The Tracer Retention Understanding Experiments (TRUE), Äspö Hard Rock Laboratory, Sweden

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SKB's concept on deep geological disposal of spent nuclear fuel is based on a multi-barrier system for isolation of the spent fuel from the biosphere. The barriers are a low-solubility waste form, encapsulation of the fuel in a copper canister, a bentonite buffer surrounding the canister, and the host rock. In case of an initial canister damage, the retention capacity of the host rock for the short lived radionuclides such as Cs and Sr is important. For the Operating Phase of the Äspö Hard Rock Laboratory the need for a better understanding of radionuclide transport and retention processes was recognised. This included enhancement of confidence in models to be used for quantifying transport of sorbing radionuclides in performance assessment. Further, to be able to show that pertinent transport data can be obtained from site characterisation or field experiments and that laboratory results can be related to retention parameters obtained in situ. To resolve these issues SKB initiated the Tracer Retention Understanding Experiments (TRUE). The TRUE programme is based on a staged approach. Periodic evaluation of test results and a close integration of experimental and modelling work should provide the basis for detailed planning of subsequent test cycles and successive improvement of models. The planned duration of the total the program is about 10 years, beginning in 1994 and ending in 2003. The basic idea is to perform a series of tracer experiments with successively increasing complexity. Each tracer experiment will consist of a cycle of activities beginning with geological characterisation, modelling, followed by a set of hydraulic and tracer tests. Injection of epoxy resin in the transport paths of the tested rock volume followed by excavation and analyses for flow path geometry and tracer concentration is considered as a final activity. The first test cycle, TRUE-1, which recently has been concluded, is small scale (5-10 metres), focused on a single feature, of limited time duration, and primarily aimed at technology development, but including tests with radioactive sorbing tracers. Supporting work included development of techniques for pore space characterisation using resin, batch sorption and through diffusion tests using weakly sorbing tracer tests in the laboratory, and analytical and numerical modelling. Ongoing is TRUE Block Scale, an international partnership project, which is focused on the characterisation, experimentation and modelling of transport phenomena in a network of fractures at a length scale of 10-50 metres. The project ia. constituted a test bench for techniques for determining the conductive geometry and material properties of the studied fracture network. Presently the TRUE Block Scale Project has reached a point where it is entering into its most interesting stage. Tracer tests in the block scale have been demonstrated, and through a series of planned tracer experiments, the transport characteristics and set up hypotheses for the investigated rock volume will be investigated and tested. The tracer experiments, including tests with radioactive sorbing tracers, will be subject to blind model prediction and evaluation using various modelling concepts for fractured crystalline rock.