USING FOCUSED HARD X-RAYS FOR INVESTIGATIONS RELATED TO NUCLEAR WASTE DISPOSAL

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Micro-focused synchrotron radiation techniques to investigate determinant processes in actinide element transport in geological media are becoming an increasingly used tool in nuclear waste disposal research. There are a number of reasons for this but primarily they are driven by the need to characterize radionuclide speciation localized in components of heterogeneous natural systems. The advantage of using X-rays is that *in situ* investigations are possible, due to elimination of a vacuum requirement, no need for invasive sample preparation, and the high penetration capability of X-rays. The ultimate goal of such studies is to advance development of reliable predictive models for radionuclide transport processes at varying spatial and temporal scales, with a reliable estimate of uncertainty. This information is necessary for designing safe nuclear disposal concepts by assessing potential hazards associated with any radioactive contamination release.

The first two examples deal with characterizing what are referred to as natural analogs, in this case clayey sediments rich in uranium [1,2,3], using μ-XRF, μ-XAFS, and μ-XRD. Natural analogs are considered to mimic repository geochemical and geological conditions on a geological time scale and knowledge gained from their study can be used to span the long time scales in a top down approach for predicting repository radiological safety. The last example pertains to actinide transport in column tracer studies [4], which are important for identifying processes determinant in the fate of radionuclides in the environment (e.g., sorption, precipitation, solid solution formation reactions), as well as for disposal site specific characterization.

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