THE AMERICAN WELL OWNER

★ INFORMATION AND ADVICE ABOUT GROUND WATER, WELLS AND WATER SYSTEMS ★

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Independent Authority on Ground Water

Methane in Ground Water

MESSAGE FROM THE PUBLISHER

Water Holds Surprises

Recent research on the nations rivers and lakes shows that minute quantities of chemicals such as pharmaceuticals, caffeine, nicotine and perfumes are entering the hydrologic system and are being detected in the range of parts per billion or trillion. Studies on fish show that male and female fish can develop the other sex's proteins and organs when there are traces of birth control pills or steroids in rivers and streams. What is unclear is the effect these highly diluted chemical cocktails may have on humans, if any.

Because of population growth, more water is being used. Most wastewater (including the unused pharmaceuticals that have passed through our bodies) enters the sewer system, goes to the wastewater treatment plant, and then back to the hydrological system into a river or stream. Drinking-water plants use water from the rivers and streams, treat it, and send it back to the taps in our homes.

Well owners should not get smug about the issue. While much of the research is in major rivers, the cycle of chemicals in wastewater reaching ground water, is also documented. Well owners do have some element of control however by being vigilant about keeping chemicals out of their septic systems. We can't do much about pharmaceuticals that pass through our bodies, but we can ensure that septic systems are NOT used to dump unused drugs. Well owners have a strong vested interest in using environmentally friendly cleaning chemicals and personal hygiene products.

"Endocrine disruptors" is the term used to describe some of the pharmaceutical compounds found in drinking water. If you haven't heard the words endocrine disruptor before; chances are that you will before too long.

Andrew W. Stone
American Ground Water Trust

Most ground water contains dissolved gases. The type and amount of the gas depends on the geology of the rocks through which the water flows. In some cases, the gas levels may be high enough to be noticeable as effervescence, odor, bubbles or as a "sputtering" release when water is drawn from the tap. The more common gases found in ground water are oxygen, hydrogen sulfide (rotten egg smell), carbon dioxide and methane (natural gas). Methane is a common constituent of ground water in regions with rocks containing organic (carbon) substances such as coal or carbonaceous shales. Oil producing regions of the country are also prone to having methane in ground water.

The origin of methane may be related to the action of anaerobic bacteria that live in habitats with low or no oxygen. The bacteria produce methane gas as a waste product as they use organic materials to create energy as part of their life cycle. Methane gas can also be produced in the geologic environment if there are subsurface conditions of heat and pressure, which may break down carbon bonds of organic components of rock sediments.

The methane molecule contains one carbon atom and four hydrogen atoms (CH4). It is a clear, odorless gas that is lighter than air. Methane is also known as swamp or marsh gas because it can form as vegetation in wetlands decomposes in water. Methane is the major constituent of natural gas, which also contains other "short chain" hydrocarbon gases such as ethane (C2H6), propane (C3H8), butane (C4H10) and hexane (C5H12). Methane has a very low solubility in water and will release readily out of tap water to the open air.

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Methane in Ground Water . . . ***continued from page 1***

The US Environmental Protection Agency has not set a drinking water standard nor identified a human health risk for methane when consumed in drinking water. There can be a concern about methane in water wells because methane is explosive when its concentration in the air (that is, the average concentration measured in a room of your house) is between 5 and 15 percent. Treatment of well water to remove methane before it enters a home's plumbing system is recommended when the methane concentration exceeds 1 percent by volume in the water itself (that is, the volume of methane from a known volume of water collected using a bubbler pail, or similar, method). Qualified laboratories may test a gas sample for methane using a method known as Flame Ionization Detection (FID).

Methane removal from water can be achieved by aeration. The usual process is to agitate the water in an enclosed tank at room temperature by using spray valves. The methane collected in the aeration process is then directed outside the building and released above the roofline away from active living areas or chimneys. Basements or other confined areas (including the treatment equipment area), where large volumes of water are used should be vented to prevent the accumulation of gas.

