

Review of first years deliverables

BEACON EARB – Expert Advisory Review Board

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Outline

- Summary on work done so far by EARB deliverable 1
- EARB deliverable 2: Preliminary remarks on available WP deliverables during the 1st year (collection of input from Klaus, Jinsong, Frederik and my *interpretation*)
- Discussion

Summary on work done so far by EARB

deliverable 1: First joint evaluation report

- Scope: Initial view on BEACON work plan
- Information from:
 - Grant Agreement, in particular Technical Annex
 - Kick-off meeting & Initial Workshop 2017
- Date of issue of this report: 07/09/2017
- Author(s): Klaus-Jürgen Röhlig, Frédéric Bernier, Jean-Dominique Barnichon, Jinsong Liu, Wilfried Pfingsten
- Issues addressed
 - Scientific project management / co-operation
 - Safety relevance / link to Safety Case
 - Some scientific and technical details
 - Interaction with Civil Society
 - Relationship(s) between the above
 - Visibility in scientific community. Education
- Feedback ?

EARB deliverable 1: First joint evaluation report, cont.: recommendations include e.g.:

- Project management:
 - Identification of research needs appreciated
 - Need to periodically re-visit and review
 - Recommendations on info & data management
- Safety relevance:
 - Holistic perspective (Work plan, fig. 8) appreciated
 - Need to establish organisational framework appropriate from a Safety Case point of view
- Scientific / technical details:
 - Bentonite types?
 - Initial phase: Focus on conceptual understanding! Recommendations for designing experiments
 - Recommendations on verification / validation models
- Interaction with Civil Society:
 - Appreciated
 - Technical topics might be too specific as starting point? Focus on general issues first?
 - Challenge: “give Civil Society [as such] the opportunity to follow, discuss and give feedback”

EARB deliverable 2: Preliminary remarks on deliverables during the 1st year (list)

- D1.1 State-of-the-Art Report - Bentonite Mechanical Evolution
- D2.1 Beacon Initial Workshop
- D2.2 Review of data and models on the mechanical properties of bentonite available at the start of Beacon
- D3.1 “Description of the constitutive models available at the start of the Beacon project” - Not yet available (as of March 27, 2018)
- D6.1 A report from the workshop in task 1 including the summary of the analysis of the working group - Not yet available (as of March 27, 2018)
- D7.5 Training Course - The file on projectplace was/is empty.

Remarks on D1.1 State-of-the-Art Report on ...

- **Questionnaire approach seems appropriate and successful** - valuable report providing a good overview ...
7 WMO (or representatives) and 1 NGO delivered input
-**Why no questions about the material choice** (kind / type, origin of bentonite)
- A “**deterministic approach** (upper lower limit, mean values)” **is not a way to “address heterogeneity”** as such, it is rather a **way of ignoring it** (.... ***probabilistic approach but for homogenized parameter values...***)

-Under “bentonite modelling” a distinction is made between **performance assessment** and **safety assessment** – was the use of the two terms agreed upon amongst participants?
- This **deliverable discusses comprehensively and thoroughly different disposal concepts prevailing in most of the Europeans countries**, with emphases on the role of bentonite and the occurrence of heterogeneity and the uncertainties related to such heterogeneity.
This gives a very good delineation of the scope of Beacon’s undertakings.
 - The EARB has the opinion that the document could serve the project even better **if more discussions are given in Chapter 6 , Bentonite Modelling**, to the modelling aspects specifically related to resaturation/heterogenisation processes.
 - The EARB has the opinion that the document could make a better guidance to the orientation of Beacon project if it could **outline relatively more detailed effects the project should focus on** (based on the study of the present status of the research in the related areas), just as one example among many other possibilities, deterministic versus probabilistic approaches as indicated in the third sub-bullet point above.

Remarks on D1.1 State-of-the-Art Report on ...

cont.

