AQUEOUS GEOCHEMISTRY OF URANIUM, LOS ALAMOS AND SURROUNDING AREAS, NEW MEXICO

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This presentation provides analytical results for groundwater obtained during four characterization-sampling rounds conducted at several regional aquifer and perched-intermediate wells at Los Alamos National Laboratory. Springs discharging in White Rock Canyon and in the Sierra de los Valles have also been sampled as part of this investigation. Uranium is a trace element of interest because natural background generally is less than 2 μg/L, depending on the reactive-phase mineralogy of aquifer material, aqueous chemistry, and age and residence time of groundwater. Uranium has been processed at Los Alamos National Laboratory since the early 1940s for a variety of purposes.

Analytical results for the wells near Los Alamos National Laboratory show that solute concentrations within the regional aquifer are presently below maximum contaminant levels (MCLs) established by the EPA, including those for uranium (MCL of 0.030 mg/L). Groundwater collected from the regional aquifer and perched zones at Los Alamos National Laboratory is dominantly a calcium-sodium-bicarbonate type and is relatively oxidizing. Natural uranium concentrations in the regional aquifer increase east of the Pajarito Plateau and Rio Grande.

Geochemical calculations using the computer programs PHREEQC2.2 and MINTEQA2 were performed to evaluate solute speciation, mineral equilibrium, and adsorption/desorption in assessing uranium aqueous chemistry and transport. Results suggest that the regional aquifer approaches equilibrium with respect to amorphous silica phases or volcanic glass and $CaCO_3$ and that the aquifer is undersaturated with respect to $USiO_4$, $UO_2(OH)_2$, $MnCO_3$, and $SrCO_3$. Groundwater shows variable saturation with respect to $Ca(UO_2)_2(Si_2O_5)_3 \cdot 5H_2O$ (haiweeite), based on silica activity and pH. Surface complexation modeling (diffuse layer) of U(VI) shows that ferrihydrite partly adsorbs uranyl carbonato species, which is in agreement with experimental and field observations.