

# Healthy Drinking Waters

for

M A S S A C H U S E T T S

Safe and healthy lives in safe and healthy communities

## Lead in Private Drinking Water Wells

**P**riate well owners are responsible for the quality of their drinking water. The U.S. Environmental Protection Agency (EPA) does not regulate private wells. Homeowners with private wells are generally not required to test their drinking water, although local Boards of Health or mortgage lenders may require well water testing. While there is also no state requirement to have your well water tested, the Massachusetts Department of Environmental Protection (MassDEP) recommends that all homeowners with private wells do so, and use a state certified testing laboratory. Homeowners can use the public drinking water standards as guidelines to ensure drinking water quality.

The Maximum Contaminant Level Goal (MCLG) for lead in public drinking water supplies is zero milligrams per liter (parts per million) as established by the EPA. An action level of 15 micrograms per liter or 15 parts per billion (ppb) has been established for drinking water. The standard accounts for average lead exposures from other environmental sources. Nevertheless, since lead has no beneficial health effects, it is advisable to reduce lead in your tap water as much as possible.

### Summary

Lead rarely occurs naturally in drinking water, but has been detected at elevated concentrations in bedrock wells in Massachusetts. It is



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more common for lead contamination to occur at some point in the water pipe, fittings, fixtures, and solder. Lead in the human body can cause serious damage to the brain, kidneys, nervous system and red blood cells. Young children, infants and fetuses are especially vulnerable to lead poisoning. Children under 6 years old should have their blood tested for lead. In addition, if there are children under 6 in the home, arrange to test the drinking water for lead. Test for lead in drinking water by following instructions and procedures provided by a state certified laboratory. If test results indicate the presence of lead, take appropriate steps to identify and eliminate the source(s). Options for treating lead in drinking water include:

- Remove the lead source by replacing old lead pipes, the well pump or other plumbing components containing lead-based solder or brass.



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- Manage the water supply used for drinking and cooking through proper flushing of the pipes.
- Install a home treatment system.
- Use an alternative water source such as bottled water.

The treatment options you select must be based on your specific situation, which include factors such as identifying what part of the plumbing system is contributing the problem, how feasible it is to replace those plumbing sources, the concentration of the lead in the drinking water, whether children are living in the house, etc. Home treatment systems available for treating lead include ion exchange, reverse osmosis, distillation, and activated carbon.

### Potential Health Effects

It has been demonstrated that lead has no benefits to humans or animals. It can be absorbed through the digestive tract and is carried by the blood throughout the body. The severity of the effects of lead poisoning varies depending on the concentration of lead in the body. This concentration can be determined with a blood test.

Although lead has long been recognized as poisonous at high dosages, recent studies show it is damaging at lower levels than previously believed. As a result, maximum lead exposure levels have been lowered. While some effects of lead poisoning may diminish when exposure is reduced or eliminated, others are irreversible. Excess lead in the human body can cause serious damage to the brain, kidneys, nervous system, and red blood cells. Young children, infants and fetuses are particularly vulnerable to lead poisoning. Growing children absorb lead more rapidly, and it can stunt a child's mental and physical development.

Lead in drinking water is usually not the



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predominant source of lead poisoning, but it can increase total lead exposure, particularly the exposure of infants who drink baby formulas and juices mixed with water. On average, about 10 to 20 percent of a child's total lead exposure might come from drinking water. Infants on formula could get 40 to 60 percent of their lead intake from water.

### Indications of Lead

Lead does not noticeably alter the taste, color, or smell of water. The effects of low levels of lead toxicity in humans may not be obvious. There may be no symptoms present or symptoms may be mistaken for flu or other illnesses.

### Sources of Lead in Drinking Water

Lead rarely occurs naturally in water, but can be present in bedrock wells. Elevated concentrations have been detected in wells installed in granitic (amphibole, potassium feldspar, quartz, and sodium feldspar) rock formations.

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Usually, lead contamination in water takes place at some point in the water pipes. This occurs as a result of corrosion—the reaction between the water and lead in parts of the water delivery system. Materials in the water delivery system that may contain lead include old lead pipes, lead-based solder and brass components. Well pumps may also contain brass fittings.