All water wells associated with methane gas should be vented at the wellhead where the casing sticks out of the ground. If the methane concentrations are near or exceed the explosion limits, the well venting system should be designed to release the gas through a venting chimney to avoid risk of accidental explosions related to activities such as lawn mower use, barbeque use or other outdoor events involving electricity, hot motors or open flame. Well contractors in areas where methane may occur should be familiar with the well code and safety requirements required or recommended by state and local authorities.

In deep wells, methane as a gas may be entering the well from rock layers above the water table. In such cases, there may be methane in the well - but not in the water! If you suspect that your well and/or well water contains methane gas, contact your state department of environmental quality or environmental protection and ask them about the locations in the state that are known or suspected to have high gas concentrations and what types of gas may be present. Well contractors should also be aware of “problem” areas. For emergency situations, most local fire departments have methane-detection equipment to measure the methane concentration in air (your living space). The Trust recommends that a well professional undertake any testing involving removal of a well cap. If you have other questions, you may contact the Trust for additional help.

When is an Aquifer Full . . . ***continued from page 4***

usually during the early spring when the snow melts. For other areas, where precipitation is more variable, there may not be an annual "fill-up", and recharge may only occur during times of prolonged rainfall. [Steady rain over a period of several days is good for recharge - short, sharp heavy downpours are not.]. In semi-arid areas in particular, recharge to aquifers giving a partial “fill-up” may only occur every few years.

The removal of water by pumping can deplete aquifer storage. The effect of well pumping on an aquifer is related to the amount in storage, the amount pumped, and the rate (and reliability) of recharge. Domestic wells for single family homes typically use small amounts of water, and because most homes with an independent water supply also have an on-site waste water disposal system, 80% or more of the water used is returned to the ground water system. In areas where there are extensive aquifers with large wells in addition to smaller domestic wells, such as the Atlantic Coastal Plain and the High Plains, then the collective water use may result in the aquifers never refilling to their pre-development natural conditions. In such cases, the "half-full" aquifers may present a terrific opportunity for water engineers to undertake artificial recharge, a process by which surplus surface water is added to "fill-up" aquifers for later use. There are over 40 active artificial recharge projects throughout the US, especially in Florida, New Jersey, Arizona and California, and it is very likely that in the years ahead, water managers will need to implement more and more recharge schemes to "fill-up" aquifers to store water for later use.

For more information about artificial recharge visit the International Association Of Hydrogeologists' web site: http://www.iah.org/recharge/index.html

How to Choose a Water Testing Laboratory

What is in your well water? All well water contains dissolved minerals, and may contain traces of compounds or microbiological organisms. For reasons of health, and to ensure efficient operation of a home water system, it makes sense to know what is in the water. All states have water-testing laboratories. These can be found looking in your local phone book or entering "water testing laboratories" in your favorite Internet search engine. So how do you choose a testing laboratory? A good first move is to enquire whether your local health department, state environmental office, or Cooperative Extension office offers water-testing services for well owners. However, such services may only test for a limited number of potential well water "ingredients."

Water testing laboratories are NOT All the same. The best laboratories follow rigorous protocols and procedures to ensure that the test results they produce are consistently accurate, precise and reliable. Each state has an accreditation process that laboratories must complete to become state certified as technically competent to perform specific test procedures. There are many different water test procedures because there are many compounds and substances. One single test procedure cannot detect all compounds or substances. Many tests require specialized equipment, especially if testing for small levels of substances, and most water laboratories are not certified for all possible test procedures.

Certification ensures that the laboratory is consistently capable of providing error free and reliable test results and that the results can be trusted. Using a state certified laboratory reduces the possibility of having to retest the water, which can save time and money. If you are testing a well because of a pending property transaction, then third parties can also have confidence in the results. Some quality tests require very specific sampling procedures and absolutely sterile sample bottles. Laboratories are not likely to accept samples sent in old soda bottles.

