SEASONAL FLUCTUATION IN URANIUM DECAY-SERIES COMPOSITION OF WATERS AT PEÑA BLANCA, MEXICO

SIMMONS, Ardyth M., amsimmons@lbl.gov, Lawrence Berkeley National Laboratory, Michael Murrell and Steven J. Goldstein, MS J514, Los Alamos National Laboratory, Los Alamos, NM 87545

In the 1970s, the Peña Blanca region (~50 km north of Chihuahua City, Mexico) was a target of uranium exploration and mining by the Mexican government. Since that time the Nopal I uranium deposit, located in unsaturated volcanic tuff, has been studied extensively because it is a good analogue for evaluating the fate of spent fuel, associated actinides, and fission products at a Yucca Mountain repository. Water samples were collected from various locations (adit seepage, perched water, water supply well) near the Nopal I uranium deposit. $^{234}U/^{238}U$ ratios were higher in samples collected previously during relatively wet (summer) conditions (Pickett and Murphy 1999) than those of our data collected over the last two years from the same locations during dry (winter) conditions. Wet season samples have uranium concentrations <6 ppb and $^{234}U/^{238}U$ ratios of 76×10^{-6} to 278×10^{-6} (Pickett and Murphy 1999). Dry season samples show uranium concentrations of <68 ppb and $^{234}U/^{238}U$ ratios of 50×10^{-6} to 156×10^{-6}. Two processes could be responsible for the seasonal variations in uranium isotopic composition at the site: 1) increased uranium dissolution and/or lower α-recoil-associated ^{234}U enrichment rates in the vadose zone near the deposit during the dry season; and 2) increased evaporation under low-humidity conditions. Large variations in the ^{238}U concentration and $^{234}U/^{238}U$ ratio were also found in samples collected from the saturated zone during the dry season. Observations such as these are important to performance assessments for evaluating the effects of climate on the long-term behavior of uranium in an oxidizing geologic environment. To correct analytical model results for the possible effect of evaporative concentration, chloride and stable isotope measurements made on water samples from the vadose zone are compared to those of rainwater. The U-series model results contribute toward understanding of the 3-D transport of uranium and radiogenic daughter products at Peña Blanca.