YOUR WATER HEATER

If you have a tank-type water heater, you (or a plumber) should drain and clean it annually to remove sediment and, to the extent possible, scale (hard water deposits). The annual cleanings will likely extend the life of the water heater in addition to minimizing conditions for Legionella growth. Follow the manufacturer’s instructions to avoid damaging the heater or voiding the warranty.
**WATER SOFTENERS**

If you have hard water, consider installing a water softener or electronic frequency water conditioner to minimize the build-up of scale in your piping.

Water softeners may lower *Legionella* risk also by reducing the amount of iron (which promotes *Legionella* growth) in the water. Most water softeners reduce iron by approximately 2 parts per million (ppm), which is probably sufficient for most public water supplies.

Don't rely on water softeners to lower *Legionella* risk by reducing calcium and magnesium in the water. Although one study indicated an association between *Legionella* and calcium and magnesium in hospital plumbing systems, two separate studies of Pittsburgh homes found no such association.

A possible but as yet unproven disadvantage of water softeners is their potential for serving as a habitat for *Legionella* growth.

**WHAT YOU NEED TO KNOW ABOUT WATER FILTERS**

**Refrigerator and icemaker filters**

Carbon or sediment filters typically used on lines supplying refrigerator icemakers and water dispensers, as well as most faucet and shower filters, provide a good habitat for *Legionella* and other bacteria. It's fine to use these filters to remove chlorine at the point of use, but be sure to replace them at the intervals recommended by the
manufacturer, or sooner. Otherwise bacteria that build up on the filters may be released into the water.

**Whole house water filters**

Be careful about using whole house sediment or carbon filters. Both can provide a habitat for *Legionella*, and carbon filters also remove the disinfectant (chlorine, chloramines, chlorine dioxide) from the public water supply. If the filters are used, be sure to maintain them according to the manufacturer’s recommendations.

*Filters (left) and filter housings*
HUMIDIFIERS

Humidifiers are used to relieve dryness in the nose, throat, lips, and skin and to alleviate nuisances such as static electricity, peeling wallpaper, and cracks in paint and furniture.

Four types of humidifiers are marketed and sold today:

- Ultrasonic: Sound vibrations produce a cool mist.
- Impeller: A high-speed rotating disk produces a cool mist.
- Evaporative: A fan blows air through a wet wick, belt, or filter, transmitting moisture to the air.
- Steam vaporizer: Water is heated, releasing steam. "Warm mist" steam vaporizers cool the steam before it exits the machine.

Ultrasonic and impeller humidifiers generally pose a greater risk than do evaporative and steam units. Ultrasonic and impeller humidifiers efficiently disperse water particles into the air, whereas evaporative and steam humidifiers produce little airborne water particles. Also, *Legionella* and other bacteria are less likely to grow in steam humidifiers because of the high temperature.

Console humidifiers are encased in cabinets and placed on the floor. Portable humidifiers are smaller and easy to move. Central humidifiers are built into heating and air-conditioning ductwork for humidification of the whole house.
Portable humidifiers

Portable humidifiers have been blamed for cases of Legionnaires' disease and one study showed *Legionella* bacteria dispersed by a humidifier caused the disease in guinea pigs.

Do not use portable humidifiers or vaporizers unless absolutely necessary. If you must use them, take the following precautions:

- *Fill the humidifier with sterile water.* You can produce sterile water by boiling tap water for 10 minutes. Distilled water is second best. Do not use tap water. Tap water is more likely than distilled water to contain *Legionella*. In addition, minerals in tap water cause scale build-up in humidifiers, which can lead to microbial growth. Distilled water has fewer minerals than tap water, even tap water that has been treated by deionization or reverse osmosis. Be aware that water labeled "purified," "spring," "artesian," or "mineral" is not the same as distilled.

- *Disinfect the humidifier before each use.* Use a brush or other scrubber to remove any scale or film that has formed on the sides of the tank or on interior surfaces (be sure the power cord is unplugged). Follow the manufacturer's suggestions for cleaning products or disinfectants. In the absence of specific recommendations, clean all surfaces with either a bleach solution or a 3% solution of hydrogen peroxide. Rinse the tank thoroughly with sterile or distilled water (not tap water). Because *Legionella* and other bacteria can multiply rapidly in humidifiers
within 24 hours, you should disinfect the humidifier daily (or more frequently if children, older adults, or immunocompromised adults live in the home) if it is used continuously for more than one day.

- *Clean the humidifier at the end of each humidifying season or whenever it will not be used again soon.* Before storage, make sure all the parts are dry. Dispose of used demineralization cartridges, cassettes, or filters. Store the humidifier in a dry location.

- *Take precautions when using demineralization cartridges, cassettes, or filters supplied with or recommended for your humidifier.* While demineralization accessories can help reduce your risk of bacterial growth, the effectiveness of these devices varies widely. Additional research is needed to determine how well and how long these devices work. In addition, these devices can be a breeding ground for *Legionella* and other bacteria if dirt or minerals build up in them. Watch for the appearance of white residue, which would indicate that minerals are not being removed.

The above procedures may need to be modified for console humidifiers. Check the manufacturer’s recommendations for details.

**Humidifiers installed in ventilation ductwork**

Do not install humidifiers in ductwork unless absolutely necessary. If you must have whole-house humidification, take the following precautions:
• *Use a steam humidifier instead of the cold-water type.* *Legionella* cannot survive at the high temperatures at which steam units operate.

