



UNIVERSITY OF
GEORGIA
EXTENSION

UGA EXTENSION

Revised by UTTAM SAHA
PAMELA TURNER
LETICIA SONON
JAKE MOWRER
DAVID KISSEL

ORIGINAL MANUSCRIPT BY
JORGE H. ATILES
PAUL F. VENDRELL

TESTING FOR WATER QUALITY

When you pour yourself a glass of water to drink, it may appear clean, taste good, and you may expect it to be safe. However, many sources of water we assume are safe may contain dissolved minerals, organic compounds or even live organisms at harmful concentrations. Contaminated water used for drinking and cooking may affect your health. Also, high concentrations of certain minerals in your water can result in quality issues such as unpleasant taste and odors or staining of bathroom fixtures and/or laundry.

In 2009, the U.S. Geological Survey (USGS) released a report on test results of private well water from 30 of the nation's 62 principal aquifers across the United States. Important findings were:

- one of every five private wells contained one or more contaminants at concentrations exceeding the U.S. Environmental Protection Agency's (EPA) human health benchmarks
- approximately half of all wells had at least one problem
- a third of all wells had microbial contamination

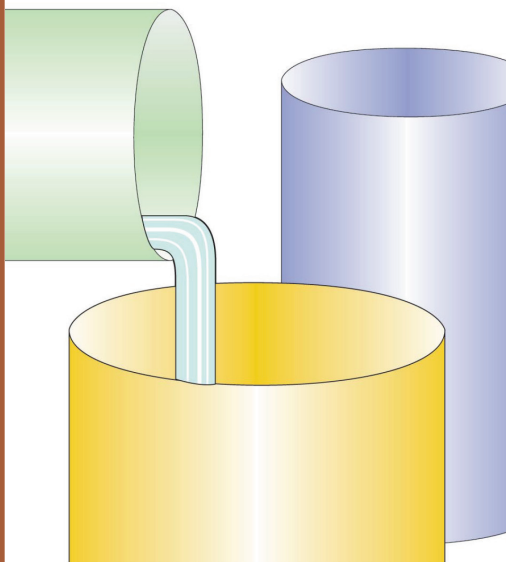
The quality and safety of drinking water is of great concern to many Americans today because of an increased interest in health and environmental quality. This new focus on water quality has led many Americans to consider testing their water. This publication is intended to help you understand water testing and to identify the tests needed.

WATER TESTING FOR PUBLIC WATER SUPPLIES

A Public Water System (PWS) is one that has at least 15 service connections or serves at least 25 people per day for at least 60 days of the year. If you receive drinking water from a PWS, the source of drinking water is either a surface water reservoir, a public well that pumps groundwater, or both. A system of pipes distributes the water to you and your neighbors. When your home is on a PWS, there are fewer concerns about water quality and safety because they are routinely tested and treated (if needed) for potential contaminants according to the EPA "Safe Drinking Water Act (SDWA)-1974."

The Environmental Protection Division (EPD) of Georgia ensures that all public water systems in the state continuously meet SDWA standards. Occasionally, problems such as spills, floods or treatment malfunctions do prevent the PWS from meeting water quality standards. Consumers are notified immediately of such violations and advised if any corrective actions (such as boiling water) are required. In 1996, Congress amended the SDWA, requiring PWSs to begin providing annual drinking water quality reports to customers beginning in 1999. The report is referred to as Consumer Confidence Report (CCR). If you have not received your CCR, you may request it by contacting your water utility company.

The CCR is usually based on the source water at the treatment plant. It is possible that water meets SDWA standards when it leaves the public water treatment plant but does not meet those standards by the time it reaches your kitchen or bathroom sink. For example, water can pick up lead from lead solder found in homes with plumbing installed before 1987 or from lead pipes found in very old homes. You may want to test your household water even if it comes from a PWS if there is a possibility of in-house contamination due to your home's plumbing, connections or treatment system.



HOUSEHOLD
WATER
QUALITY
SERIES

2

WATER TESTING FOR PRIVATE WATER SUPPLIES

Government agencies do not monitor or regulate water quality in private wells, and water testing is not required by any federal or state regulation. If you are one of the 1.7 million Georgians with a private well, you are responsible for the quality and safety of your well water. Testing your well water quality is important to your health. Properly constructed and maintained water wells can provide many years of trouble-free service. However, surface contaminants may enter the well if it is not properly constructed and maintained, and the well may eventually deteriorate or become damaged as it gets older. In addition, some groundwater naturally contains one or more chemical substances at levels above the EPA's health-based standards, called the Maximum Contaminant Levels (MCLs). The taste, odor and appearance of your drinking water can give you an indication of its quality, but it does not indicate if the water is really safe or unsafe to drink. Contaminated water can taste and smell fine, whereas unpleasant-tasting or -smelling water can be safe to drink or use. Many of the most serious problems can only be detected through laboratory testing of the water.

