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

Paper No. 15-9

Presentation Time: 10:40 AM-10:55 AM

IDENTIFYING MINERAL SCHEMES FOR AQUIFER RESTORATION AFTER URANIUM IN-SITU RECOVERY

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Uranium in-situ recovery (ISR) involves the injection of an oxidizing lixiviant fluid into the roll front ore zone of an aquifer for the purpose of mobilizing and extracting uranium. The lixiviant solution oxidizes and dissolves uranium in ore minerals and keeps the U(VI) in solution by forming strong aqueous complexes that react little with the host rock so that sorption or precipitation does not hinder uranium removal. Water quality effects within the aquifer are caused primarily by chemical reactions between the lixiviant and the geologic medium, as well as with the associated secondary minerals in the host rock formation. These interactions include redox, dissolution, precipitation, and sorption or ion exchange reactions. The lixiviant oxidizes the U(IV) minerals in the ore, as well as other reduced minerals. There is also the potential for mobilization of trace elements including arsenic, vanadium, zinc, selenium, molybdenum, iron, and manganese.

At the conclusion of ISR, it is necessary to restore the groundwater quality. Groundwater sweep alone is typically insufficient for complete restoration because of aquifer heterogeneities and alterations to the host rock mineralogy caused by the lixiviant; oxygen scavengers or reducing agents are then added to re-establish reducing conditions in the ore-bearing unit of the aquifer.

Current methods of groundwater remediation show an initial decrease in contaminants after restoration, but concentrations tend to rebound shortly after. This observed rebound has caused stakeholder concerns and difficulty in permitting ISR operations. Current methods are simplistic, focusing primarily on the aqueous phase of uranium. Focus should be placed on restoring the mineral phases, and establishing “mineral schemes” that facilitate restoration as well as achieve sustained compliance with restoration targets. We present a framework for a robust strategy for restoration that emphasizes synergy between microbiology and mineralogy, with focus on meeting goals for radionuclides, metals, and metalloids. Data from ISR case studies will be discussed in this context, including geochemical modeling and mineralogical evaluations supporting this approach.

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General Information for this Meeting

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Colorado Convention Center: Room 205
8:00 AM-12:00 PM, Sunday, 31 October 2010

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