BELBaR

EURATOM

Karlsruhe, 12 October, 2015

WP2 – EROSION INTRODUCTION

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(CIEMAT)

WP2 OVERVIEW

Work Package 2: PARTICIPANTS and PMs

Work package number	2	Start date or starting event:					Project Month 1			
	Erosion									
Activity Type	RTD									
Participant	CIEMAT	MSU	KIT-INE	NRI-REZ	SKB	B+Tech	ClayTech	VTT	JYU	NDA	KTH
Person-months for the participant	18	6	6	10	1	28.5	9	16	11	1	1

11 participants, 7 countries

WP2 OVERVIEW

Work Package 2: MAIN OBJECTIVES

To understand the main mechanisms of clay particle erosion from the bentonite surface and try to quantify the (maximum) extent of the possible erosion under different *physico-chemical conditions*.

1. Analysis of bentonite erosion is important for establishing the functionality of the bentonite barrier at the long-term, which could be compromised if a significant clay loss occurs.

WP 4

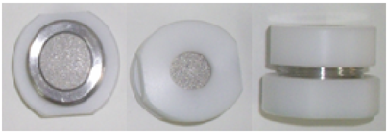
2. The "eroded" colloids might interact with RN and affect their transport of towards the far-field of the repository.

WP 3

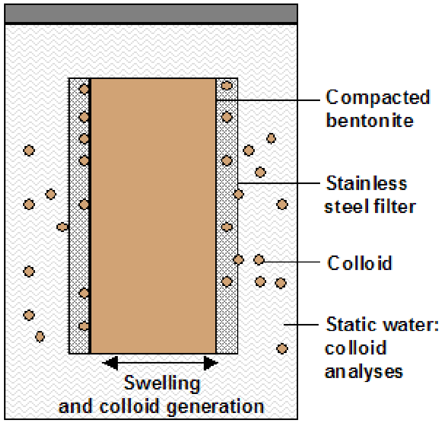
Stability studies needed

Comparison of data from different set-up / different organisations

(a)

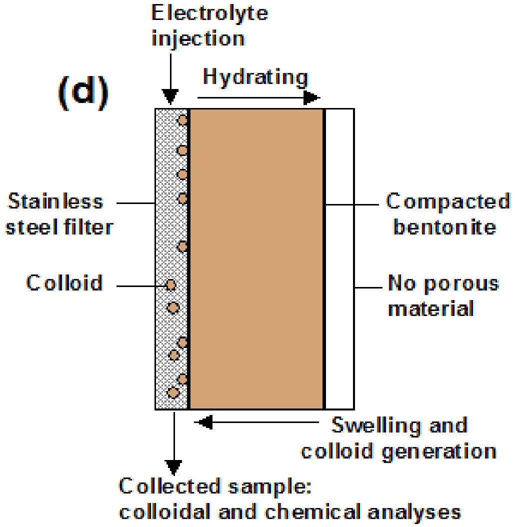


(b)

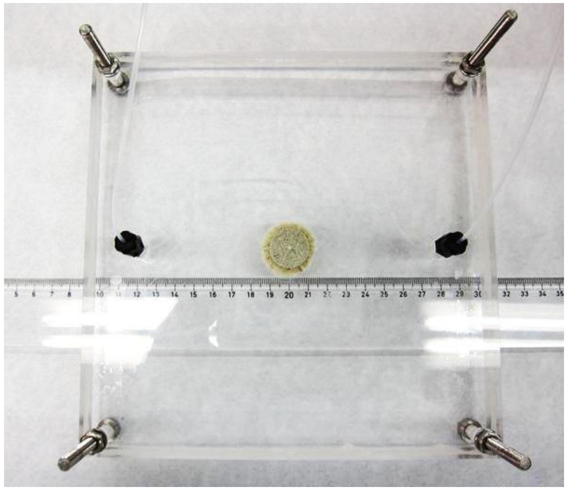


(c)

(d)



Radial" cells:



Static approach

CHEMISTRY

Dynamic approach

CHEMISTRY
+ FLOW

CHEMISTRY
+ FLOW
+ fracture
+ gel analysis

- Different clay density;
- Different clay type: natural, Ca, Na;
- Different flow rates;
- Different water chemistry;
- Bentonite/electrolyte contact area;
- Etc.,.

