New Mexico Water Resources Research Institute
New Mexico State University, MSC 3167
PO Box 30001, Las Cruces, NM 88003-8001
(575) 646-4337 Fax 646-6418
http://wrri.nmsu.edu

For Release: August 13, 2010

From: Cathy Ortega Klett, 575-646-1195

Abating Uranium Contamination in Four Corners Area Groundwater
by Will Keener, WRRI (attached photo)

When Antonio Lara, Assistant Professor in New Mexico State University's Chemistry and Biochemistry Department, learned that student Nick Beltran was from Gallup, New Mexico, he had a project for him. Throughout the Four Corners area on and off the 27,000-acre Navajo Reservation, a legacy of earlier uranium mining in the area has left uranium-contaminated groundwater, presenting serious problems for the health of residents.

"Professor Lara suggested the uranium problem," Beltran recalls. "Although I was somewhat familiar with the mining, I didn't know about the water situation. Dr. Lara is very attracted to research that benefits communities. What we are working on is an appropriate technology that people can understand and use. It's a local solution to a problem."

Uranium is a natural element that can be found everywhere. However, mining activities can increase human exposure. Processing and transporting ore during various weather conditions – windy and rainy weather – can mobilize uranium particles. These particles can combine with the rainwater and migrate into the groundwater.

With a research grant from the Water Resources Research Institute, Lara and Beltran designed experiments and gathered data to provide a proof of concept on a relatively low-tech, low-energy approach to cleaning up the groundwater.

The project involves the use of phyllosilicates found in common clays around New Mexico to capture the uranium ions in contaminated water. The phyllosilicates, or sheet silicates, have a unique structure that allows them to capture metallic ions in solution. When uranium-containing water contacts the clay, an exchange of one positively charged uranium ion in solution for two positively charged sodium ions in the clay occurs.

Nick Beltran (left) and Professor Antonio Lara discuss some recent data recorded during experiments. Lara's emphasis on the uranium work and other projects is to provide community-based solutions to problems.

In the experiments, uranium solutions of known concentrations are introduced to clay pellets on the test-tube scale. One experiment showed that the uranium 132.4 parts per billion (ppb) in the first fifteen minutes. The clay reduced concentrations to below EPA's safe drinking water limit of 30 ppb within the next hour and a half. The final uranium concentration was 1.5 ppb after eight hours of exposure to the layered phyllosilicates.

“It takes some time to get to that point, and that’s one of the things we’re still addressing,” says Beltran. “But the process is very simplistic, with low energy requirements.”

The research team is using two key tools to study the uranium abatement process and find opportunities to optimize it. The inductively coupled plasma mass spectrometer can determine the presence of uranium isotopes at the parts per billion level, Beltran explains. It takes an accurate snapshot of the water sample at a point in time. Another instrument, the luminescent spectrometer, can track changes over time, although only in the parts per million concentration range.

“As the abatement takes place, we can see the charged uranium quickly concentrates around the sorbent (clay particles), but the ion exchange moves slower,” says Beltran.

The researchers are testing different clays as opportunities arise, but so far the type of clay hasn’t mattered. “We see brown clays from near Berino and red clays from around Gallup, but the structures are similar and both seem to work equally well,” says Beltran.

Team members are studying water pH, uranium concentrations, exposure times to the clay, and other variables in bench-scale tests to better understand the process. Right now, the team describes the uptake of uranium by the clay as “sorbing.” This is a term that describes potential mechanisms that may be at work – adsorption or absorption, says Beltran. “The next step is to do kinetic and thermodynamic studies to determine what actually goes on inside the clay and then propose models that will improve the sorption design.”

“The use of clay to abate uranium is only one potential application,” Lara explains. “We will be working with one element at a time, but there is no reason to have heavy metals in drinking water with this approach. It’s an appropriate level of technology.” Lara has reached out to affected communities by establishing a relationship with researchers at Dinè Community College at Shiprock, New Mexico. When Dinè Environmental Institute Director Marnie Carrol and a Dinè College student arrive on the NMSU campus in late July, Lara, Beltran and the team will work with them to help analyze soil and water samples collected on the Navajo Reservation. This outreach is critical, says Beltran. The problem threatens to become worse, as attention on U.S. uranium supplies becomes more intense and mining companies again eye potential mining sites in the Four Corners region.

By proving that the concept works and demonstrating it at a community scale, Beltran is hopeful that mining companies as well as local governments will adopt the process.

Members of the research team have included several NMSU undergraduates: Jesus Martinez, biology; Raymundo Chavira, genetics; Vanessa Begay, biology; Amanda Munoz, biochemistry; David Kimball, biology; William Bradley, chemical engineering; Rich Eriacho, chemistry; and Diane Shelby, animal and range science.

Most of the team members have become involved in the uranium project through the Bridge Program, which promotes the education of Native American students in biomedical research, and the NMSU RISE to Excellence Program. RISE encourages minorities and other selected groups to participate in a research career.

The New Mexico Water Resources Research Institute is a nonprofit organization that funds water-related projects at all of New Mexico’s universities.