RECONNAISSANCE SURVEY OF ARSENIC SPECIES, RADIONUCLIDES, AND OTHER NATURALLY OCCURRING CONTAMINANTS IN WATER FROM MUNICIPAL SUPPLY WELLS, HOUSTON, TEXAS

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ABSTRACT

Many contaminants occur naturally in ground water. Local geology and geochemistry can control the occurrence and distribution of naturally occurring contaminants in ground water. During summer 2007, the U.S. Geological Survey, in cooperation with the City of Houston, began a reconnaissance survey of naturally occurring contaminants in water from municipal supply wells in the Houston area. Water samples were collected from 14 municipal supply wells completed in the Evangeline Aquifer of the Gulf Coast aquifer system in northeastern Houston and analyzed for major ions, trace elements, arsenic species, tritium, and selected radionuclides (uranium, radium isotopes, and gross alpha- and beta-particle activity). This initial survey is part of ongoing research to determine concentrations, spatial extent, and associated geochemical conditions conducive for transport of these constituents. Aquifer geochemistry is being studied because results of research across the country indicate that arsenic and radionuclides can be present in aquifer materials but are not mobilized into the water in concentrations of concern unless geochemical conditions are suitable for release of these constituents from aquifer materials.

Radium is most soluble in reducing, chloride-rich environments or acidic conditions, whereas uranium is most soluble in oxidizing, alkaline environments. The highest concentrations of radium were in water samples from environments under reducing conditions. Results of preliminary tritium analysis indicate that the “apparent” age of water samples is greater than 70 years, indicating the water has had ample residence time for geochemical reactions to consume dissolved oxygen. The solubility of arsenic depends on its speciation, which also is controlled by the geochemical environment. Arsenate tends to occur at larger concentrations in oxidizing and alkaline environments, and arsenite tends to occur at larger concentrations in reducing, near-neutral environments. Preliminary results from 12 of the 14 public supply wells indicate that the ground water is primarily reducing and slightly alkaline. Arsenite is the most prevalent species of arsenic in the water at these 12 sites. The two remaining wells yielded dissolved oxygen concentrations greater than 2 milligrams per liter, and consequently arsenate was the dominate species at these sites.

KEYWORDS

Naturally occurring contaminants, radionuclides, arsenic, arsenic speciation, municipal supply wells