TYPES OF WATER QUALITY TESTS

In general, water testing can be classified as bacterio-logical, mineral/inorganic and organic chemicals tests.

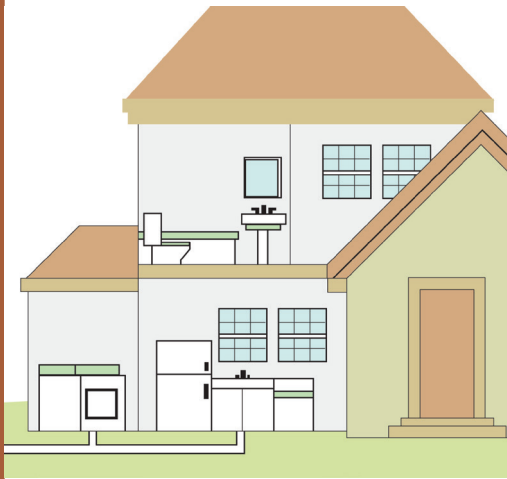
- **Bacteriological tests** generally check for indicator bacteria (for example, total coliform, fecal coliform or *Escherichia coli*) and can indicate the presence or absence of disease-causing bacteria. However, there are many types of bacteriological tests that cover a variety of bacteria. These tests are costly and are conducted only if they are absolutely essential.
- **Mineral tests** can determine if the mineral content of your water is high enough to affect either health or the aesthetic and cleaning capacities of your water. A mineral test may include calcium, magnesium, manganese, iron, copper, zinc and some others. An abundance of these minerals can cause hard water, plumbing and laundry stains, or bad odors.
- **Organic chemicals** tests are generally performed only if there is reason to believe a specific contaminant has infiltrated the water system (such as pesticides entering the water supply). Industrial and petroleum contamination can also be found through organic chemical testing.
- **Other tests** may be conducted on radiological contaminants (radium and radon) or heavy metals (such as arsenic, mercury, lead or cadmium) based on the suspected natural and anthropogenic (man-made) sources of such contaminants.

WHEN SHOULD I TEST MY WELL WATER?

After construction of a new well or when an unused old well is brought back to service, make sure that the water is safe to drink. Consult a drinking water specialist at a water testing laboratory, local health department or your local county Extension agent to get information about the local contaminants of concern. Water quality remains fairly stable if the well is properly constructed and maintained. Even if your current water supply is clean and safe to drink, regular testing is important because it establishes a record of water quality that may help solve future problems. It is also necessary to regularly check the well for potential mechanical problems (improper well construction and/or poor soil filtration), especially in late winter or early spring after a heavy rainstorm. Test the water once each year for total coliform bacteria, nitrates, total dissolved solids and pH levels. If you suspect other contaminants, you should test for those as well. In contrast, the quality of water in defective wells may change suddenly and remain unnoticed as the water may look, smell and taste the same. More frequent testing and corrective actions may be required.

During home sale transactions, some lending institutions require drinking water testing for lead, nitrate and bacteria before mortgage approval. Contact both the lending institution and the local health department for information on required tests.

After a new well is drilled or an existing well is opened for pump repair/replacement or any other maintenance, test your water for coliform bacteria to ensure that surface water is not entering the well. Take the sample only after shock chlorination and substantial flushing of the water system.



You should also consider testing your water if:

