

## Private Water Well Analysis

Groundwater is a resource found under the earth's surface. Most groundwater comes from rain and melting snow soaking into the ground. Water fills the spaces between rocks and soils, making an "aquifer". About half of our nation's drinking water comes from groundwater. Most is supplied through public drinking water systems, but many families rely on private, household wells and use groundwater as their source of fresh water.

If your drinking water comes from a household well, then you are on a private water supply. Federal and Oklahoma governments do not regulate privately-owned wells in Oklahoma; however, the Oklahoma Department of Environmental Quality and other entities provide education and technical support to private well owners on appropriate testing. You, the private well owner, are responsible for assuring your water is safe and of adequate quality for your needs. Even if you currently have a safe water source, regular testing can be valuable. For this reason, routine testing for a few of the most common contaminants is highly recommended.

This fact sheet explains some of the most common testing that is performed for private water supplies, as well as sampling and testing actions. The results provided will help establish a baseline for the current quality of your drinking water that can help diagnose future changes in water quality. This guidance will assist you with interpreting the results effectively from our Water Wellness test panel that includes chloride, conductivity, copper, hardness, iron, lead, manganese, nitrate/nitrite, pH, sodium, and sulfate. The Water Wellness test panel has been designed to provide the most benefit to a well owner and will aid in addressing the aspects of human health, oil and gas related contamination, possible treatment recommendations, corrosivity, bacteriological species indicators, and aesthetics.

**Note that the Water Wellness panel does not include all of the Environmental Protection Agency (EPA) primary and secondary drinking water standard parameters.**

Testing is recommended if there are known problems with the groundwater or drinking water in your area, or if conditions near your wells have changed significantly (flooding, land disturbances, or new construction or industrial activity). Other reasons to test your well water are if there has been repairs on the well system or if you notice a change in your water quality (i.e., odor, color, taste).

### Interpreting Your Results

Test results should be compared against the current EPA maximum contaminant levels (MCLs) and secondary standards (SMCLs) for each result.

EPA has established MCLs for certain contaminants which, when present at excessive levels, may have an adverse effect on human health. MCL concentrations are the highest concentration of a contaminant allowed in drinking water.

**Note that not all contaminants have MCLs.**



EPA has also established National Secondary Drinking Water regulations for some contaminants that can make the appearance, taste or odor of drinking water less pleasing to a consumer. These SMCLs are neither mandatory nor enforceable but can assist public water supply systems with managing their drinking water for aesthetic considerations. They are not considered to present a risk to human health in concentrations at or below the SMCL

The units of measurement for most of these standards are reported either in micrograms per liter ( $\mu\text{g/L}$ ) or milligrams per liter ( $\text{mg/L}$ ).  $\mu\text{g/L}$  and  $\text{mg/L}$  are equivalent to the units part per billion (ppb) and part per million (ppm), respectively. To convert the units, multiply the value measured in  $\mu\text{g/L}$  or ppb by 1000 to calculate for  $\text{mg/L}$  or ppm. Inversely, divide the value measured in  $\text{mg/L}$  or ppm by 1000 to calculate the measurement in  $\mu\text{g/L}$  or ppb. Tests with concentration results below that lab test's lowest reportable value are indicated by a "<" (less than symbol) followed by that test's lowest level that can be reported. In such cases, it means no significant concentration of the contaminant was detected in the sample.

## Copper

Copper is a naturally occurring metal found in rock, soil, water, and sediment. Pure copper is red-orange but becomes blue-green when exposed to air and water. For centuries, humans have used it to produce copper alloys including brass and bronze. Today, copper is widely used in the production of many items including pennies, electrical wiring, and plumbing materials such as household water pipes.

The major source of copper in drinking water is corrosion of household plumbing, faucets, and water fixtures. Water absorbs copper as it leaches from plumbing materials such as pipes, fittings, and brass faucets. The amount of copper in your water depends on the types and amounts of minerals in the water, how long water stays in the pipes, the water temperature and acidity.

## Lead

Lead can enter drinking water when plumbing materials that contain lead corrode, especially where the water has high acidity or low mineral

content that corrodes pipes and fixtures. The most common sources of lead in drinking water are lead pipes, faucets, and fixtures. In homes with lead pipes that connect the home to the water main, also known as lead services lines, these pipes are typically the most significant source of lead in the water. Lead pipes are more likely to be found in older cities and homes built before 1986. Among homes without lead service lines, the most common problem is with brass or chrome-plated brass faucets and plumbing with lead solder.

## Nitrate/Nitrite

Nitrates are present in sewage, animal manure, soil, and fertilizers. It can contaminate a private well through groundwater movement, surface water seepage, and water run-off. The maximum allowable level for nitrate in a domestic well, a public water supply, or other primary source of drinking water is 10  $\text{mg/L}$ . Nitrates are of particular concern to pregnant women and infants under six months old since drinking water high in nitrates may cause Methemoglobinemia (Blue Baby Syndrome). Nitrates are typically of little concern for adults or older children. This contaminant cannot be removed or reduced by boiling; boiling will increase the concentration of nitrate in the water. The treatment options for removing nitrates include reverse osmosis, ion exchange filtration, and distillation.