Many water-testing laboratories do offer homeowner water testing "package deals" that include tests for typical local conditions. Not all tests are necessarily directly health related. For example, high levels of calcium or iron may be more of a nuisance than a health risk. It is essential to have an accurate water test before buying any conditioning equipment. Remember too, that the amounts of some well water "ingredients" may vary throughout the year. Virtually all well water is a cocktail of water encountered during drilling. Depending on rates or recharge, or nearby pumping, the proportions of your well water from different rock layers may change during the year.

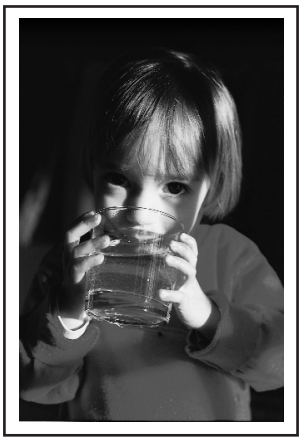
The US Environmental Protection Agency has identified health risks for exposure to the primary drinking water contaminants and set legally enforceable Maximum Contaminant Levels (MCL) for public supplies. Some examples of these contaminants include coliform bacteria, nitrate, arsenic, volatile organic compounds (including components of gasoline), pesticides and herbicides, lead and copper. The EPA has also developed standard testing procedures that laboratories must use for each of the primary drinking water contaminants.

A State's Department of Environmental Protection, Department of Health or Department of Environmental Quality usually handles water testing laboratory accreditation. Many states maintain this information on the Internet. The telephone numbers for these state agencies are available in the state listings of your local phone book. Alternatively, the Trust has a list of accreditation agency telephone numbers.

In addition to state certification there are sometimes requirements by local Boards of Health (BOH) that laboratories must also follow, so it is important for a home owner or potential buyer to check with the local BOH to cover this possibility. Most states require that a water sample from a home be tested for coliform bacteria and nitrates before a property transaction can be completed. Some states are now also requiring additional testing for VOCs, arsenic, fluoride and radon as part of a property transaction.

If possible, solicit price quotes from at least three certified laboratories. Some laboratories will send a technician to your home to collect the sample, although this can add to the cost. Laboratories usually provide sample containers and sampling instructions as part of the analytical fee. Ask what the "turn-around" time is for receiving the results of the testing back after the sample is submitted. It is very helpful if the laboratory report of results also includes an explanation of what the results mean or a telephone number to a laboratory representative who can interpret the results for you. In most cases, the American Ground Water Trust can also help homeowners assess the results.

The Trust recommends that well owners test their water at least once a year for coliform bacteria and nitrates if fertilizer is used on the property or if there are cultivated fields nearby. Additional testing suggestions and criteria are explained on the Trust website (http://www.agwt.org/info/pdfs/watertestingabc.pdf).



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AMERICAN GROUND WATER TRUST
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TOPICS IN UPCOMING ISSUES

- **Ozonation Water Treatment for Private Wells**
- **Mixing Surface and Ground Water**
- **Lightening and Wells**

WHEN IS AN AQUIFER FULL

Most people understand that an aquifer is the zone of sub-surface ground water storage. Water wells are drilled into rock layers that have their pore spaces or fractures filled with water. The water well is the "engineered hole" fitted with a pump that brings water from the aquifer up to the surface. When the well is pumped, water from the saturated rocks moves to the well. Aquifers come in all shapes and sizes, and depending on the spaces in the rock, may contain different amounts of water. For example, granite bedrock may have just 1% of the rock volume filled with water, whereas a sand aquifer may have 25% of its volume containing water. To know how much water there is in an aquifer we need to know its shape and size (often called aquifer geometry) and the approximate amount of space in the rocks that could be filled with water (porosity).

If we think of the aquifer as a storage vessel for ground water, then it is "full" when all the available storage space is filled. When "full," additional water entering at the ground surface, as rain or snowmelt may initially move through the top soil layers but will then move (sideways) through the soils or over the surface, directly to creeks and streams. To really understand the concept of aquifer storage we need to understand how and when water might enter (recharge) or leave (discharge) the aquifer under natural conditions and how much might leave because of pumping. In areas of the US such as the northeastern states, most aquifers are "filled up" every year,

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