WaterReview

Consumer Report

A Publication of the Water Quality Research Council Volume 7, No. 3, 1992

Well Water Concerns And Contaminants

According to the U.S. Environmental Protection Agency (EPA), approximately 15 percent of the U.S. population relies on individually owned and operated sources of drinking water, such as wells, cisterns, and springs. The majority of household wells are found in rural areas.

Those who receive their water from a private well are solely responsible for the safety of their water. Private wells are not subject to federal drinking water regulations and are generally regulated on a very limited basis by the states.

Since the well owner is primarily responsible for the water in his well, it is important to know what poses a threat to the well and the groundwater which is its source.

The first step in analyzing your well water is to have it tested. Testing will specify any problems so that the right treatment can be applied.

When the safety of the water is in question, it should be tested by a state certified, EPA certified, or other reputable laboratory. Testing for aesthetics such as taste, odor, hardness, and color problems may be performed in the home by a professional water treatment dealer.

A variety of sources can cause well waters to become contaminated. Several contaminants occur in nature that may present a health risk if they are found in drinking water. Many of these contaminants are naturally present in rocks and consequently end up in the water supply.

Other sources of contamination are the result of human activity such as manufacturing, agriculture, or individual misuse. Harmful chemicals may enter a well owner's water supply through leakage from waste disposal, seepage and runoff from the application of pesticides and fertilizers, or improper disposal of household wastes such as cleaning fluids, paint, and motor oil.

Disinfection

Bacteria, viruses, protozoans, and other microorganisms are sometimes present in well water. These organisms may enter a water supply when the source water is contaminated with human or animal wastes. While these naturally occurring organisms are usually harmless, some of them, particularly those associated with the intestine, can cause gastrointestinal disorders such as cramps, diarrhea, and nausea. Illnesses such as these usually occur shortly after one drinks the contaminated water.

Disinfection is the process that is used to destroy pathogenic (disease-producing) bacteria and other harmful organisms that may be present in water. Centrally treated tap water is disinfected at the treatment plant. Homeowners with private wells, however, must disinfect their own water supply to make it bacteriologically safe to drink.

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The use of chlorine and its compounds is undoubtedly the most common disinfection method used in the United States. Chlorine is used to kill infectious organisms such as bacteria and viruses. Its use helps prevent the outbreak of diseases such as giardiasis, salmonellosis, or dysentery. Chlorine is a potentially harmful chemical which should be handled carefully when applied in the disinfection process.

Nitrate

Another substance that may be of concern to well owners is nitrate. Since ingestion of water containing high nitrate concentrations can be fatal to infants, the EPA has established a level of 10 mg/L total nitrate as the maximum contaminant level (MCL) in drinking water. MCLs are federally enforceable standards set by the EPA.

Nitrate in drinking water can be responsible for a temporary blood disorder in infants called "methemoglobinemia," which is also known as "blue baby syndrome."

In infants less than six months old, a condition exists in their digestive systems which allows for the chemical reduction of nitrate to nitrite. The nitrite absorbs through the stomach and reacts with hemoglobin to form methemoglobin, which does not have the oxygen carrying capacity of hemoglobin. The oxygen deficiency in the infant's blood causes the skin to become a bluish color.

According to recently released results of Phase II of the National Survey of Pesticides in Drinking Water Wells (NPS) conducted by the EPA, approximately 4.5 million people in the United States are served by community water system wells or rural domestic wells that exceed the EPA's MCL for nitrate. Approximately 66,000 of those 4.5 million people are infants under one year of age.

It should be noted that nitrates are rarely a problem for humans older than six months except at extremely high levels. And fortunately, when the nitrate contaminating source is removed, the effects of nitrate are reversible.

The principle sources of nitrate contamination in water are fertilizers, animal waste, and septic tank waste. The water supplies most vulnerable to nitrate contamination are in agricultural areas and in areas having large numbers of septic tanks. In the United States, high nitrate levels is the most frequent reason for shutting down wells.

Anion exchange, distillation, and reverse osmosis are three methods that are considered to be practical, feasible, and economical for reducing nitrate.

It must be recognized that technologies that remove nitrates may have varying effectiveness based on the amount of nitrate in the water supply and the balance of other ions in the water. The anion exchange process, for example, is sensitive to waters containing high total dissolved solids (TDS), high sulfate, and high hardness levels.

Commercially available line pressure and pump driven reverse osmosis membranes reduce nitrates from water by 60 to 95 percent.