## Chloride

The recommended upper limit for chloride is 250  $\text{mg/L}$ . Concentrations greater than 250  $\text{mg/L}$  can give a salty taste to the water, kill vegetation, and cause increased blood pressure.

## Iron

Iron is a naturally occurring drinking water contaminant that can cause poor taste and odor issues and can be associated with discoloration that leads to staining of fixtures, dishes, and laundry.

Iron makes up at least 5% of the Earth's crust. That means there are plenty of opportunities for rainwater to pick up iron as it seeps across soil and through layers of rock that may contain this metallic element. This water ends up in aquifers, lakes, rivers and other sources of municipal water supplies and private wells.

## Manganese

Manganese is a common, naturally occurring mineral found in rocks, soil, groundwater, and surface water. Manganese is a natural component of most foods. Manganese is an essential nutrient, and eating a small amount of it each day is important to stay healthy.

## pH

pH reflects the acidity or basicity of water. This measurement has a range from 0 to 14 standard units (SU). A pH of 7 is neutral; any value below 7 is considered acidic and values higher are basic. The optimum range for pH in drinking water is between 6.5 to 8.5 SU. Water with a pH below 6.5 is corrosive and can damage plumbing fixtures or leach metals from pipes and solder. Water with a pH above 8.5 creates conditions where calcium carbonate may precipitate out and clog water lines. If the pH is too high or low, the water may not be suitable for your lawn, garden, or houseplants.

## Sulfate

Sulfate is a mineral that occurs naturally in drinking water. The recommended maximum for sulfate is 250 mg/L. Excessive concentrations of sulfate may act as a laxative to unaccustomed consumers. A bitter or medicinal taste is often associated with high sulfate concentrations.

## Conductivity

Conductivity is typically reported in units of  $\mu\text{mhos/cm}$  and is a measure of the ability of water to conduct an electrical current. Some level of conductivity is normal in well water. Conductivity increases with increasing amounts of certain ions such as chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium and iron. Elevated conductivity beyond usual baseline levels can be an indicator of water pollution, typically caused by oil and gas activity or road runoff. There is no EPA MCL for conductivity.

In general, water having a conductivity of less than 1,000 microohms is slightly mineralized but should be suitable for human consumption. Depending on the minerals dissolved in the water, it may have some hardness as well as issues with odor and taste. These problems may become more pronounced with increasing conductivity

to the extent that levels greater than 2,000 microohms may make the water objectionable to human use.

## Hardness

Hardness is the measurement of dissolved magnesium and calcium in water. Hardness can increase through contact of water with natural accumulations of salts in soil and geological formations, primarily limestone, dolomite and gypsum. It is reported as mg of calcium carbonate per liter (mg/L). Water hardness can be expressed in four ways:

- Soft – less than 60 mg/L
- Moderately Hard – between 60 and 120mg/L
- Hard – between 120 and 180 mg/L
- Very Hard – greater than 180 mg/L

Water hardness varies throughout Oklahoma. In areas where the water is relatively hard, users of well water might have to use a water softener to reduce hardness. Excessive hardness may cause laundering difficulties, produce scale build-up, and shorten the life of appliances. Scale build-up, caused by long-term movement of hard water through pipes, can reduce the inside diameter of your pipes. This will gradually restrict water movement through the pipe and lowers water pressure.

## Sodium

Sodium is the sixth most abundant element on Earth and is widely distributed in soils, plants, water, and foods. Most of the world has significant deposits of sodium-containing minerals. Sodium ion is ubiquitous in water because of the high solubility of many sodium salts. Groundwater typically contains higher concentrations of minerals and salts than do surface waters. Sodium is present in road deicing chemicals, in water treatment chemicals, in domestic water softeners, and in sewage effluents. These uses contribute significant quantities of sodium to water. At the present time the EPA guidance level for sodium in drinking water is 20 mg/L. This value was developed for those individuals restricted to a total sodium intake of 500 mg/day and should not be extrapolated to the entire population.

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If you have additional concerns or questions, or if you are experiencing other problems which you feel may affect your water, contact the DEQ's State Environmental Laboratory at (405) 702-1000 or (866) 412-3057, or email [selsd@deq.ok.gov](mailto:selsd@deq.ok.gov), to discuss your needs and testing options, and to coordinate additional well water testing.

## Additional Information

Visit our webpage at <https://tinyurl.com/3msajd66> for additional information.

Home Water Testing FAQ has additional information about private wells, well testing, recommended tests, and private water treatment options.

