

Research & Development Plan SURA0 2020

Main review findings and recommendations

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General

- The Research and Development Plan SURAO 2020 is an impressive document showing how much effort SURAO has already made
 - SURAO's R&D approach seems very well justified
- Interdependencies of selecting and characterizing a site and designing the repository and the disposal concept could be expressed more clearly
 - Selecting a site and host rock defines the disposal concept that can be applied, and the properties of the host rock strongly effect the repository design, too
 - The disposal concept defines the components of the disposal system, i.e. the engineered barrier system (EBS), their roles/safety functions in the system and therefore, the concept forms the basis of the requirements for the EBS
 - That's why they all should be designed iteratively and developing a safety concept could be helpful, see also P. 4 (*DGR design*) and P. 8 (*Safety case work*)

Siting, site characterization and site description

- Criteria for site selection and exclusion should be stated more clearly for transparency of the site selection process
 - Site selection is such a sensitive matter that transparency of the selection process should be emphasized in every phase
- The main reasoning for conducting site investigations and choosing the processes to be monitored and investigated could be more visible in the report.
 - Characterization and monitoring data eventually lead to the Safety Case and the statement of the long-term safety of final disposal at that site, so the link between the site investigations and the Safety Case should be clearly presented.
- It would be beneficial to aim at integrated interpretations and a site model through integrated modelling methods from the beginning.
 - Integration should be presented at all stages from deterministic to numerical modelling to ensure a coherent site description model without any obvious contradictions.
 - Depending on the level of details to pursue in site characterization and modelling, focus should be placed towards data gathering and integrated databases. E.g. fracture specific hydrogeological data collected by Posiva Flow Log (PFL) combined to geological information is needed for integrated DFN-modelling and Rock Suitability Classification (RSC). Focused functional databases should also be planned to serve several end users (monitoring, modelling, construction etc.). Reflecting on Posiva's persevering work and experience on that field, prioritizing the database development at early stages of the programme will be beneficial at later stages.

DGR design

- I would recommend to draft an overall layout (design) of the DGR.
 - Drafting of the DGR layout (design), even if it would be generic, very preliminary and partially based on assumptions, it would be beneficial to illustrate the DGR design to get an idea of it and its extent - the area and infrastructure it would need. It would also supplement the programme to be even more balanced than now.
- I understood from the report that SURAO plans to construct the underground research laboratory at the same site where the actual repository is planned to be construct – that's very wise, saves a lot of time and costs!
 - Ch. 2 Tab. 1: Start of construction of an underground laboratory **at the final site** – 2030, start of the construction of the deep geological repository - 2050

Operations

- Some ideas how the EBS is planned to be emplaced could be described, even if very preliminary, since it makes an essential part of the performance of the EBS
 - The emplacement, its machinery and operations have a large impact on future costs, too.
 - It would not need much work from SURAO since it could refer to Posiva's or SKB's work done on this field. For example, the following reports could be referred to: Canister Production Line 2012 (POSIVA 2012-16), Buffer Production Line 2012 (POSIVA 2012-17) , Backfill Production Line Report (POSIVA 2012-18), Closure Production Line Report (POSIVA 2012-19).

- SURAO presents good plans on the development of excavation methods – but no need to do everything by itself, a lot can be learned from Posiva and SKB

Research and development of waste disposal packages

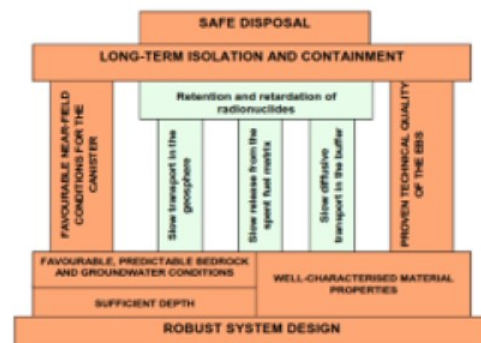
- The requirements, suggested design and conclusions on the WDP are not quite clear. The choice of the WDP design doesn't seem truly objective. The reasoning to choose steel over copper canister for WDP material is not clearly explained, neither choosing stainless steel in the inner part and carbon-steel on the outer part of the WDP.
- The statement in report on copper corrosion processes is in strong conflict with the corrosion studies and analysis of SKB and Posiva.
 - It has been proven that radiation doesn't pose a threat to copper outer shell life-time, assuming the radiation level on the canister surface is lower than 1 Gray. Microbial processes are very complex and include several reactions and factors, like ground water composition, gases, and other hydrogeological properties of the site, clay composition, amount of organic substances in the repository (for example in concrete); it has been largely studied by SKB and Posiva. Posiva's interpretation is that copper is not susceptible to microbe induced (sulphide) corrosion in the repository conditions that prevail in Olkiluoto.
- It is also stated that copper welding is challenging, even though SKB and Posiva have tested successfully friction stir welding, FSW for sealing the copper canister.

Development of other EBS components and excavation method

- SURAO presents a comprehensive programme for the buffer and backfill development work. This is justified! However, a lot of has been done by Posiva and SKB so there is no need for SURAO to do all the work on its own.

Safety case work

- I would recommend drafting a safety concept and build the safety functions of each component (subsystem of the concept) on that.
 - It would enable a systematic approach to formulate safety functions for each component of the disposal system and further on requirements from the safety functions
- Formulation of scenarios and handling of uncertainties could be described a little more transparently
- Compiling a safety case for several sites is a lot of work!
 - To get an idea of the amount of work, take a look at Posiva's safety case for the construction licence, see reports POSIVA 2012 – 3, POSIVA 2012 – 4, POSIVA 2012 – 5, POSIVA 2012 – 6, POSIVA 2012 – 7, POSIVA 2012 – 8, POSIVA 2012 – 9, POSIVA 2012 – 10, POSIVA 2012 – 11, POSIVA 2012 - 12



Outline of the safety concept for a KBS-3 type repository for spent nuclear fuel in a crystalline bedrock.

Posiva 2012-03, Figure 5.1, P. 52.

Schedule of the Research and Development Work

- It would be more practical to read if the schedule would be embedded in each chapter, not only on a separate table
- A long-term schedule, stretching beyond the site selection phase, even if it would not show any years (time table), but would show various phases of the programme, would help to get an overview of the whole programme and make a clear vision for all the work ahead



Posiva

Solutions