Taking advantage from different approaches to the problem

Deliverables in progress

WP n°	Deliverable N°	Title	Version	Lead beneficiary	Person months	Nature	Dissemination level	Document type	Delivery date from Annex I (proj month)	Forecast date	Status
1	3	D1.3 Workshop 1	0.0	NUCLEAR DECOMMISSIONING AUTHORITY - NDA	5.0	Other	PU		30/11/2012 (9 months)	30/11/2012	Pending
1	4	D1.4 Synthesis report of colloids and related issues in the long term safety case	0.0	NUCLEAR DECOMMISSIONING AUTHORITY - NDA	15.0	Report	PU		30/11/2015 (45 months)	30/11/2015	Pending
2	11	D2.11 Evaluation of experimental results on bentonite erosion	0.0	CENTRO DE INVESTIGACIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNOLOGICAS-CIEMAT	8.0	Report	PU		31/10/2015 (44 months)	31/10/2015	Pending
2	12	D2.12 WP2 partners final report. Evaluation of experimental results on bentonite erosion	0.0	CLAY TECHNOLOGY AB	20.0	Report	PU		30/06/2015 (40 months)	30/06/2015	Pending

Where we were at the beginning

**Initial Objectives & Issue
(NDA Report)**

Where we are now

**Accomplished Objectives
Remaining Uncertainties**

CONCLUSIONS FOR BELBAR FINAL REPORT (*)

Synthesis of Issues WP2

	position at start of BELBaR	final State-of-art report
Mechanisms of erosion of clay particles from the Bentonite surface	Erosion will cause a loss of bentonite buffer performance under some conditions. This may lead to corrosion failures of the canisters. Corrosion failure leads to the largest impact on risk, a less pessimistic approach may have significant impacts on the calculated risk.	Mechanisms of clay colloid release (WP2 output). Improved quantitative models with new data (WP5 output). **Suggested and any Issue potentially important to be included**
Characteristics of Bentonite clay	Divalent cations have not been studied that systematically. Should the existence and quantitative effect of divalent cations be argued, the importance of this outstanding uncertainty would reduce.	The role of divalent cations (WP2 and WP4). The stability of different bentonites (WP4)

BELBaR

Synthesis of Issues WP2

Issue	Safety case position at start of BELBaR	Outcomes sort for final State-of-art report
Groundwater Chemistry	The key factor for colloid stability is the ionic strength and the content of divalent cations. pH should have an effect, but the pH-range considered in the safety case is rather limited.	The effect of mixed monovalent/divalent systems (WP2, WP4 and WP5)
Clay – Groundwater interactions	Changes in bentonite porewater solute concentrations can be modelled. The related rates assumed to be limited by the availability of different porewater solutes. Mass loss rate assumed to have hydrodynamic contribution. The buffer and the groundwater never reach a true equilibrium.	A validated argumentation for (the conditions for) maximum clay mass loss rate to be used in safety case (cross-WP effort). Summary of how these processes should be integrated in the safety case.

Synthesis of Issues WP2

Issue	Safety case position at start of BELBaR	Outcomes sort for final State-of-art report
Groundwater velocity	Groundwater velocity has been considered as a variable. The loss of bentonite will be affected by the groundwater velocity and it is important to verify this dependence for erosion rates.	Verification of the dependence between the groundwater velocity and the erosion rate.
Clay extrusion paths	Fractures have been assumed to be planar with a constant aperture. Extrusion of clay into a fracture is an integral part of the current model and will have a strong impact on the mass loss. Piping may occur before full saturation of the buffer under certain circumstances.	The effect of fracture geometry on clay mass loss (WP2).