

Well Water Testing and Understanding the Results



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Priate well owners are responsible for making sure their well water is safe to drink. Private drinking water wells are not required to be tested on a routine basis like public water supplies. Many substances that can be found in well water and can affect drinking water quality have no taste, color, or smell. The only way to know if they are present is to have your water tested each year.

WHAT'S THE DIFFERENCE BETWEEN PUBLIC AND PRIVATE WATER SUPPLIES?

If your water comes from a public or municipal water system, it is tested regularly for contaminants regulated by federal and state standards, such as pathogens, radioactive elements, and certain toxic chemicals. Each municipality is required to provide a Consumer Confidence Report or Drinking Water Quality Report.

Private water supplies include wells, springs, and cisterns. The home owner/well owner is responsible for assuring the water is safe for potable use. Routine testing for common contaminants is highly recommended. Even if you have a safe water supply, regular testing can be valuable as it establishes a record of water quality. If your water quality changes, you can address it; and if someone damages your water supply, your records can demonstrate the historical water quality which may help you in your efforts to correct the impaired water supply.

WHY SHOULD YOU TEST YOUR WELL WATER?

Because no one else will. Regular testing helps to protect you and your family's health and protects the financial investment you have in your home. The only reliable way to detect contaminants in your water is to test it. Laboratory testing provides you with information on the quality of your well water.

WHEN SHOULD YOU TEST YOUR WELL WATER?

In addition to yearly testing, as a private well owner you should have your drinking water tested whenever:

- You notice a change in the taste, odor, or color of your water
- Before buying or selling a home with a private well
- Before installing any type of water treatment system

Because of differences in groundwater quality throughout Arizona, it is best to check with your drinking water agency or local health department for information to help you determine what to test for, as there may be local pollution issues that influence your drinking water quality. The most common times to test your well water quality are when buying a home or experiencing problems. See Table 1:

Table 1. Recommended drinking water tests for various conditions of (or nearby activities to) the source.

Conditions or Nearby Activities	Recommended Test
Recurrent gastro-intestinal illness	Coliform bacteria
Household plumbing contains lead	pH, lead, copper
Radon in indoor air or region is radon rich	Radon
Scaly residues, soaps don't lather	Hardness
Water softener needed to treat hardness	Manganese, iron
Stained plumbing fixtures, laundry	Iron, copper, manganese
Objectionable taste or odor	Hydrogen sulfide, corrosion, metals
Water appears cloudy, frothy, or colored	Color, detergents
Corrosion of pipes, plumbing	Corrosion, pH, lead
Rapid wear of water treatment equipment	pH, corrosion
Nearby areas of intensive agriculture	Nitrate, pesticides, coliform bacteria
Coal or other mining nearby	Metals, pH, corrosion
Gas drilling operation nearby	Chloride, sodium, barium, strontium
Odor of gasoline or fuel oil, and near gas station or buried fuel tanks	Volatile organic compounds (VOC's)
Dump, junkyard, landfill, factory, or dry-cleaning operation nearby	VOC's, total dissolved solids (TDS), pH, sulfate, chloride, metal
Salty taste and seawater, or a heavily salted roadway nearby	Chloride, TDS, sodium

HOW DO YOU COLLECT A WATER SAMPLE FOR TESTING?

1. Water samples must be collected in a sterile container. The best option is to obtain a container from the laboratory that will be analyzing your water.
2. Water samples should be collected at the wellhead (if possible), after a water treatment device, and at the tap (choose an inside cold water line). Remove any aerators, flow restrictors, or screens. DO NOT CHOOSE a faucet that is connected to a water treatment device (water softener, reverse osmosis unit, distiller, for example) or one that swings or leaks. HINT: The bathtub faucet is a good spot to obtain your sample.
3. Sterilize the faucet by flaming the end of the tap with a disposable butane lighter. Keep in mind that by sterilizing the faucet with a flame, you could be removing a source of bacterial contamination. NOTE: extreme care should be used when using an open flame to accomplish this procedure.
4. Allow the water to run for 2-5 minutes. This clears the lines of stagnant water and brings in fresh water for a more accurate test sample.
5. Fill the sterile container to the overflowing limit or "fill line" indicated on the collection bottle. Be careful not to touch the inside of the container, sample container lid or top, or the faucet with your fingers.
6. Refrigerate samples promptly. NOTE: Do not freeze samples. It is best if the samples arrive at the laboratory within 6 hours of collection, but some laboratories allow for up to 12 hours. Remember to put the sample in an ice chest with ice when transporting it to the laboratory. Many labs will not accept samples

on Friday, so confirm the schedule with the laboratory before taking the sample. Water tests for contaminants other than coliform bacteria may allow for a longer delivery time to the laboratory. Mailing water samples that are to be tested for bacteria is not recommended as the results are not reliable because the time delay gives any bacteria present time to grow and multiply.