- your well does not meet construction codes, including deteriorated/damaged wellcap, well casing or curbing (concrete slab)
- family members or guests consuming the well water complain of gastrointestinal ailments
- anytime a pregnant woman, woman anticipating pregnancy or infant under the age of six months uses well water for drinking
- you are concerned about the presence of lead pipes or soldering in your home
- your water or pipes show signs of deterioration (e.g., water with a strange color, odor, taste or consistency, or pipes that are corroded or leaking)
- your water stains plumbing fixtures and laundry.
- you notice a water quality change after a heavy rain or an unexplained change in a previously trouble-free well (e.g., funny taste, cloudy appearance, etc.)
- you spill fertilizers, pesticides, oil, gasoline or other toxic substances on the ground within 500 feet of the well or in the well
- you have experienced some problems near your well (e.g., the area around the wellhead has been flooded or submerged, there have been land disturbances or new waste disposal sites nearby)
- you notice a substantial development in your area with land uses that handle hazardous chemicals
- you hear about new contamination problems in your area
- your neighbors find toxic chemicals in their well water
- you installed a new treatment system or replaced the main component of the existing one (filter media or cartridge)
- you detected that back-siphoning has occurred due to vacuum break failure or any other reason
- your water or well system has been contaminated or is suspected to have been contaminated by human or animal waste
- you discovered that your (or your neighbor's) septic system absorption field is within 100 feet of your well
- you detected that your heating oil tank or underground fuel tank near the well has leaked

WHICH TESTS SHOULD I REQUEST FOR MY WELL WATER AND HOW OFTEN?

No single test provides information on all possible contaminants, but water quality can be determined by the right test(s). Some contaminants, called *primary contaminants*, can be a health risk if present in concentrations above the primary MCL (Maximum Contaminant Level). These include microorganisms such as bacteria, viruses or protozoa; inorganic chemicals such as arsenic, lead or nitrate; and organic chemicals such as insecticides, herbicides, fuel and solvents. Some contaminants, while not a health risk, can affect acceptability of water for domestic use if their concentrations exceed the secondary MCL. Given the long list of potential water contaminants, it may be cost prohibitive and in most cases unnecessary to test for all of them. **Table 1** lists the water tests appropriate for some common situations; **Table 2** summarizes some common water quality concerns, their causes and relevant water testing; and **Table 3** includes some unique situations and required water testing. These tables are just guidelines and do not replace the need for an expert opinion from a water specialist. Consult an expert if you suspect any contaminant that could present an immediate or long-term health risk. Your local county Extension agent, a professional from the local health department or a water specialist from your testing laboratory can help.

Table 1.
Generally recommended water tests for private wells in Georgia.

Testing Objective	Type of Test	Testing Frequency	Geographical Regions
<i>Minimum Testing Recommendations</i>			
Well Maintenance	Bacteria	Annual	All geographical regions
	Nitrates (Total Nitrate and Nitrate+Nitrite)	Annual	
	Turbidity and Color	Annual	
	Comprehensive Water Chemistry: Basic Water Chemistry (see below) plus Alkalinity, Soluble Salts (or Total Dissolved Solids), Nitrate, Chloride, Fluoride and Sulfate	Initially and then every 3 years	
	Basic Water Chemistry: pH, Hardness, Aluminum Calcium, Chromium, Copper, Iron, Magnesium, Manganese and Zinc	Annually after initial comprehensive water chemistry	
<i>Additional Testing Recommendations</i>			
Verification of Potential Contamination	Lead and Copper	At least once and then yearly follow-up for: 1) houses with plumbing that pre dates the 1987 plumbing codes with copper piping with lead solders 2) very old houses in which there are lead pipes 3) houses with brass and/or chrome fixtures (brass contains 3-8% lead; chrome fixtures contains lead)	All geographical regions
	Arsenic	At least once and then a yearly follow-up	Southern Coastal Plain region below the "Fall Line" on the Georgia map
	Uranium	At least once and then a yearly follow-up	Piedmont-Blue Ridge regions above the "Fall Line" on the Georgia map
	Volatile and Semi-volatile Organic Compounds, Pesticides, Petroleum Hydrocarbons and Other Organics	Not required on a regular interval; recommended only when contamination is suspected.	All geographical regions

Table 2.
Water quality concerns,
common signs, causes and
recommended test(s).

