Groundwater Resources

Domestic water supply wells in aquifers may be compared with drinking straws in a glass of water. The question frequently asked is how many straws can be used before the glass runs dry? The answer depends on the size of the glass, how often it is refilled, how deep in the glass the straws are, and how much is used by each straw.

One cannot take ground water resources for granted. Once pumped from the ground, it takes longer to replenish a ground water supply source than a surface water source. Recharge is relatively slow because the replacement (recharge) water from rain or snow melt generally must filter down (infiltrate) slowly through the soil and rock to the ground water table.

Too many wells, too much consumptive use, and extended dry conditions can impact water resources. Depending on the residential lot sizes, a residential well may be hydrologically independent of the neighboring wells; however, it is possible that a well may be affected by nearby pumping from another private, irrigation and/or community water supply well. If a residential well is dry, deepening the affected well is the only alternative.

Depending on your location, you may get your water from a private well or a public water system. Private wells are typically located on your property and provide water to your home only. If you are on a private well system, you will typically have an exterior well with piping running to your house. Generally there is a water holding tank in your home or garage that is attached this piping. The water pump may be attached to the water tank, but more commonly are now installed in the well. An apparently failing well does not necessarily mean there are deleted water resources. A possible reason for a decline in a well's yield may be chemical or biological incrustation in the well, or a worn and inefficient pump. Clogged wells can be rehabilitated, and pumps can be replaced. Neglect can cause the well components to breakdown which may allow harmful contaminants into the drinking water.

Public water systems are generally a single pipe entering your home with a meter on it to calculate the amount of water you use. If you are being billed for your water, you are most likely on a public system. Public water suppliers are regulated by federal and state authorities for quality and are required to providing testing results on an annual basis. These reports are legally required and are available to consumers, and provide the testing results on the quality of the water you are drinking.

Groundwater Quality

"Pure" water does not exist. All water contains some dissolved gases and minerals. Groundwater quality is influenced by the chemical make-up of the rock formations in which it comes in contact, and the length of time that it has been underground. Dissolved minerals from the rocks cause increases in chemical constituents

These constituents may include trace levels of iron, manganese, calcium, magnesium, sodium, bicarbonate, silica, sulfate, chloride, nitrate, and fluoride. Small amounts of these elements and compounds do not usually cause health problems in drinking water. In some cases, however, the levels may be high enough to affect the aesthetics of the water (e.g., staining, hardness) and must be reduced. Certain constituents can even damage the inside plumbing and bathroom/kitchen items (sinks, dishwashers, toilets, showers and tubs).

Groundwater contamination may result from point sources, such as leaking aboveground and underground petroleum storage tanks, animal feedlots, spills of hazardous substances. The use of chemicals such as fertilizers and pesticides can be a non-point source of aquifer contamination. Household chemicals/prescription medications/petroleum products improperly

disposed in on-lot septic systems can impact local groundwater quality and find their way into surrounding private/public water supply wells. Inadequate septic systems and leaking sanitary sewer pipelines can cause localized contamination.

This is a general term for a broad range of hazardous or regulated substances and waste products that are not naturally occurring. They may end up in the ground water supply if they are improperly handled. A few examples of these types of materials include organic compounds (e.g., benzene, MTBE), heavy metals (e.g., cadmium, chromium, lead, mercury, etc.), pesticides and herbicides, polychlorinated biphenyls (PCBs), petroleum hydrocarbon fuels, and polycyclic aromatic hydrocarbons (PAHs).

Coliform bacteria is the bacteria most commonly associated with water quality. The Environmental Protection Agency standard for acceptable drinking water is a total coliform count of zero. Coliform bacteria are a large group of various species of bacteria. The group includes bacteria that occur naturally in the intestines of warm-blooded animals (fecal coliform) and non-fecal coliform bacteria. Fecal coliforms can include disease causing and non-disease causing species.

Escherichia coli (E. coli), often listed in water quality analyses, is one species of fecal coliform bacteria. They occur in the digestive system of healthy warm-blooded animals. E. coli are present in large numbers in human sewage. E. coli can be easily cultured in a laboratory and therefore, they are a good indicator species. Its presence in a water sample indicates that sewage material may be present and that if sewage is present, more harmful disease causing organisms may also be present.

Acidic (low pH) water can leach copper out of pipes causing a metallic taste, especially when the water is not flushed from the pipes frequently. An odor problem may occur with the presence of iron bacteria, which may cause a musty or swampy smell in the water.

