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1. Introduction

The representative preliminary safety analyses aim to assess the extent to which the safe containment of the radioactive waste can be expected (Section 27 StandAG). The analysis of the disposal system will be based on elaborating its potential future evolutions (Fig. 1, § 3 EndlSiAnfV). This requires large amounts of data concerning different components of the disposal system to be managed, for example the compilation of physical, geoscientific and technical parameters. The compilation of these data, linked to features, events and processes (FEP) will generate site specific potential evolutions (scenarios) of the disposal system. A **database solution** aims to not only provide the data, but also the framework needed for the analyses.

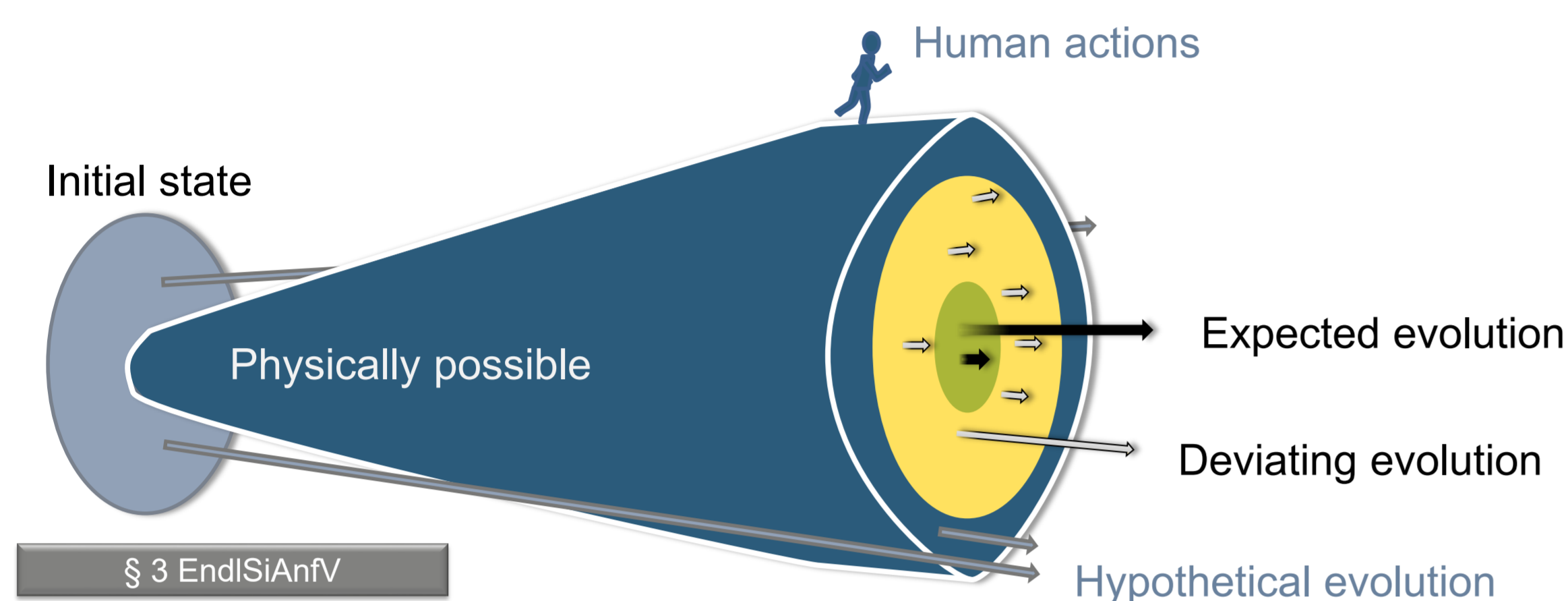


Fig. 1: The initial state marks the beginning of the post-closure phase and starting "area" of all expected, deviating and hypothetical future evolutions of the disposal system. The cone represents the future space (after Christophilopoulos, 2021), single evolutions of the system are indicated by arrows. Evolutions based on human actions, less predictable than technological and natural evolutions, are represented by the sketch of a person. In the representative preliminary safety analyses only expected and deviating evolutions based on geogenic events and processes have to be considered (§ 7 para. 6 no. 1 EndlSiUntV), hypothetical evolutions and human actions are therefore greyed out. (Source: BGE)

