



Present status of criteria to prove functionality of the geological barrier in order to demonstrate safe confinement of HLW/SF- radioactive waste

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In Germany a new site selection process has been started in order to select a site for an HLW/SF final repository which shows the best possible safety within the assessment period of 1 million years. According to the findings of the Repository Commission (Endlagerkommission) and the Site Selection Law (StandAG) possible host rocks are salt, clay, and crystalline rock.

As salt has been the reference host rock in Germany in the past, criteria were developed to prove the integrity of the geological rock salt barrier to demonstrate the safe confinement of radioactive waste. In rock salt the demonstration of integrity of the geological barrier covers the proof of its functionality because undisturbed rock salt is tight. In detail, the so-called dilatancy criterion which describes the boundary where generation and growth of cracks due to deviatoric loading occurs and the fluid-pressure-criterion which describes the condition where opening of grain boundaries occurs if the fluid pressure exceeds the stress and adhesive forces at the grain boundaries were published, discussed, and verified. Presently, they are broadly accepted to demonstrate the integrity and tightness of the geological rock salt barrier.

In 1999 a forum – AKEnd (Arbeitskreis Auswahlverfahren Endlagerstandorte) - was started to discuss questions around final disposal of radioactive waste in the public. As a result of this discussion clay was regarded to serve as an additional potential host rock in Germany. Consequently, research activities were started in order to develop criteria to prove the functionality of the clay barrier. Within research projects comparable criteria to the dilatancy criterion and the fluid pressure criterion were developed taking into account clay properties. These criteria are called dilatancy criterion and fluid-pressure criterion as well. These two criteria, however, do not cover all aspects of demonstrating the functionality of a geological clay barrier. A third criterion turned out to be decisive - the so-called advection criterion. Although water migration is slow in clay the repository induced water migration needs to be assessed. This criterion was developed within a research project, recently.

Presently, research activities are performed to develop comparable criteria for crystalline rock focusing on the conditions that describe boundary where cracking occurs and the condition where opening of cracks will occur due to pore pressure. A first approach is available to solve this problem.

This contribution gives an overview of the present status of criteria to prove integrity and functionality of the geological barrier in salt, clay, and crystalline host rock.