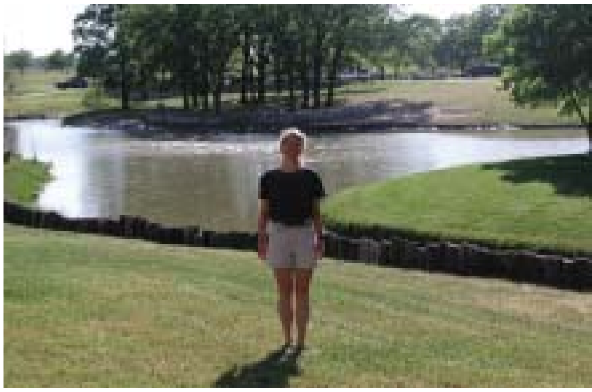
Radon Concern in the Hickory Aquifer

Graduate student assesses radionuclide problem



As the primary water source for Mason, Concho, McCulloch, San Saba, Menard, Kimble, and Gillespie counties in Central Texas, the threat of elevated radionuclide concentrations in the Hickory Aquifer's groundwater poses health risks for residents in the area.

Radon is a natural, radioactive gas that may be found indoors in air or drinking water. Radon is the decay product of radium, so radon indirectly reflects the presence of radium. Radon in groundwater occurs from the decay of radium both within the aquifer host rock and in the groundwater itself. It does not react chemically with either, however, because it is a noble or inert gas. About 1 percent to 2 percent of potentially harmful radon originates in drinking water.

Studies have shown that people exposed to large quantities of radon in the air may have increased lung cancer risk. Although the health effects related to drinking water with high radon are unclear, household use of water containing high radon concentrations can release potentially dangerous levels of radon into the air.

Leslie Randolph, a graduate student at Texas A&M University's Department of Geology, is using her U.S. Geological Survey (USGS) Research Grant administered through the Texas Water Resources Institute (TWRI) to assess the spatial and temporal distribution of radon in Hickory groundwater.

Randolph conducts her research at a small field site in the Katemcy Creek watershed in northern Mason and southern McCulloch counties. She hopes to gather enough data to achieve the first step in a long-term assessment of radionuclides in the Hickory aquifer system's groundwater.

Previously, no systematic study has been done to assess the degree of the radionuclide problem, but Randolph will explore the relationships between observed radon distributions, aquifer stratigraphy and mineralogy, and groundwater dynamics.

A primary goal of the research is to evaluate the function of major stratigraphic variations on radon concentrations. Randolph hopes to "provide new insights regarding the occurrence and distribution of radon and radium in the world's aquifers that are geologically and hydrologically similar to the Hickory aquifer," she said, anticipating her research leading to further investigations of relationships between radon gas and its parent nuclides, aquifer mineralogy, and aquifer geochemistry.

Another goal, which she admits may be idealistic, is to determine if one or more stratigraphic zones in the aquifer contain radionuclide concentrations within adequately safe levels in terms of human risk.

"Water wells could be designed to draw from only those zones, rather than from across the entire aquifer as typically is done," Randolph said.

Groundwater samples are collected during both the summer irrigation season and periods of static flow in the aquifer. This allows Randolph to better assess effects of differing groundwater flow rates on radon activity. At the field site, Randolph prepares the samples for radon and radium analysis, and she analyzes them for anion concentrations. Additional samples are sent to the TAMU Trace Element Research Lab for cation and trace element analysis.

Randolph designed a groundwater sampling scheme based on the stratigraphic variations in the Hickory sandstone aquifer at the field site. Her preliminary measurements show that radon activities vary between approximately 100 picoCuries per liter (pCi/L) and 1000 pCi/L, with the lowest activities in water collected from within a fault zone, and the higher activities found generally in the lower parts of the aquifer. Activities overall are generally higher when nearby irrigation wells are pumping.

These numbers may sound high, but they actually are of questionable concern in terms of human health risk. The EPA has not yet set a maximum contaminant level (MCL) for radon in drinking water, but recommends a limit of 4000 pCi/L for untreated water and 300 pCi/L for treated water.

However, radon's radioactive parent radium has been detected in groundwater from many Hickory Aquifer water wells at levels that exceed the MCL of 5 pCi/L. Randolph uses stratigraphy to assess the variations in radium concentrations at her field site.

Through this preliminary effort, Randolph has discovered that not only has the expenditure been surprisingly high, but she has run into some other difficulties as well.

"The financial cost of doing the research is higher than I anticipated," Randolph said.

"Coordinating groundwater collection opportunities with the researcher who installed the wells, the local farmers, and Mother Nature has proven more difficult than I anticipated."

She said that she appreciates the TWRI grant because it has helped her pay for necessary analytical instruments and field and laboratory supplies.

"This research could not have been done without TWRI's help," Randolph said.

Because most people are not aware of the risks associated with radionuclides in drinking water, Randolph hopes her research will inform the average person about their existence and give them the knowledge to be on the lookout for these natural contaminants.