7. Write down the collection date, time, and location for each sample so that you can provide this information to the testing laboratory.

WHAT ARE MY CHOICES FOR WELL WATER TESTING?

STATE-APPROVED LABORATORIES

Private well owners should have their water tested each year at a certified laboratory that has been "approved" by the State of Arizona. It is important that you have your water tested at a state approved lab, as these labs are following accepted procedures for testing your water. The Arizona Department of Health Services, Bureau of State Laboratory Services, is responsible for certifying water-testing facilities in Arizona [contact information: 3443 N. Central Avenue, Suite 810, Phoenix, AZ 85012-2208; (602) 255-3454; (602) 255-3463 FAX; <http://azdhs.gov/lab/index.htm>]. There is more information on water testing labs described in the Arizona Cooperative Extension fact sheet Laboratories Conducting Soil, Plant, Feed, or Water Testing (AZ1111).

TEST KITS

Private well owners have at their disposal numerous types of water testing kits that can be readily purchased for basic water quality analysis. Most of these kits rely on color changes in either paper strips or liquid solutions. When a water contaminant is exposed to a specific chemical reagent, a characteristic color develops. Most testing kits provide complete instructions



and easy-to-follow steps. Deviating from them usually results in erroneous data so it is important to follow manufacturer instructions. Other kits may only provide “negative” or “positive” results, in which case it is necessary to know the contaminant level that determines the outcome.

Testing kits have several limitations when compared to many U.S. Environmental Protection Agency (EPA) approved methods used in laboratories, and these include:

- high contaminant detection limits (may or may not detect contaminants at or below drinking water standards);
- limited or narrow contaminant detection range;
- testing method and/or shortcuts used may or may not be EPA approved;
- poor or insufficient precision and/or accuracy;
- results may be influenced by the presence of other water contaminants; and
- user error.

On the other hand, these kits can serve private well owners well when:

- using kits to routinely monitor your well and to highlight when a more accurate analysis may be required; and
- using kits from reputable companies that offer a certification or approval for use from the EPA.

There are several companies that provide water-testing kits with varying degrees of sophistication. These vary from simple paper strips to portable colorimeters that also require multiple reagent mixing steps. You should use kits that are EPA certified. Avoid testing kits from companies that also sell water treatment devices. Examples of independent companies that sell many types of water-testing kits include Hach®, Lamotte®, EM Quant®, WaterWorks®, Ben Meadows, Forestry Suppliers, and Gempliers (no endorsements implied).

WHAT IS THE COST OF WELL-WATER ANALYSIS?

STATE-APPROVED LABORATORIES

Laboratory fees for water quality analysis vary greatly from one parameter to another. For example, testing for hardness, TDS, and pH may cost about \$50. Testing for lead or nitrate may cost about \$30. However, testing for all possible individual pollutants can cost more than \$2500 per sample. Contact the Arizona Department of Health Services to obtain a list of certified labs. From the list that they give you, you can call several labs to establish current prices. Refer to fact sheet Laboratories Conducting Soil, Plant, Feed, or Water Testing (AZ1111) for more information on laboratories.

TEST KITS

The price of these kits ranges from a few dollars to thousands depending on the degree of precision and accuracy, number of tests, and automation that you want. Since most tests are based on color, results may be read directly using color strips or by using sophisticated portable colorimeters that can cost over \$1000. This initial investment may be worth the money depending on the number of samples, types of tests, and data quality desired.

HOW DO YOU INTERPRET YOUR TEST RESULTS?

After your water has been tested at a state licensed laboratory, you will receive the test results in the mail. Each laboratory report looks different. However, for each substance that was tested, the amount of that substance found in the water sample should be reported. You can compare the amount detected in your water sample with the drinking water standard that is set by the U.S. EPA for public water supplies. A drinking water standard is the maximum contamination level (usually expressed as a concentration) in a public drinking-water supply, designed to protect human health. Often times, the lab report will list the standard for each substance tested on the report. For more information on water quality standards, see the Arizona Cooperative Extension fact sheet, Drinking Water Standards (AZ1009), or visit EPA's website <http://www.epa.gov/safewater/standards.html>.

