Which Processes could define Temperature Limits on the Outer Surface of a Container in a Disposal Facility?

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When the recommencement of the search for and selection of a site for a disposal facility for HLRW in Germany was stipulated by the Site Selection Act (StandAG 2017) in 2017, a precautionary temperature limit of 100 °C on the outer surface of the containers with high-level radioactive waste in the disposal facility section was set. This precautionary temperature limit shall be applied in preliminary safety analyses provided that the “maximum physically possible temperatures” in the respective host rocks have not yet been determined due to pending research. Therefore, this issue is addressed and discussed in this paper, contributing to “pending research” by a review of the literature.

This presentation briefly discusses a few examples of thermohydraulic, mechanical, chemical and biological processes in a disposal facility, because temperature limits are derived based on safety impacts regarding THMCB-processes. The temperature-dependent processes have been extracted from databases for features, events and processes (FEP-databases). Furthermore, it is discussed if the feasibility to retrieve and recover HLRW is hampered at high temperatures.

It is concluded that a design temperature concerning single components of a disposal facility for the preservation of their features can be derived when a safety concept is established. However, the interactions of all relevant processes in a disposal concept must be considered to determine a specific temperature limit for the outer surface of the containers. Therefore, applicable temperature limits may vary for particular safety and disposal concepts in the following host rocks: rock salt, clay stone and crystalline rock.

Technical solutions for retrieval and design options for recovery seem to be viable up to temperatures of 200 °C with different, sometimes severe, downsides according to expert judgement.

It is summarized that temperature limits regarding the outer surface of the containers can be derived specifically for each safety concept and design of the disposal facility in a host rock. General temperature limits without reference to specific safety concepts or the particular design of the disposal facility may narrow down the possibilities for optimisation of the disposal facility and could adversely affect the site selection process in finding the best suitable site.