Concerns	Common Signs	Causes	Recommended Tests
Appearance	Reddish-brown or yellowish	Dissolved organic matter or iron	Iron and Tannin
	Frothy or foamy	Detergents	Detergents or Total Anionic Surfactants
	Cloudy	Suspended sediments	Turbidity and Total Suspended Solids
	Slimy brown precipitate	Dissolved iron with iron-bacteria	pH, Iron and Bacteria
	Black flakes or particles	Dissolved manganese	pH and Manganese
Stains on bathroom fixtures or clothing	Red or Brown	Dissolved iron	pH and Iron
	Yellow	Dissolved iron, hydrogen sulfide, hard water	pH, Hardness, Iron and Hydrogen Sulfide
	Black	Dissolved manganese, hydrogen sulfides	pH, Manganese and Hydrogen Sulfide
	Green or blue	Corrosive water, dissolved copper	pH, Hardness, Alkalinity, Saturation Index and Copper
Abnormal odor or taste	Bitter	Dissolved nitrate or sulfate	Nitrate and Sulfate
	Rotten egg	Hydrogen sulfide	Hydrogen Sulfide
	Soapy	Detergents, surfactants	Detergents and Total Anionic Surfactants
	Metallic	Dissolved metals like iron, manganese zinc, copper, lead	pH, Iron, Manganese, Zinc, Copper and Lead
	Salty	Excessive soluble salts	Total Dissolved Solids, Chloride, Sodium and Electrical Conductivity
	Septic, musty, earthy	<ul style="list-style-type: none"> • Decaying organic matter in the drain • Pollution of well water from surface drainage • Bacteria in the drain and/or well 	Bacteria, pH
	Gasoline, kerosene, oil	Contamination by petroleum hydrocarbons, oil and grease	Petroleum Hydrocarbons, Oil and Grease
	Fruity	Fuel spill, leaking underground fuel storage tank, road runoff, ponding near well	Volatile Organic Compounds

Other	Corrosion of plumbing materials	Corrosive water	pH, Hardness, Alkalinity, Saturation Index, Lead, Copper, Iron, Manganese, Sulfate, Chloride and Electrical Conductivity
	White deposits on bathroom fixtures and pots or soap scum	Hard water	pH, Hardness, Alkalinity, Sulfate and Electrical Conductivity (or Total Dissolved Solids)
	Tarnished silverware	Hydrogen sulfide gas	pH and Hydrogen Sulfide
	Gastrointestinal illness (e.g., stomach ache, nausea, diarrhea)	Bacterial contamination, presence of excess nitrate, sulfate and manganese	Bacteria, Nitrate, Sulfate, Manganese, Detergents
	Discoloration and/or mottling of children's teeth	Excessive fluoride	Fluoride

Table 3.
Situation-specific water test recommendations.

Situation	Test(s) to be Considered
Water supply for infant less than 6 months, pregnant or nursing woman, or elderly person with a genetically impaired enzyme system	Nitrate
Water supply used for children under 12 with developing teeth buds	Fluoride
Lead pipe or lead solder in plumbing (older home)	Lead, Copper, Zinc, pH, Hardness, Alkalinity
Close to old fuel storage tanks	Petroleum Hydrocarbons, Volatile Organic Compounds
Close to gas and oil drilling	Chloride, Total Dissolved Solids, Sodium, Barium, Lead, pH, Electrical Conductivity, Volatile Organic Compounds
Close to confined livestock area	Nitrate, Coliform Bacteria
Close to a chemical/pesticide spill or sprayer loading/rinsing area	Specific Chemical or Pesticide
Close to a landfill or dump site	Volatile Organic Compounds, Heavy Metals, Synthetic Organic Compounds
Septic system failure	Coliform Bacteria, Nitrate, Detergents, Total Dissolved Solids, Chloride, Sodium, Sulfates
Well located within an area of intensive agricultural use	Coliform Bacteria, Nitrate, Pesticide Scan, pH, Total Dissolved Solids
<ul style="list-style-type: none"> • Well near the coast or a salt storage pile • High blood pressure in the family • Water softener in place 	Sodium, Chloride, Total Dissolved Solids

Adapted from "Water Quality Series: Drinking Water Testing," Oklahoma Cooperative Extension Service AGCE-878.

HOW SHOULD I TAKE A WATER SAMPLE FOR TESTING?

- Samples collected from the wellhead would allow evaluation of source water properties and designing any treatment system that may be necessary.
- Samples collected from a kitchen faucet would reflect the source water properties plus any potential contamination from the well owner's water supply system. For example, sampling at the wellhead for lead is not necessary, but sampling from the faucet for lead would indicate if lead solder was used in the plumbing. Also, it can indicate the efficiency of an existing treatment system.

WHERE SHOULD I TEST MY WELL WATER?

To have your water tested, call your local county Extension office or county health department or check with your municipal water supplier to find a suitable laboratory near you. These offices or your water testing laboratory can provide you the necessary information about sampling procedure, type of container, any preservative(s) necessary and shipping method.

HOW ARE THE WATER TEST RESULTS INTERPRETED?