Most substances in water are measured and reported as a concentration. Depending on the substance, the results may be reported as:

- Part per million (ppm) = milligram per liter of water = mg/L
- Part per billion (ppb) = microgram per liter of water = µg/L
- CFU/100 mL = colony-forming unit per 100 mL of water

In addition, the lab will often report the minimum detection limit for each substance tested. This is the minimum amount of a particular substance that can be detected in the sample using the equipment and testing procedures that the lab follows. Other items that may be included in the report include:

- **Nitrate** – high levels of nitrate can cause a potentially fatal condition in infants called methemoglobinemia, or blue baby syndrome.
- **Microorganisms** – microorganisms in your water can cause a range of gastrointestinal illnesses including dysentery and cholera. Typically, total coliform, fecal coliform, or Escheria coli are the bacterial tests that indicate the microbiological quality of water.
- **pH** – although pH is not a primary drinking water standard (those that cause health problems), it can impact color, taste, and odor and thus is known as a secondary drinking water standard (contributes to the aesthetics of the water). On a scale of 1 to 14, the pH number measures acidity (1-6), neutrality (7), or alkalinity (8-14). A standard range is 6.5-8.5, and beyond that the water is considered corrosive.
- **Total dissolved solids (TDS)** – TDS is also a secondary drinking water contaminant, and its standard is 500 ppm. High levels of TDS can make water taste bad, cause hard water deposits, and reduce the effectiveness of soaps and detergents. Total dissolved solids may include organic matter, filterable residue of dissolved materials, and inorganic salts. Principal salts include calcium, magnesium, carbonates, bicarbonates, chlorides, and sulfates, with traces of iron, manganese, and other substances.

If you live on or near an agricultural area, you may want to consider additional tests for pesticides (herbicides, insecticides, fungicides). If you live near past or present mining operations, you may want to consider testing for metals. Mine tailings can leach harmful metals into the groundwater. Organic chemicals used in some businesses, such as dry-cleaning businesses, can also present a risk to your water quality. There are additional tests that are available to you upon request of a laboratory.

Table 2. General testing frequencies for selected drinking water tests.

Test	Frequency
Lead. If you suspect your home plumbing contains lead in materials, fittings, or lead solder.	Immediately.
Coliform bacteria, nitrate, pH, and TDS.	Once each year. Spring and summer testing is preferred, after rainy season. Also test after repairing or replacing an old well, pipes, or installing a new pump or system components. If a new baby is expected, test for nitrate immediately, then every six months until child reaches one year of age.
Sulfate, chloride, iron, manganese, hardness, and corrosion	Every three years.

HOW FREQUENTLY SHOULD YOU GET YOUR WATER TESTED?

Testing frequencies in Table 2 are general guidelines. If you suspect there is a problem with water quality, test immediately. If any of the tests produce positive results, contact your county health department or call the Safe Drinking Water Hotline for more information (800-426-4791).

SUMMARY

The important part about interpreting your test results is whether or not the substance is considered a health threat at the particular concentration found in your water sample. Compare your water test results to EPA's standards and consult the fact sheets mentioned above. For help interpreting your test results, contact your state or local drinking water agency, or County Cooperative Extension Office.

WEB RESOURCES

- Arizona Department of Environmental Quality: <http://www.adeq.state.az.us/environ/water/index.html>
- Arizona Department of Health Services: <http://www.hs.state.az.us>; Bureau of State Laboratory Services: <http://www.azdhs.gov/lab/license/env.htm>
- Arizona Department of Water Resources Well Owner's Guide: http://www.water.az.gov/adwr/Content/Publications/files/well_owners-guide.pdf
- USDA-CSREES National Water Program: <http://www.usawaterquality.org/themes/health/default.html>
- USEPA: <http://www.epa.gov/safewater/>

FOR ADDITIONAL INFORMATION

Arizona Cooperative Extension (ACE) bulletins contain a variety of information about water, water quality, safe drinking water, and private wells. They are available through your county Extension office or from CALSmart Distribution Center, located in Tucson, at 4101 N. Campbell Avenue; (877) 763-531; (520) 795-8508 FAX; or visit <http://ag.arizona.edu/pubs/>

SOURCES

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- Blue Baby Syndrome at Environmental Health Perspectives. Available at <http://www.encyclopedia.com/doc/1G1-65640291.html>. Accessed 27 June 2008.
- Home Water Testing, Office of Water, EPA, WH-550A, EPA 570/9-91-500, June 1991.