Ground Water: Well Worth Looking For

No pun intended, but it works for me. As a certified ground water professional, I often find myself "on the stump" preaching the benefits of using ground water as a source for potable water supplies. The advantages of ground water are greatest for small to medium-size public water systems, serving fewer than 10,000 people, that require less than four million gallons of water per day. In addition to the obvious benefits of lower costs for initial construction and much lower annual treatment costs for ground water, many of the water quality problems associated with surface water are avoided simply by starting off with a cleaner source of water.

Two such water quality issues are now receiving much public attention: endocrine disrupting chemicals and disinfection by-products. They are primarily a problem for water systems that use surface water such as streams, rivers, and reservoirs. These chemicals are recognized as having the potential to cause adverse health effects in humans, and they can be delivered to your water tap despite the best efforts of drinking water professionals. Poor quality source waters and outdated treatment facilities often limit the ability of the operator to produce the best quality water.

The endocrine system of vertebrates is made up of ductless glands that produce hormones that are discharged to the blood or lymph systems. The endocrine glands include the pituitary gland, the thyroid, parathyroid, and adrenal glands, pancreatic glands, and the gonads. Endocrine disrupting chemicals can mimic hormones that can disrupt normal body functions. Detrimental effects on amphibians, bald eagles, alligators, seagulls, the Florida panther, as well as decreases in male sperm counts, and increases in testicular, prostate, and breast cancers have been blamed on endocrine disruptive chemicals (American Water Works Association Journal, Volume 92, Issue 8, August 2000).

Many of these pharmaceuticals, hormones, and other organic wastewater contaminants (OWCs) can be found in effluent discharged from wastewater treatment plants into our streams and rivers. Large river systems often have wastewater plants located upstream of water intakes for potable water supplies down stream. A recent study conducted by the U.S. Geological Survey identified 95 OWCs in water samples collected from a network of 139 steams across 30 states during 1999 and 2000. While measured concentrations rarely exceeded health or aquatic life criteria, many of the compounds detected do not have such guidelines established. (Environmental Science and Technology, Volume 36, Number 6, 2002). You can be sure more investigations, and more regulations, will be forthcoming on endocrine disruptors.

Disinfection by-products are chemicals that are formed when chlorine is added to water containing organic carbon. Chlorine is the most common and effective chemical used to disinfect water and is a critical component in reducing the risk for waterborne diseases. Under the recently published Interim Enhanced Surface Water Treatment Rule, the need for adequate disinfection must be balanced with lower levels of disinfection by-products.

Disinfection by-products have been shown to induce liver tumors, liver and kidney damage, damage to the central nervous system, and to be carcinogenic in experiments with mice (Bull, R.J., and F.C. Kopfler, 1991, Health Effects of Disinfectants and Disinfectant By-Products, AWWA Research Foundation and AWWA). Because surface water usually contains much higher concentrations of organic carbon than ground water, water systems using surface water as a source are much more likely to have problems meeting lower limits for disinfection by-products recently established by the U.S. Environmental Protection Agency (USEPA).

These chemicals, such as chloroform and trichloroacetic acid, are regulated under the Stage I Disinfection/Disinfection By-Products Rule. This rule lowered the allowable limits for total trihalomethanes and five haloacetic acids, the principal disinfection by-products. Many large surface-water systems will find it necessary to alter their disinfection process in order to meet the lower standards. Small systems using surface water and all ground water systems under the influence of surface water must comply with the new standards no later than January 1, 2004. Because ground water usually has very little organic carbon, the precursor to disinfection by-products, ground water systems in Tennessee are not expected to have difficulty meeting the lower limits.

In addition to chemical contaminants, surface water systems are likely to have more problems complying with the new filter backwash-recycling rule. This rule applies to all systems that employ conventional filtration, as do almost all surface water systems, that recycle spent filter backwash water. Small systems that recycle must report to the state by December 8, 2003. The USEPA is also expected to require routine testing for biological contaminants such as Cryptosporidium and e. coli bacteria in source waters, also more prevalent in surface water. High counts in the source water will result in additional treatment requirements.

HR3448, the Public Health and Security and Bioterrorism Preparedness Act, requires public water systems serving 3300 or more persons to conduct an assessment of the vulnerability of the system to terrorist attack or other intentional acts intended to disrupt the system's ability to deliver a safe and reliable supply of drinking water. It is much easier to secure a wellhead than to secure a surface water intake and what can be miles of raw water line.

Ground water is by far the most economical source of water for public water systems. Those systems experiencing water quality problems, revenue problems, difficulties meeting regulatory requirements (especially new turbidity and disinfection by-product standards), or facing the cost of upgrading an existing surface-water plant should consider a ground-water investigation.

Larger systems should consider drilling wells near their surface water sources to avoid building and maintaining expensive intake structures and to realize the benefits of "bank-side filtration." Let Mother Nature do some of the filtering for you!

Bradfield Environmental Services, Inc. has developed wells capable of producing one to three million gallons of water per day for the cities of Erwin, Elizabethton, Decatur, Athens, and Loudon, Tennessee. Discussions of these case studies include local geology, the number of wells required to locate suitable sources for each PWS, the results of aquifer tests, and the benefits realized from using ground water over other options available to these systems (Tennessee Public Works, November/December Issue, 1996, and March/April Issue, 2001).

The list of advantages of ground water keeps growing as new technology and new concerns about the safety of drinking water emerge. For more information about ground water and ground water source development visit our website at www.bradfieldenviro.com. For a more complete review of drinking water regulations visit www.epa.gov/epahome/laws.htm and the Tennessee Department of Environment and Conservation website at www.state.tn.us.environment. TPW