Some contaminants are reported in parts per million (ppm) or milligrams per liter (mg/L); others in parts per billion (ppb) or micrograms per liter (µg/L). Bacteria in water are generally reported as Most Probable Number (MPN) or Colony Forming Units (CFU) per 100 mL. The presence of a contaminant is not always an indication of a health hazard or a serious nuisance. The level at which it is found is most important. Interpretation of the test results requires knowledge of the MCLs established under the SDWA. The concentration of a contaminant above its MCL merits attention and action to reduce it below the MCL. The primary MCLs have been set at concentrations that provide a wide margin of protection from harmful health effects for most people over a lifetime of drinking. Even though primary MCLs are enforceable standards for PWSs only, private well owners may choose to follow these standards to protect themselves from the potential health risk of drinking contaminated water. As an example, **Table 4** cites the MCLs for some selected contaminants.

Table 4.
EPA drinking water standard
for some selected primary and
secondary contaminants.

Contaminants	MCL
A. Primary Contaminants	
• Arsenic	10 ppb
• Lead	15 ppb
• Total Coliform	0 MPN/100 mL
• <i>E. coli</i>	0 MPN/100 mL
B. Secondary Contaminants	
• Aluminum	0.2 ppm
• Iron	0.3 ppm
• Manganese	0.05 ppm
• Sulfate	250 ppm

Contact your local county Cooperative Extension office, local health department, or Georgia EPD for a complete list of drinking water standards. You can also find it online at <http://www.epa.gov>. Testing through UGA's water testing laboratory will provide details on any concerns as well as treatment options.

WHAT SHOULD I DO IF MY TEST RESULTS INDICATE A PROBLEM IN MY WELL WATER?

If your water test report shows any primary contaminant with a concentration above the MCL, you are at a risk of adverse health effects. In such a case, there are five basic alternatives:

- If possible, locate and eliminate the source(s) of contamination
- Install an appropriate treatment system
- Install a new well with expert guidance
- Connect with a public water system (if available)
- Use bottled water

Besides primary contaminants, certain nuisance contaminants, such as hydrogen sulfide or sodium, when found at high levels, may indicate the need for an alternative water source or a home treatment system. Refer to the other water publications in this series for more information about specific problem contaminants.

Sources:

- “Residential Well Water Testing. Private Well Program.”* State of Connecticut Department of Public Health.
- “Testing for Water Quality.”* University of Georgia Cooperative Extension.
- “Water Quality Testing for Private Wells in New Hampshire.”* New Hampshire Department of Environmental Services, Concord, NH.
- DeSimone, L.A., P.A. Hamilton, R.J. Gilliom. 2009. “Quality of Water from Domestic Wells in Principal Aquifers of the United States, 1991–2004.” USGS NAWQA Scientific Investigations Report 2008-5227. <http://water.usgs.gov/nawqa/>
- DeSimone, L.A., P.A. Hamilton, R.J. Gilliom. 2009. Quality of water from domestic wells in principal aquifers of the United States, 1991-2004—Overview of major findings: U.S. Geological Survey Circular 1332, 48 p. <http://pubs.usgs.gov/circ/circ1332/>
- Frankenberger, J. and C. Janssen. 1990. Why & How to Test Home Water Supplies. Purdue Extension.
- Skipton, S., B. Dvorak and W. Woldt. 2005. G89-907 Drinking Water: Testing for Quality. University of Nebraska – Lincoln Extension.

Reviewers:

Dr. Mark Risse, Georgia Power Professor of Water Resources, Department of Crop and Soil Sciences, University of Georgia; **Ms. Dana Lynch**, County Extension Agent (Family and Consumer Sciences), Monroe County, University of Georgia Cooperative Extension; and **Ms. Kristine Uhlman**, Extension Program Specialist—Water Resources, Texas A&M University.

extension.uga.edu

Circular 858-2

Reviewed October 2022

COLLEGE OF AGRICULTURAL AND
ENVIRONMENTAL SCIENCES
and the
COLLEGE OF FAMILY AND
CONSUMER SCIENCES

Published by the University of Georgia in cooperation with Fort Valley State University, the U.S. Department of Agriculture, and counties of the state. For more information, contact your local UGA Cooperative Extension office. *The University of Georgia College of Agricultural and Environmental Sciences (working cooperatively with Fort Valley State University, the U.S. Department of Agriculture, and the counties of Georgia) offers its educational programs, assistance, and materials to all people without regard to race, color, religion, sex, national origin, disability, gender identity, sexual orientation or protected veteran status and is an Equal Opportunity, Affirmative Action organization.*