Hardness, which is very common in water supplies, is caused by calcium and magnesium in water. Hardness at a moderate level may be beneficial because water becomes acidic at low hardness levels, which may cause plumbing corrosion or leaching of lead from soldered plumbing joints into the drinking water. Hard water is disadvantageous because soap does not clean efficiently and may leave an insoluble curd on bathtubs, sinks, clothing, and skin. Hard water also deposits a scale inside pipes, boilers, and hot water tanks, reducing their capacity and heat-transfer properties. The condition is commonly treated with water softeners.

Alkalinity is similar to hardness, and is a measurement of your water's overall buffering capacity against extreme pH changes. Its concentration is usually similar to the hardness concentration when calcium carbonate is the main contributing factor to the value. However, if alkalinity is significantly higher than the hardness concentration then the reason may be high sodium in the water. If alkalinity is much lower than the hardness value then the water may be high in chloride, nitrates or sulfates.

Certain metallic ions, such as iron and manganese, sometimes color water yellow, brown or red after contact with air, heat or after disinfection with bleach. Highly discolored water is objectionable because it may stain household fixtures and clothing as well as reduce the water's visual aesthetic appeal.

The common sources of nitrate in ground water are farming and lawn fertilizers or the decomposition of septic waste. The presence of nitrates may be especially harmful to those with potential respiratory impairments including the elderly or young children (less than 6 to 12 months old). Nitrates may be transformed into nitrites by bacteria in the digestive tract. Nitrites may then be absorbed into the blood stream. In infant digestive systems, there is insufficient hydrochloric

acid to kill nitrite-producing bacteria. Nitrites in the blood stream inhibit the transport of oxygen in the blood stream, which can cause shortness of breath, heart attacks or asphyxiation. Because the condition can create a bluish skin color, it is called "blue baby syndrome" (technically: methemoglobinemia). High nitrate levels are commonly treated with ion- exchange or reverse osmosis systems. Boiling water increases the nitrate concentration.

Older shallow dug wells without properly installed casing are more easily polluted than drilled wells. In the same area where there is some shallow well contamination, deeper ground water from properly constructed wells may be safe to consume.

An area of localized aquifer contamination can often be contained by remedial action. Knowledge of local groundwater movement and proper monitoring may allow the safe use of groundwater in the surrounding area. Federal and state regulatory authorities establish “clean” drinking water standards. When a municipality or community well system meets these standards, the water is considered “safe” to drink. While most experts agree these standards are adequate to protect the health of most residents, the regulations do allow some contaminants to enter the water supply. This fact can be disconcerting to some people.

Chances are that your water is just fine, but YOU CAN'T TELL JUST BY LOOKING, SMELLING OR BY TASTING

Water Quality Testing

Private wells are typically tested only during original installation or in some cases, during a property transfer. Often, homeowners don’t realize that they should be testing their private well water regularly. Homeowners with wells have primary responsibility for the quality of their water supply. Testing well water is important to family’s health. If testing is not done, you and your family may face a health risk and not know it.

Contaminants can enter the water as it travels from the water treatment facility to your home or hazardous substances can enter the water from inside the home. This may be a reason to test the water inside your home even if the source is from a public water system.

It is recommended that the drinking water supply be checked with a laboratory test each year. Wells should be tested for the contaminants including total coliform bacteria, iron, manganese, pH, volatile organic compounds (VOCs) with established Maximum Contaminant Levels, nitrate/nitrite, Sulfate Chloride, lead, hardness, alkalinity, total dissolved solids (TDS). If total coliform bacteria are detected, a test should be conducted for fecal coliform or E. coli.

At the very least on a yearly basis, well owners should be monitoring water for certain contaminants, like bacteria and nitrate and pH (acidity). If pH is less than 7.0, test for lead.

Do-it-yourself bacteria testing kits are on the market for about $15. It is important to follow directions. A bacteriological analysis by a certified laboratory usually costs between $30 and $40. Sample bottles (and instructions) are available from virtually all certified water quality labs. These kits provide a quick convenient test for homeowners but will not have the accuracy of a laboratory test and the results may not be accepted for purposes such as property transfer water quality tests.

A reliable water sample is of utmost importance. Homeowners that obtain the water sample themselves should request written instructions and sterile sample bottles from the laboratory or agency performing the analysis. Following the correct "sampling protocol" is vital for an accurate and meaningful water quality analysis. Typically, sampling of the untreated water directly from the well is recommended. If you have a water treatment system, such as a water softener, simply

bypass it to take the raw sample. Then turn the system back on and take a sample of the treated water. Treatment systems are often installed to remove known contaminants in the water. The second sample can show that the system is working and correcting failures found in the untreated water. If there is no treatment unit installed, the water may be taken from any cold water, non-aerated tap in the building.

