Saf. Nucl. Waste Disposal, 2, 43–44, 2023
https://doi.org/10.5194/sand-2-43-2023

SaND
Safety of Nuclear
Waste Disposal
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Concretisation of host-rock-dependent canister concepts through the development of a consistent but variable multi-barrier system for the future engineered barrier system

Thomas Hassel

Materials Science, Leibniz Universität Hannover, 30823 Garbsen, Germany

Correspondence: Thomas Hassel (hassel@iw.uni-hannover.de)

Received: 28 March 2023 – Accepted: 22 May 2023 – Published: 6 September 2023

Abstract. A clear and necessary shift in the site selection process is emerging, as otherwise a participatory, science-based, transparent, self-questioning, learning and reversible process seems futile. The questions of guaranteeing safety and the careful trade-offs to be made with extensive participation of society therefore require a rethink with regard to the time set for site selection (StandAG – targeted site selection 2031). Since this also pushes the decision on the selection of a host rock even further into the future, the question arises as to how the preparation of technical developments can be continued in a manner as concrete as possible. In particular, answering questions about the type of technical barrier, i.e. the development of the barrier system, therefore runs the risk of not being able to be advanced with the necessary focus (“pressure on the vessel”). In this paper, a methodical approach is presented on how the container development can be advanced in a target-oriented manner through research and development, even without a quick decision for a host rock. The basis of the approach is the division of the consideration of the engineered barrier system (EBS) development into two approaches. The first approach is from the “inside to the outside” of the inventory, so that the questions of radiological safety, heat flow and nuclide release are focused and can essentially be regarded as independent of the host rock. The second approach then focuses on the environmental influences on the container, the “outside to inside”. With this, the individual systems can be worked out depending on the host rock, which can then be coupled modularly with the first approach. It is not necessary to know the exact coupling point or the number of possible barriers in such a system. Through an intelligent choice of the coupling point later on as well as the number of barriers, the previous requirements for the repository containers for highly radioactive materials can thus be regarded, and the necessary flexibility for the requirements that still need to be further specified is maintained nevertheless. The findings on this are based on the work in the completed collaborative project ENTRIA (Entsorgungsoptionen für radioaktive Reststoffe: Interdisziplinäre Analysen und Entwicklung von Bewertungsgrundlagen), the ongoing collaborative project TRANSENS (Transdisziplinäre Forschung zur Entsorgung hochradioaktiver Abfälle in Deutschland) and the associated interdisciplinary and transdisciplinary exchange in many scientific and societal discussions, as well as the disciplinary research project ElaBeMa (Recherche und Beschreibung für das Endlagerbehältersystem in Frage kommende Materialien), which is currently ongoing.

Published by Copernicus Publications on behalf of the Federal Office for the Safety of Nuclear Waste Management (BASE).

Financial support. This research has been supported by the Bundesministerium für Umwelt, Naturschutz, nukleare Sicherheit und Verbraucherschutz (grant nos. TRANSENS FKZ 02E11849F and ElaBeMa FKZ 02E12092).