2010 GSA Denver Annual Meeting (31 October –3 November 2010)

Paper No. 15-4

Presentation Time: 9:10 AM-9:25 AM

ANTHROPOGENIC INDUCED REDOX DISEQUILIBRIUM IN URANIUM ORE ZONES

ABITZ, Richard J., Savannah River National Laboratory, Savannah River Site, Aiken, SC 29808, richard.abitz@srnl.doe.gov and DARLING, Bruce K., SW Geological Consulting Services, 7425 Amanda Ellis Way, Austin, TX 78749

Drilling is a destructive process that disturbs the physical and chemical state of solid and liquid phases in uranium ore zones. Physical degradation occurs as the drill bit grinds through the ore and changes the surface area of the uranium phases. Chemical changes are induced by the introduction of mud, fluid and air during drilling and well development. The increase in surface area of the uranium phases exposed in the drill hole and introduction of oxygen from fluid and air may create a transient signature of redox disequilibrium in the first several rounds of groundwater samples. These changes must be understood and documented before establishing an accurate baseline that can be used in a valid assessment of the environmental impact of uranium *in situ* recovery (ISR) operations on groundwater quality.

A transient redox condition is observed in groundwater samples collected from the proposed uranium ISR project in Goliad, TX. Samples collected over a period of approximately 18 months from monitoring wells placed outside and inside the ore zone show decreasing uranium and/or arsenic concentrations between the first, second, and third rounds of samples. In the ore zone, first round samples show uranium variation from 0.804 to 0.005 mg/L, while third round samples are tightly clustered between 0.010 and 0.005 mg/L. Decreasing uranium values follow solubility curves for uraninite and soddyite as Eh decreases. Samples collected from monitoring wells in the overlying sand outside the ore zone show that the arsenic variation of 0.032 to 0.010 mg/L in Round 1 decreases to 0.010 to 0.005 in Round 3. The anthropogenic disturbance of the ore zone also releases additional radium-226 into the groundwater, and radium-226 remains elevated in subsequent sampling rounds because it is insensitive to redox variation. This example serves to illustrate that conventional drilling and development methods may not produce accurate baseline values for uranium and arsenic until initial redox conditions return. However, once the ore deposit is disturbed, it is unlikely that a true baseline value can be developed for radium-226. Alternate sampling methods (e.g., geoprobe push rods) should be used to collect the most representative sample possible to ensure valid baseline values will be established for important water-quality parameters.

2010 GSA Denver Annual Meeting (31 October –3 November 2010)
General Information for this Meeting

Presentation Handout (.ppt format, 3615.0 kb)

Session No. 15
Reducing the Environmental Impact of Uranium In Situ Recovery
Colorado Convention Center: Room 205
8:00 AM-12:00 PM, Sunday, 31 October 2010

Geological Society of America *Abstracts with Programs*, Vol. 42, No. 5, p. 56