Some certified laboratories offer nation-wide water testing via mail/courier service. If extensive chemical analyses is preferred, or if unusual chemicals in low concentrations are suspected, consider the services of a certified laboratory. Laboratories sampling/testing rates vary, depending on difficultly of sample collection, the location of the property in relation to the lab, and other factors. It is estimated that the average price will be between $450 and $650. Request that the laboratory test results are reported in comparison with State and Federal drinking water standards.

Because most private wells located in our area are drilled into bedrock, it is highly recommended wells be tested for arsenic. Arsenic is a naturally occurring element that generally enters well water in these areas through natural processes. Arsenic may also have been released into the environment through human activities, such as pesticide use, and other industrial processes. Arsenic has been linked to several different adverse health effects, such as diabetes mellitus, cardiovascular disease, nervous system damage, skin disorders and different forms of cancer.

Because of the health risks of some chemical substances found in water, the U.S. Environmental Protection Agency established drinking water regulations that set limits on the concentration of some substances in public drinking water supplies. These limits are helpful in assessing the quality of individual home water supplies. Maximum Contaminant Level, means the maximum permissible level of a primary contaminant that is allowed in drinking water in accordance with the Safe Drinking Water Act and corresponding regulations. If the well water does not meet one or more of the drinking water standards, it does not mean it is not safe to drink. Some of the standards are based on aesthetics (secondary standards), while some are based on long-term health effects (primary standards). The fact that water tests above the standard would not necessarily mean that the water is unsafe to drink. For example, high levels of iron (secondary standard) in the water are generally not dangerous but do give the water an unpleasant taste. On the other hand, as described above, the presence of nitrates (primary standard) above the MCL may cause a condition called blue baby syndrome in infants.

If analysis shows an exceedance of an acute parameter, such as VOCs, coliform or nitrates, resample. If the second sample results show presence of these acute parameters, you need to immediately investigate sources of contamination, disinfect your water system and notify the Bucks County Health Dept. or the Department of Environmental Protection,. These agencies have the discretion to notify the reported presence of a parameter in a private well to nearby well owners to test for the parameter(s) of concern.

"Do-it-yourself' water testing kits are available in many hardware stores. If there is an immediate health issue, such as gastrointestinal illness, a local or county public health department, sanitarian or county extension agent should be consulted and water testing done by a certified laboratory.

Water Treatment

Some dissolved contaminants can be removed or reduced with residential treatment equipment. Home water treatment is often a simple cost-effective solution to water quality problems. It is reported that approximately 30 percent of the homes in the United States have some kind of water conditioning equipment to meet personal or recommended water quality standards. You may be surprised and find out there’s an easy treatment to make the water better for drinking.

Look for a professional who understands your water chemistry, explains your treatment options and who pays attention to the details specific to your home and water supply. Before purchasing major conditioning equipment, obtain information and bids from more than one conditioning company. You may want to check on the reputation of the company by contacting your local Better Business Bureau.

In order to obtain good results, the water treatment systems require attention and maintenance. An improperly maintained treatment system may be ineffective and may cause additional water quality problems.

Chemical Treatment: There are generally three major types of home drinking water treatment devices available to consumers for removing chemical contaminants. These treatment devices include filters, distillers, and softeners. **Filters**, such as carbon or reverse osmosis**,** use different kinds of media to filter out contaminants from drinking water as the water passes through it. **Distillers** use a process where the water is heated and subsequently cooled to remove contaminants. **Water softeners** utilize a process known as ion exchange to remove contaminants from drinking water. **Ion exchange** uses reciprocal transfer of contaminant ions between the drinking water and a resin or other solid media to remove a contaminant. These devices are capable of removing a variety of contaminants that may be found in drinking water, but individually they may not provide all of the necessary treatment for all contaminants of concern.

Microbiological Treatment: Microbiological treatment can be achieved either through disinfection or physical removal. For microbiological disinfection, treatment devices such as **ultra violet light (UV) or Chlorinators** may be effective. Reverse osmosis can also be used to effectively treat water with microbiological contamination.

Water treatment devices, such as water softeners, and ion exchange and reverse osmosis units, must be maintained in accordance with the manufacturer's specification so they are continually effective.

Other sources of information and advice:

- EPA Drinking Water Hotline (800) 426-4791 (Washington, D.C.). The EPA provides general information about Federal Drinking Water regulations and guidelines.
- National Ground Water Association (614) 337-1949 (Ohio). The NGWA is a 23,000 member international organization representing all professions of the ground water industry.
- Center for Disease Control and Prevention (404) 639-2206 (Atlanta). Federal center of expertise.