Arsenic

Another contaminant that may be present in well water is arsenic, which is

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Well Water

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mainly caused by natural deposits and extensive use in the past as a pesticidal agent. The ingestion of as little as 100 mg of arsenic can result in severe poisoning. The effects of the poison, when ingested in small amounts, appear very slowly and may take several years for the poisoning to become apparent.

Chronic arsenosis, in its most extreme form, causes death. Arsenic in chronic doses can cause a vascular disorder called "blackfoot disease," and some data link arsenic with skin and lung cancer. The EPA has classified arsenic as a human carcinogen and has proposed an MCL of 0.05 mg/L which is currently being reviewed.

Several techniques may be used for reducing the arsenite, arsenate, and organic forms of arsenic from drinking water. Deep backwashable beds of granular activated carbon produce reduction rates from 40 to 70 percent. Weak and strong base anion exchange resins are very successful in reducing arsenic levels by 90 to 100 percent to levels below 0.05 mg/L. Distillation is capable of reducing arsenic to levels less than 2 percent of the incoming level, and reverse osmosis is capable of reducing arsenic by 90 percent.

Uranium and radium

Radioactive elements such as uranium and radium may be present in underlying rock and may end up in drinking water wells. The EPA has proposed an MCL for uranium of 0.020 mg/L. Uranium has demonstrated toxic effects on human kidneys leading to kidney inflammation and changes in urine composition.

According to the EPA, uranium is also believed to cause bone cancer and other cancers in humans at high exposure levels. Strong base anion exchange resins will remove uranium complexes effectively to meet the MCL requirement. Reverse osmosis and distillation are also effective techniques for reducing uranium levels.

The EPA has proposed a revised MCL of 20 picocuries per liter (pCi/L) for radium 226 and 20 pCi/L for radium 228. Radium may be effectively reduced by conventional water softeners using strong acid cation resin in the sodium form. Reverse osmosis and distillation are also effective in reducing radium levels.

Additional Contaminants

A variety of additional contaminants which are the result of the particular composition of formations or nearby land use activity may be found in well waters. Knowledge of the pesticides used in your area will help determine which contaminants of this type may be present. Commercial and industrial activity may result in spillage of petroleum products or solvents to groundwater. Sewage disposal may also cause leekage to groundwater if septic drain fields become overloaded or used for improper disposals.

Other substances that may be present in well water but do not cause any helath risk are iron, manganese, and hydrogen sulfide. The presence of iron and manganese discolors water and may cause the staining of surfaces and materials that are touched by the water, while hydrogen sulfide causes an objectionable "rotten egg" odor.

Treatment Technologies

Water treatment products using ion exchange, distillation, reverse osmosis, chemical oxidation/disinfection, and granular activated carbon, media, and cartridge filtration may be installed directly in the home at single or multiple taps.

Technologies are designed to solve one or several different water quality problems. However, in order to choose the right equipment, it is important to confirm the nature and extent of the problem through testing. Before purchasing a product, be sure to determine which contaminants it reduces and to what level.

Water treatment products, like many other pieces of equipment, require maintenance to function properly. Some retailers may include a service contract in the price of the product. Check with your retailer about the specific maintenance needs of your equipment and who will perform them.

Please write:

Water Quality Association
Post Office Box 606
Lisle, Illinois 60532

for more information about water quality improvement technologies. □

Consumers Ask. . .

Q. What is ion exchange and how does it work?

A. Ion exchange is a reversible process in which ions are released from an insoluble permanent material in exchange for other ions in a surrounding solution. An ion is an electrically charged atom or group of atoms. A cation is a positively charged ion, and an anion is a negatively charged ion. Consequently, in cation exchange, positively charged ions are exchanged for other positively charged ions, and in anion exchange, negatively charged ions are exchanged for other negatively charged ions.

Several water treatment processes involve ion exchange. Water softening, for example, most commonly uses cation exchange. Water is softened when calcium and magnesium ions, which cause water hardness, are exchanged by the water softener for sodium ions.

In addition to softening water, the ion exchange process can also reduce the presence of some contaminants from water. □

***WaterReview** is published quarterly by the Water Quality Research Council, in cooperation with the Water Quality Association for public policymakers, educators, water managers, and consumers.*

The Water Quality Research Council is an independent not-for-profit corporation whose purpose is to conduct or sponsor scientific research and public education in the area of water chemistry as it relates to aesthetics, health, and pollution. It is located at 4151 Naperville Road, Lisle, Illinois 60532. Third class postage is paid at West Chicago, Illinois.

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