Necessary knowledge about the disposal system:

- Characterizing **features**: components and their properties
- Events and processes: **processes** acting in and on the disposal system

2. Challenges

- Large area and number of subareas will generate a large number of investigation areas and hence analyses that have to be performed.
- Scenario development in the past has been performed for generic disposal sites or to compare a small number of potential sites (Beuth et al. 2012, Mayer et al. 2019), but not yet for multiple different disposal concepts and a large number of potential sites at the same time.
- Innovation is required to reduce workload while still ensuring fair representation for each investigation area.

German Site Selection Procedure

The Federal Company for Radioactive Waste Disposal (BGE) is the German waste management organisation responsible for implementing the search for a site with the best possible safety for the disposal of high-level radioactive waste for at least 1 million years, following the amendments of the Repository Site Selection Act (StandAG) in 2017. The selection procedure is meant to be a participatory, transparent, learning and self-questioning process based on scientific expertise. It consists of three phases with an increasing level of detail. The first step of the first phase of the site selection procedure was completed in September 2020 and resulted in the identification of 90 subareas that give reason to expect favourable geological conditions for the safe disposal (BGE 2020). The potentially suitable subareas cover approximately 54% of Germany and are located in three different host rocks: rock salt (halite), claystone and crystalline rock.

The second step of phase one is currently in progress (Section 14 StandAG) and includes the so-called representative preliminary safety analyses that aim to assess the extent to which the safe containment of the radioactive waste can be expected. Representative preliminary safety analyses are one of the foundations for deciding whether an area will be considered for surface-based exploration in the next phase of the site selection procedure. Within the preliminary safety analyses, the behaviour of the disposal system is analysed in its entirety, across all operational phases of the repository and under consideration of possible future evolutions of the disposal system with respect to the safe containment of the radioactive waste.

3. Workflow and Database Model

- The database is intended to handle both parameter documentation, FEP-catalogue and scenario development, ideally generating well structured output of parameterised scenarios for the modelling team.
- A prototype of the database is currently developed using MS Access, final implementation utilizing MS SQL Server.
- Publication is intended as web-interface as well as a printed report for long-term archival storage.

Proposed workflow (Fig. 2):

- Develop generic disposal concept and generic scenario development for each possible disposal system
- Document parametrisation of disposal system for each investigation area
- Screen generic concept and scenario development, then assign local information to generic concept for each investigation area