### Corrosivity

Some water sources are naturally more corrosive than others. Several factors cause water to be corrosive including: acidity (low pH), high temperature, low total dissolved solids (TDS) content, and high amounts of dissolved oxygen, carbon dioxide, sodium chloride, hydrogen sulfide, or sulfate. Generally, naturally soft water is more corrosive than hard water because it is more acidic and has low TDS. Softening naturally hard water with an ion exchange unit does not appreciably change the corrosivity of the water, resulting in little, if any, effect on the water's ability to dissolve lead.

### Lead Pipes

Through the early 1900s it was common in some areas of the country to use lead pipes for interior plumbing. Lead piping was also used in the service connections that join residences to public water supplies. Lead piping would most likely be found in homes built before 1930. Copper piping has replaced lead piping, but lead-based solder may have been used to join the copper piping. Plumbing systems installed in homes built before 1988 may contain lead-based solder.

### Brass

Today, brass materials are used in nearly 100 percent of all residential, commercial, and municipal water distribution systems.

Many household faucets, some older pipes, plumbing fittings, check valves and well pumps contain brass parts. Brass contains some lead to make casting easier and the machining process more efficient, however, the lead content of brass plumbing components is now restricted to 8 percent. Even at this low level, lead can leach from new brass faucets and fittings. Some private wells may have submersible pumps containing brass or bronze capable of leaching lead.

### Well Construction

Some well screens also may contain lead or a “lead packing collar.” Potential lead contamination also exists if the well is a driven point well and has been “shot” to clear the screen. Lead shot was sometimes poured into a well to keep out sand. Alternatively, lead wool was also used. None of these practices are recommended.

### Testing for Lead in Private Drinking Water Wells

To determine if lead is present and the possible source, arrange to test your water at a state certified laboratory. It is recommended that you use a state certified laboratory that can detect lead in drinking water at 5 ppb or less. Carefully follow laboratory instructions to avoid contamination and to obtain a representative sample. Home test kits may not provide accurate results.

### First-draw Sample

To evaluate the household's highest level of lead exposure, collect a sample when water has remained stagnant in the plumbing system for six or more hours. This would be the first thing in the morning or in the evening upon coming home from work and school. When collecting the sample, collect the first draw of water from the faucet. Collect the water sample at



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the kitchen cold water tap or other cold water tap used for drinking and cooking purposes. Do not allow any water to run before collecting the sample. This is commonly referred to as the first-draw sample. Because lead will continually dissolve in the water as the water sits in the pipes, the lead concentration in water will increase with time. This is why water drawn after any extended period of non-use will contain the highest lead levels.

### Flushed Sample

Collect a second, flushed sample from the same faucet after the tap has run for one minute at the maximum flow rate when collecting for lead analysis. This is called a flushed sample, which will indicate the lead concentration in water that has not been in contact with the plumbing system for an extended period of time.

### Interpreting Test Results

Interpreting water test results for lead involves considering both the magnitude of the lead concentration in the samples and comparing the first-draw and flushed samples. As discussed earlier, if results show higher levels of lead in the first-draw sample compared to the flushed sample, the lead is likely coming from household plumbing components (lead piping, lead-based solder or brass fixtures and fittings). On the other hand, if test results show nearly equal amounts of lead in both the first-draw and flushed samples, the lead is probably coming from a source outside the house, like the well pump or your well water.

### Reducing Your Exposure to Lead in Your Drinking Water

*If the first-draw sample is much higher than the flush sample (flush sample is below the Federal Drinking Water Standard):*

These water test results indicate the source



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of lead to be within the household plumbing system. When feasible, attempt to identify and eliminate the lead source(s). Anytime the water in a particular faucet has not been used for six hours or longer, flush your cold-water pipes by running the water until it becomes as cold as it will get. This could take as little as five to thirty seconds if there has been recent water use such as showering or toilet flushing. Otherwise it could take two minutes or longer. The more time water has been sitting in your home's pipes, the more lead it may contain. Avoid cooking with or consuming water from hot-water taps, especially for making baby formula. Hot water dissolves lead more readily than cold water.