Laboratory Service Fees contain current pricing for analytical services.

## Sources

EPA: Drinking Water from Household Wells <https://tinyurl.com/fjs3s7tc>

Analyte	Sources	When to Test	Acceptable Ranges	EPA Classification
Copper	Corrosion of household plumbing, fixtures or service lines that contain copper; erosion of natural deposits; surface water runoff and soil seepage.	<ul style="list-style-type: none"> <li>Household plumbing or service lines that contain copper</li> <li>Stained plumbing fixtures, laundry</li> </ul>	< 1.3 mg/L*	Primary MCLs
Lead	Corrosion of household plumbing, fixtures, or service lines that contain lead; erosion of natural deposits.	<ul style="list-style-type: none"> <li>Household plumbing or service lines contain lead</li> <li>Corrosion of pipes, plumbing</li> <li>House was built before 1986</li> <li>Pregnant, nursing, or infant person in household</li> </ul>	< 0.015 mg/L*  Health-Based Goal: 0 mg/L	
Nitrate	Runoff from agricultural areas, neighborhood lawns, livestock operations; sewage, septic fields	<ul style="list-style-type: none"> <li>Pregnant or nursing person in household</li> <li>Infant &lt; 6 months old in household</li> <li>Nearby agricultural area, livestock operations or live in areas with high lawn fertilization rates</li> </ul>	< 10 mg/L	
Nitrite	Runoff from agricultural areas, neighborhood lawns, livestock operations; sewage, septic fields	<ul style="list-style-type: none"> <li>Pregnant or nursing person in household</li> <li>Infant &lt; 6 months old in household</li> <li>Nearby agricultural area, livestock operations or live in areas with high lawn fertilization rates</li> </ul>	< 1 mg/L	

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Analyte	Sources	When to Test	Acceptability Range	EPA Classification
Chloride	Oil and gas activity or injection wells; runoff from road salt; water softener	<ul style="list-style-type: none"> <li>Water tastes salty</li> <li>Nearby oil and gas activity</li> <li>Water kills vegetation</li> </ul>	< 250 mg/L	Secondary MCLs
Iron	Naturally occurring mineral found in rocks, soil, groundwater, and surface water; corrosion of household plumbing or service lines that contain iron	<ul style="list-style-type: none"> <li>Water is red, brown, orange or yellow</li> <li>Water leaves red, brown, orange or yellow stains</li> <li>Water tastes metallic</li> <li>Water smells musty, septic or earthy</li> <li>Water softener needed to treat hardness</li> <li>Stained plumbing fixtures or clothing</li> </ul>	< 0.3 mg/L	
Manganese	Naturally occurring mineral found in rocks, soil, groundwater, and surface water	<ul style="list-style-type: none"> <li>If water softener is needed to treat hardness</li> <li>Stained plumbing fixtures, laundry</li> <li>Black stains in toilets</li> </ul>	< 0.05 mg/L	
pH	Hydrogen ions, which can occur during the natural breakdown of water molecules, are measured to indicate the acidity or basicity of water	<ul style="list-style-type: none"> <li>Household plumbing or service lines that contain lead</li> <li>Corrosion of pipes, plumbing</li> <li>Dump, junkyard, landfill, factory, gas station or dry-cleaning operation nearby</li> <li>Rapid wear of water treatment equipment</li> <li>Metallic-bitter taste</li> </ul>	6.5-8.5	
Sulfate	Naturally occurring mineral found in rocks, soils, groundwater and surface water; industrial processes; agricultural runoff	<ul style="list-style-type: none"> <li>Nearby oil and gas activity</li> </ul>	< 250 mg/L	

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Analyte	Sources	When to Test	Acceptability Range	EPA Classification
Conductivity	Dissolved salts and minerals	<ul style="list-style-type: none"> <li>Nearby oil and gas activity</li> </ul>	< 1,000 µmhos/cm	No Limits Set by EPA; All Ranges are Suggestions Only
Hardness	Erosion of natural deposits	<ul style="list-style-type: none"> <li>Scaly residues, soaps don't lather</li> <li>Spots on dishes</li> <li>Damage to hot water heaters, dishwashers, and cloth washers</li> <li>Scaly residues</li> </ul>	Results in mg/L: Soft: 0-60 Moderately Hard: 60-120 Hard: 120-180 Very Hard: > 180	
Sodium	Naturally occurring mineral found in rocks, soil, groundwater, and surface water; water softener	<ul style="list-style-type: none"> <li>Water tastes salty</li> <li>Individuals on restricted diets due to high blood pressure</li> <li>Nearby oil and gas activity</li> </ul>	< 60 mg/L	

\*These values are known as “action levels” for public water systems. If more than 10% of samples exceed the action levels, public water systems must take additional treatment steps. Although the action levels were determined based on economic considerations, EPA’s health-based goal for lead in drinking water is zero.