The use of kinetic modeling as a tool in the understanding of the geochemical processes at a uranium mine site.

Mariza Franklin[1], Horst Fernandes[2]

[1] Institute of Radiation Protection and Dosimetry / Brazilian Nuclear Energy Commission, Av Salvador Allende S/N – Recreio, Rio de Janeiro, Brazil.
[2] International Atomic Energy Agency, Division of Nuclear Fuel Cycle and Waste Technology, Wagramer Strasse 5, A-1400 Vienna, Austria

As discussed in another paper presented in this conference, the knowledge and simulation of the relevant geochemical reactions along with the understanding and quantification of oxygen transport and water flow inside waste rock piles are important elements to aid in the decision making process regarding the choice of the most appropriate strategies to be applied to remediate acid generating mining waste dumps. This paper discusses the application of a geochemical kinetic model to assess the potential for contaminant release from one of the waste rock piles of the first uranium production centre in Brazil. The waste rock pile object of this study presents a volume of 12.4×10^6 m^3 and an area of 56.9×10^6 m^2. The adopted code was the STEADYQL. The model predicts the steady-state composition of the drainage resulting from the interactions between the aqueous and solid phases being this interaction subjected to a combination of kinetic and equilibrium reactions (homogeneous and heterogeneous). Aqueous complexation reactions and precipitation of secondary phases were assumed to be *fast* processes and were treated as reactions at equilibrium. The slow reactions were represented by the kinetic expression and associated rate constants in order to address the dissolution reactions of key minerals present in the pile and the Fe^{+2} oxygenation. *Very slow* processes were not explicitly included in the simulation. The concentrations of SO_4, K e F were underestimated by 2%, 13% e 5% respectively if compared to the average concentrations of these elements in the drainage waters. On the other hand Al concentrations were overestimated by in 19%..The model was not able to reproduce the concentrations of U and Fe satisfactorily. In the case of uranium this was due to a lack of information regarding the dissolution rate applicable to the simulation conditions. In the case of Fe that was due to the fact that only abiotic process was taken into account.