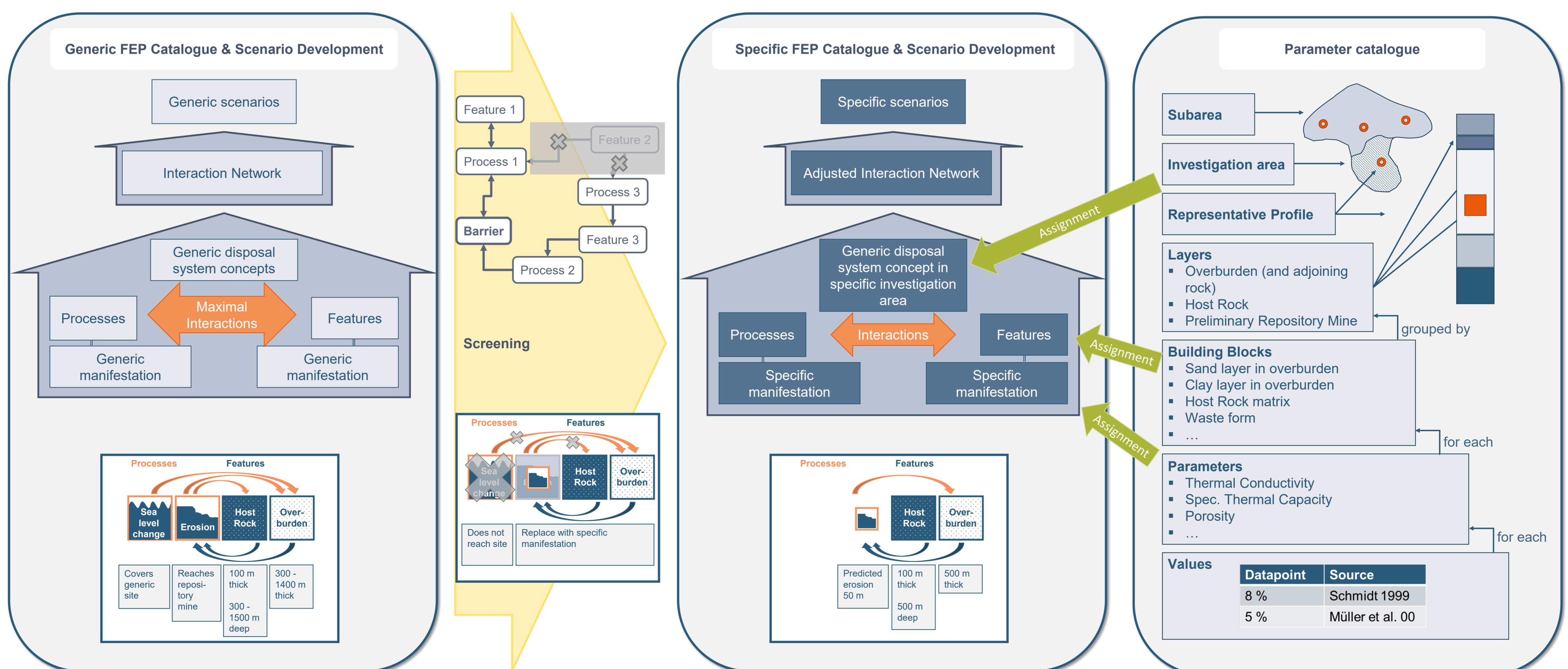


Fig. 2: Proposed workflow for the scenario development within the scope of the analyses of the disposal system for multiple disposal concepts and multiple investigation areas (Source: BGE)

References
 Beuth, T., Bracke, G., Buhmann, D., Dresbach, C., Keller, S., Krone, J., Lommerzheim, A., Mönig, J., Mrugalla, S., Rübél, A. & Wolf, J. (2012): *Szenarienentwicklung: Methodik und Anwendung*. Vorläufige Sicherheitsanalyse für den Standort Gorleben. GRS - 284. Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), DBE Technology GmbH.
 Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) gGmbH, Köln. ISBN 9783939355601
 BGE (2020): *Sub-areas Interim Report pursuant to Section 13 StandAG*. Peine: Bundesgesellschaft für Endlagerung mbH. https://www.bge.de/fileadmin/user_upload/Standortsuche/Wesentliche_Unterlagen/Zwischenbericht_Teilgebiete/Zwischenbericht_Teilgebiete_-_Englische_Fassung_barrierefrei.pdf
 Christophilopoulos, E. (2021) *Special Relativity Theory Expands the Futures Cone's Conceptualisation of the Futures and The Pasts*, Journal of Futures Studies, 26(1): 83-90
 EndlSiAnfV: Endlagersicherheitsanforderungsverordnung vom 6. Oktober 2020 (BGBl. I S. 2094)
 EndlSiUntV: Endlagersicherheitsuntersuchungsverordnung vom 6. Oktober 2020 (BGBl. I S. 2094, 2103)
 Mayer, K.-M., Beuth, T. & Bracke, G. (2019): *Szenarienentwicklung für verschiedene Wirtsgesteine und Konzepte*. GRS - 525. Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) gGmbH, Köln, Garching b. München, Berlin, Braunschweig. ISBN 9783947685103
 StandAG: Standortauswahlgesetz vom 5. Mai 2017 (BGBl. I S. 1074), das zuletzt durch Artikel 1 des Gesetzes vom 7. Dezember 2020 (BGBl. I S. 2760) geändert worden ist