wellcare® information for you about
Sulfur & Groundwater

What is Sulfur?

Two forms of sulfur are commonly found in drinking water: hydrogen sulfide and sulfate-reducing bacteria. Both forms are nuisances that usually do not pose a health risk at the concentrations found in domestic wells.

Hydrogen sulfide gas occurs naturally in some ground water that contains decaying organic matter, such as wetlands, marshes, swamps, river beds. It may be found in deep or shallow wells. Hydrogen sulfide is often present in wells drilled in shale or sandstone, or near coal or peat deposits or oil fields.

Sulfate is a combination of sulfur and oxygen, and is part of naturally occurring minerals in some soil and rock. The mineral dissolves over time and is released into ground water. Sulfur odor is produced when a non-harmful sulfur-reducing bacteria digests a small amount of the sulfate mineral.

What are the health effects of Sulfur?

The EPA considers sulfur a secondary water contaminant, with no direct threat to human health. Sulfate gives water a bitter taste and can have a laxative effect that may lead to dehydration. Hydrogen sulfide gives water a "rotten egg" odor and taste, and can cause nausea.

Hydrogen sulfide is corrosive to metals such as iron, steel, copper and brass. It can tarnish silverware and discolor copper and brass utensils. Hydrogen sulfide can also cause yellow or black stains on kitchen and bathroom fixtures. Coffee, tea and other beverages made with water containing hydrogen sulfide may be discolored and the appearance and taste of cooked foods can be affected. High concentrations of dissolved hydrogen sulfide also can foul the resin bed of an ion exchange water softener.

How do I test for Sulfur?

Testing for hydrogen sulfide can be difficult because the gas escapes into the atmosphere so quickly. On-site testing is the most accurate method for determining hydrogen sulfide concentration, especially if the odor is excessive. Hydrogen sulfide concentrations greater than 5 mg/L are more difficult to treat and could require special testing methods to assure accuracy.

Sulfate-reducing bacteria is rarely tested, however testing for sulfate ion (mineral) concentration is. The premise is: if a rotten egg odor is present and the sulfate ion concentration is excessive – greater than 150 mg/L – the odor is created by sulfate-reducing bacteria.

The EPA sets standards for secondary water contaminants based on taste, odor, color, corrosiveness, foaming and staining properties. Hydrogen sulfide is not regulated because any concentration high enough to pose a health hazard will also make the water too unpalatable to drink. The EPA's secondary limit for sulfate in drinking water is 250 parts per million (ppm).

What are the treatments for Sulfur in drinking water?

Treatment options depend on the form (whether hydrogen sulfide or sulfate-reducing bacteria) and quantities of the "rotten egg odor-producing" contaminants. Hydrogen sulfide treatment is with chlorination or aeration followed by filtration. Often, treatment for hydrogen sulfide is the same as for iron and manganese, allowing the removal of all three contaminants in one process.

Most water heater anode rods contain some sulfate so, in the presence of sulfate-reducing bacteria, a rotten egg odor is created in the hot water only. If this occurs, the first course of action is to replace the anode rod with an aluminum-based rod which limits the sulfate and therefore stops the odor.

Sulfate-reducing bacteria is treated with continuous chlorination. Removing sulfate mineral is difficult and usually not feasible, so chlorination kills the bacteria instead. The chlorination process involves a chemical feed pump system that injects a chlorine solution into the inlet of a retention tank that must be installed in the house piping. The retention tank must hold enough water to provide a 20-minute time period for the chlorine to react with the bacteria. The capacity needed for the retention tank can be calculated by multiplying the well pump output times 20. A continuous chlorine residual of 1.0 mg/L is required at the outlet of the retention tank to assure the bacteria were destroyed. Since chlorine can be combined with natural organic matter, it's always recommended that an activated carbon filter be installed after the retention tank to remove the chlorine.

For more information about Sulfur and Groundwater

U.S. Environmental Protection Agency (EPA). Sulfate in Drinking Water. Retrieved on May 7, 2007 from www.epa.gov/safewater/contaminants/unregulated/sulfate.html

Wilkes University, Center for Environmental Quality, Environmental Engineering and Earth Sciences. Sulfates and Hydrogen Sulfide. Retrieved on May 22, 2007 from www.water-research.net/sulfate.htm

Woodard J and Ross B. Virginia Cooperative Extension. (1996). Hydrogen Sulfide in Household Water. Retrieved on May 7, 2007 from www.cdc.gov/nasd/docs/d001201-d001300/d001227/d001227.html

For more information on your drinking water

Contact your local water well professional or health department for information on ground water in your area. The following websites provide up-to-date information on efforts to protect drinking water supplies and steps you can take as a private well owner. In addition, you may contact the **wellcare· hotline** at **1-888-395-1033**.

Underwriters Laboratories Inc. Drink Well™ Well Water Testing	**www.uldrinkwell.com**
U.S. Environmental Protection Agency	**www.epa.gov**
Water Quality Association	**www.wqa.org**

For more information about wells and other wellcare® publications

wellcare· is a program of the **Water Systems Council (WSC). WSC** is a national nonprofit organization dedicated to promoting the wider use of wells as modern and affordable safe drinking water systems and to protecting ground water resources nationwide. This publication is one in a series of wellcare· information sheets. There were more than 70 available at the time this document was published. They can be downloaded FREE from the WSC website at www.watersystemscouncil.org. Well owners and others with questions about wells or ground water can also contact the wellcare· **hotline** at **1-888-395-1033** or visit www.wellcarehotline.org

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