• *If cold-water humidifiers must be used, be sure that they don’t use recirculated water but are supplied directly from the cold water plumbing.*

• *Inspect humidifiers for leaks.* Keep them leak-free.

• *Clean humidifiers periodically with bleach or another chlorine-based solution capable of killing bacteria without damaging the humidifier.* Check the manufacturer’s recommendations regarding cleaning procedures and products. In the absence of specific recommendations, use either a bleach solution or a 3% solution of hydrogen peroxide.

**NEW HOME DESIGN AND CONSTRUCTION**

**Hot water recirculation**

Consider designing the plumbing system to circulate hot water continuously. Tiefenbrunner’s study found that homes with hot water recirculation systems were less susceptible to *Legionella* growth than homes without them. The installer must extend the recirculation line to the point farthest from the water heater.
Piping

Consider copper piping instead of plastic or steel. In two studies, copper resisted *Legionella* growth best. Steel was second best. Plastics varied by type, but were generally more prone to *Legionella* growth than was steel. Rubber was worst. Copper also resisted scale and biofilm formation better than other materials.

During construction

The plumbing contractor should keep pipes and fittings clean and dry before installation. Piping will ideally be delivered and stored with end caps to keep dirt and water out until installation. Also, your plumbing contractor can put a chlorine tablet in every length of pipe before installation, which will help disinfect the piping after it is filled with water. These tablets are available from plumbing supply stores.

Water treatment and filtration

Consider a water treatment or filtration system, either for the whole house or on certain faucets and showers, but be careful which one(s) you choose. Some filters block *Legionella* but others actually promote bacteria growth. Whole house filters are discussed briefly above.

Before you occupy the home

Perform a hot water flush as soon as you move in, or a day or two before, even if the plumbing contractor puts chlorine tablets in the pipes. The hot water flush procedure is described above.
WATER SAMPLING

To test for *Legionella*, a water sample is collected into a bottle from a faucet, shower, or hot water tank and the bottle is sent to a laboratory for analysis. A faucet can be sampled also by wiping the inside of the fixture with a swab and having the slime on the swab tested. Laboratory fees for *Legionella* tests are expensive, about US$100-$150 per sample.

Routine sampling of home water is unnecessary, particularly for healthy nonsmoking adults who are at low risk of contracting Legionnaires' disease. However, if a member of your household contracts the disease, you may want to test the water to determine whether the home may have been the source of the *Legionella* that caused it. Also consider testing the home if it is occupied by someone who is immunocompromised.

To properly test a home plumbing system for *Legionella*, at a minimum collect a hot water sample from the faucet or shower that is used most (master bedroom), the kitchen faucet, and the drain of the water heater. If your budget allows it, collect samples from additional faucets or showers, and collect cold water samples also.

If someone in your home contracted Legionnaires' disease, ask your health department if it will provide a *Legionella* test at no charge. If it will not, and if you want to consider testing the home yourself, ask it for a list of laboratories in your country that are qualified to test for *Legionella*. Some countries, including the United Kingdom (http://www.hpa.org.uk/eqa/legionella) and the United
States (http://www.cdc.gov/legionella/elite-intro.htm), have programs that test laboratories on their proficiency in Legionella analysis.

Analyzing water samples for Legionella is a highly specialized process so select a laboratory based on its qualifications, instead of just looking for the lowest price. For a given sample, a highly qualified laboratory may detect Legionella while a less qualified one will not. Don't waste your money on unreliable test results.

In addition to checking qualifications, ask laboratories if they will provide instructions for collecting and shipping samples and interpretation of the test results.

**PROTECTING YOURSELF WHILE GARDENING**

Although the vast majority of reported cases of Legionnaires' disease have been caused by exposure to Legionella-contaminated water, some cases have been contracted in the handling compost or potting soils.

Numerous infections from Legionella-contaminated compost have been documented in Australia and New Zealand, and a few in the United States, Japan, Scotland, and other countries, most from the species longbeachae.

Legionella was found in 33 (73%) of 45 potting soil samples collected in Australia in 1989 and 1990, 26 of which were identified as Legionella longbeachae.

Warnings were issued years ago about the risk of contracting Legionnaires' disease by inhaling dust that gets stirred up while turning over compost or while removing it
from bags. This year, however, doctors concluded that a 67-year-old man, who was described as previously fit and healthy, contracted Legionnaires' through a cut on his hand while working with compost contaminated with *Legionella longbeachae*.

Public health agencies in Australia and New Zealand have recommended the following precautions when dealing with compost:

- Read the warning labels (required in Australia) on bags of compost and potting mix.
- Avoid stirring up dust.
- Avoid inhaling dust.
- Dampen the soil or compost before use.
- Wear a dust mask that fits tightly over the nose and mouth.

After the 2010 report of the case that doctors thought was caused by compost in a hand cut, the Royal Horticultural Society recommended that gardeners wear gloves when handling compost or compost bags. Warning labels on compost bags also recommend wearing gloves.

Whether at home or elsewhere, if you suspect that you are at high risk of contracting Legionnaires' disease because of water quality or your health, you can reduce your risk by using bottled or boiled (boil vigorously for three minutes and set aside to cool) water for drinking and brushing
teeth and, in general, avoiding water splattering, sprays, and mists. In any circumstance, do not panic but take smart steps to reduce your risk and see a doctor if you experience Legionnaires' symptoms.
Bibliography