*If the first-draw sample is the same as the flush sample:*

These water test results indicate the source of lead goes beyond the household plumbing. If the source of water is a private well, check both

the well components and the pump for potential lead sources. A registered well contractor may be able to help you locate the potential source of lead. If the source of water is a public water system, contact the water supplier and ask what steps can be taken to deal with the lead contamination. Public water suppliers are responsible for replacing water distribution lines from the main service to curb only. The property owner is responsible for line replacement from the curb to house.

### Treat for corrosivity

In addition to identifying potential lead sources, consider the corrosivity and pH of the water. Raising the pH to a more neutral range of 6.5 – 8.5 can reduce the leaching of metals, including lead, from the plumbing system. Another practice which may contribute to increased corrosion is the grounding of electrical equipment (including telephones) to water pipes. Electric current traveling through the ground wire accelerates the corrosion of lead in the pipes. In this case, a qualified electrician should be consulted.

If at all possible and cost-effective, eliminate the source of lead in your water distribution system. If that is not possible, and flushing the pipes is not a sufficient management option, consider home treatment systems or an alternative drinking water source such as bottled water.

If you have naturally occurring lead in your well water, flushing will not be effective, and a home treatment system will be necessary.

### Home Treatment Systems

There are several treatment methods suitable for removing lead from drinking water, including reverse osmosis, distillation, activated carbon filters specially designed to remove lead, and ion exchange (capable of removing 20 – 90%). Typically these methods are

used to treat water at only one faucet (point of use). Reverse osmosis units can remove approximately 85 percent of the lead from water. Distillation can remove approximately 99 percent. An ion exchange can be used with either a reverse osmosis or distillation unit when water is excessively hard (high in calcium and magnesium) or high in dissolved iron and manganese. Low flow rates are required when using lead selective carbon filters. Typically they have flow controllers that limit the system to 0.25 to 0.5 gallons per minute.

When choosing a treatment method, consider both the initial cost and the operating costs. Operating costs include the energy needed to operate the system, additional water that may be needed for flushing the system, consumable supplies and filters, repairs, and general maintenance.

Regardless of the quality of the equipment purchased, it will not perform satisfactorily unless maintained in accordance with the manufacturer's recommendations. Keep a log book to record equipment maintenance and repairs. Equipment maintenance may include periodic cleaning and replacement of some components. Also consider any special installation requirements that may add to the equipment cost.



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### Resources

#### UMass Extension

This fact sheet is one in a series on drinking water wells, testing, protection, common contaminants, and home water treatment methods available on-line at the University of Massachusetts website:

[http://www.umass.edu/nrec/watershed\\_water\\_quality/watershed\\_online\\_docs.html](http://www.umass.edu/nrec/watershed_water_quality/watershed_online_docs.html)  
and Cape Cod Cooperative Extension:  
508-375-6699  
<http://www.capecodextension.org>

#### MA Department of Environmental Protection, Division of Environmental Analysis

Offers assistance, information on testing and state certified laboratories: 617-292-5770  
For a listing of MassDEP certified private laboratories in Massachusetts:  
<http://www.mass.gov/dep/service/compliance/wespub02.htm>

#### U.S. Environmental Protection Agency, New England Office

Information and education on where drinking water comes from; drinking water testing and national laws; and how to prevent contamination:  
<http://www.epa.gov/ne/eco/drinkwater>

#### US Environmental Protection Agency

For a complete list of primary and secondary drinking water standards:  
<http://www.epa.gov/safewater>

#### MA Department of Conservation and Recreation, Division of Water Supply Protection

Maintains listing of registered well drillers, information on well location and construction: 617-626-1409  
<http://www.mass.gov/dcr/waterSupply/welldrill/index.htm>

#### NSF International

The NSF International has tested and certified treatment systems since 1965. For information on water treatment systems: 800-NSF-MARK (800-673-6275)  
<http://www.nsf.org/consumer/>

#### Water Quality Association

The Water Quality Association is a not-for-profit international trade association representing the household, commercial, industrial, and small community water treatment industry. For information on water quality contaminants and treatment systems:  
<http://www.wqa.org>



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