- More generally: Could this type of activity (**designing a questionnaire**) be one for which a **priori exchange with the EARB could be considered**? Of course, such activity would be ad hoc and go beyond the EARB agreement, but nevertheless ... ?
- All **responses are about bentonite use in general**, not just about the three case studies defined: the Andra tunnel plug, the Nagra disposal cell and the KBS-3 deposition tunnel backfill. In the view of the EARB, **this is appropriate for the purpose of the deliverable**. The EARB also noted, however, **that SKB's response was very much focused on the bentonite buffer, which does not belong to the set of test cases**. Need to re-adjust scope of work? Note that even the **conclusion section is very much focused on the buffer rather than the backfill!**
- The **conclusions section appears a bit brief and general**. E. g., it would have been useful (and easy!) to juxtapose the responses from the organizations, especially the ones given in table format.

Remarks on D1.1 State-of-the-Art Report on ... cont.

Safety relevant properties

- are not given in a similar way by the partners - **buffer, backfill and shaft seals** sometimes differentiated sometimes not

- are **identified differently** by the different partners - **complicates comparison**.

We acknowledge that concepts are different and that safety properties can differ from one concept to the other.

However, for some properties it is difficult to understand **why some properties are considered by some countries and not by others** (e.g.: gas transport properties, swelling capacity, heat conductivity, ...).

These differences should be discussed.

	Nagra	SKB	POSIVA	SURAO	ENRESA	ANDRA	GRS
Buffer							
Swelling capacity	X			X	X		
Chemical retention/ sorption	X	Limit mass transfer	Limit and retard radionuclides release	X	X	X	X
Low hydraulic conductivity	X			X	X	X	X
Sufficient high viscosity	X						
Sufficient gas transport capacity	X				X		X
Minimising microbial corrosion	X	X		X			
Filter colloids		X			X		
Resistance to mineral transformation	X						
Suitable heat conductivity/ Maximal temperature	X		X	X	X		
Limit transport of corroding substances			X				
Permeability for gases				X			
Protect canister from mechanical load/ processes		X		X			
Resist transformation		X	X				
Isolation				X	X	X	
Maintain chemically favourable conditions			X				
Tunnels & shaft:							
- Keep the buffer in place		X	X				
- Limit advective mass transfer		X	X				
- Avoid the formation of new preferential paths		X	X				
- Maintain chemically favourable conditions			X				

Remarks on D1.1 State-of-the-Art Report on ... cont

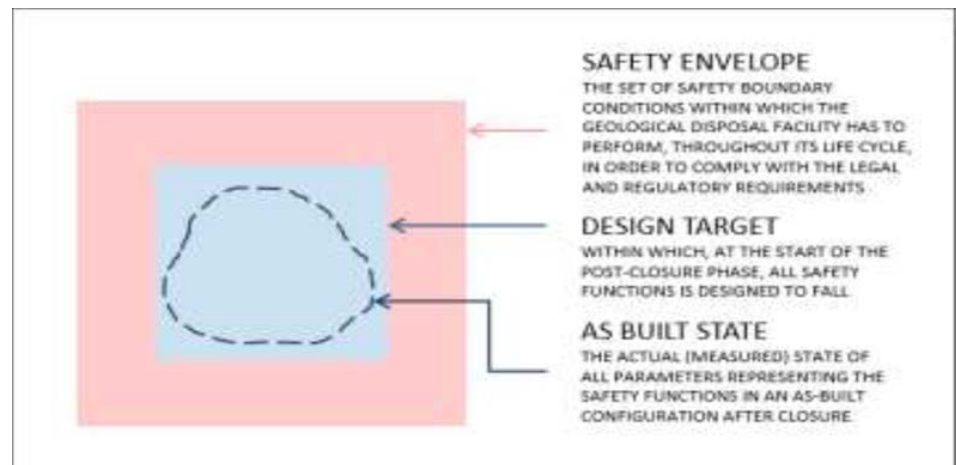
- **Performance measures**

- Are identified differently by the different partners. Some are giving preferred values others are not.

Preferred value is not really helpful in terms of performance assessment

we have to know how far we can deviate (e.g. in case of inhomogeneities) from this preferred value to stay in the safety envelope.

- It would be preferable to give the performance measures in terms of safety envelope and design target as proposed in GEOSAF II: <https://www-ns.iaea.org/downloads/rw/projects/geosaf/geosaf-tecdoc-draft.pdf>



Remarks on D2.1 Beacon Initial Workshop

- Already sufficiently addressed in first EARB report. See above (EARB deliverable 1)

Remarks on D2.2 Review of data and models on the mechanical properties of bentonite available at the start of Beacon project

- Well-structured report, good “setting-the-frame” in chapter 3.
- **Working approach seems appropriate. List of data fields (Table 2) seems comprehensive** w.r.t. experiments.
 - What about the “**models available at the start of Beacon**” (also promised by the title)?
 - Only names are asked for in the form (and only if they were used for reproducing an experiment).

“It is outside the scope of this report to conduct a detailed comparison of modelling approaches; this will be covered in a forthcoming deliverable D3.1.”, but then the **D2.2 title is somewhat misleading.**
 - At least, at some point the question on how well the models reproduced the experimental data should be addressed – for which deliverable is this foreseen?
- In 3.1 there is a comment on flow properties “**There is not a single agreed-upon conceptual model for how water flows through bentonite** (e.g. Kröhn, 2016) and therefore different authors use different material properties to describe flow” – shouldn’t there be a **general agreement in Beacon on a common concept?**

Remarks on D2.2 cont.

- The relevant experimental and field work that generates relevant data has been thoroughly reviewed and addressed.
 - Would it be possible for the Work Package to also give some **comments on whether sufficiently qualified amounts are available** for each type of data with regard to the **need of Beacon's modelling** and other studies?
- **The homogenisation of bentonite** (which is the main focus of the Beacon project) is strongly related to its resaturation. Several of the modelling works briefly mentioned in Table 1 are based either on **Cam Clay (CC) or Modified Cam Clay (MCC)** approaches. The project needs to consider the **difficulties for such models to handle processes in the unsaturated status of bentonite**.
 - Should the project consider to **rely more on the approaches of Barcelona Basic Model (BBM) or Barcelona Expansive Model (BExM)** which are more handy to deal with the saturation process?
- The first part of Section 3.2 gives a **very good description of different model approaches** that have been adapted for modelling of mechanical processes in clay.
 - but **text under the subtitle "Suction"** in Section 3.1, page 11, **needs to be improved**. (e.g. see Fredlund D. G., Rahardjo H., 1993 or Dueck A., 2004.

Remarks on D2.2 cont.

- Could this type of activity -designing a questionnaire or a data form- be one for which a priori **exchange with the EARB could be considered?**
- Table 1 summarises modelling approaches, however, the “**applications**” were qualified with rather **qualitative statements** (“good fit”), which does not mean that the model concept was “correct”
- **all models were applied to “homogenisation test”**, but what about their handling of heterogeneities – are all models applicable to heterogeneous systems?
- Good discussion (section 4.3). It could be even better if some summary is given to especially **shortage of certain types of data from Beacon’s perspective**.
- Is the **database only available in table format** or also as a “real” data bank (SQL or the like)? Does it make sense to consider the latter, also with a view to the time after BEACON’s finalization? Same later for modelling studies, perhaps?
- The **references given are quite old** (main report) except the one from Kroehn 2016, where there is the general remark on “not a single agreed-upon conceptual model” ... is there no new e.g. **multiscale modelling progress?**

Discussion

- Comments on “last” deliverables by EARB at the annual meeting reasonable?
 - WP deliverables available quite late for reviewing
 - Difficult to comment on deliverables which are generally presented at the annual meetings
 - Little time for EARB for internal discussion
 - May/June: busy months
 - > EARB deliverables + 3 months
- Is there a feedback to EARB deliverables?
 - Were recommendations taken?