

The PRACLAY experiment at URL HADES, Mol, Belgium

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ABSTRACT

The Belgian design for the disposal of the High Level radioactive Waste (HLW) considers the host-rock as the main barrier for the long term isolation in the normal evolution scenario. Boom Clay is considered as one of the potential host formations. The URL HADES at 223 m depth at Mol site was constructed in order to study the feasibility of HLW disposal in Boom Clay.

Since 1995, the URL R&D programme has focused on large scale demonstration tests like the PRACLAY experiments.

The PRACLAY in-situ experiments include a set of three tests (see Figure 1):

- The gallery and crossing test
- The heater test
- The seal test

The main aim of the heater test is to study at a large scale the thermal impact of a HLW repository on the host rock. Owing to the limitations of the test on both time and space scales, the test is designed to simulate, in a conservative way, the most critical state and phenomena that could occur within the host rock.

Plugs (within disposal galleries, between disposal and main galleries, between main galleries and shafts) are considered, at least as a conservative measure in the overall repository design. For example, they can be used to limit interactions between various repository zones through cutting the hydraulic connection along the gallery lining and EDZ (Excavation Damage Zone) and thus to increase the resilience of the repository to intrusion, and avoid gas migration.

The Praclay gallery provides an opportunity to study the possibility to seal a disposal drift in Boom clay and to test the feasibility to cut-off hydraulically any preferential pathway to the main access gallery through the EDZ and the lining with a seal in a horizontal drift (horizontal seal) in Boom clay. Indeed, this is a generic problem for all deep geological disposal facilities for HLW. An annular seal made of compacted swelling bentonite was installed at the head of heated part of the Praclay gallery for these objectives. Meanwhile, it has also been shown that this "bentonite seal" is necessary for the Praclay heater test to provide the desired "undrained" hydraulic boundary condition.

The PRACLAY gallery was constructed in 2007 and the hydraulic seal was installed in 2010. The bentonite is hydrated by natural and artificial process. The swelling, total pressure and pore pressure of the bentonite are continuously measured and analysed by numerical simulations to get a better understanding of this hydration processes.

The performance of the seal is tested systematically by means of gas injection brekthrough tests and permeability tests at interface bentonite and Boom clay and in the Boom clay around the seal.

The PRACLAY Heater will be turned on in september 2014, since a sufficient seal swelling has been attained to fulfill its role for the Praclay heater test.

This paper will focus on the Praclay seal test : what are the lessons learned from its design to installation? How we understand the the process behind the hydration of the bentonite.

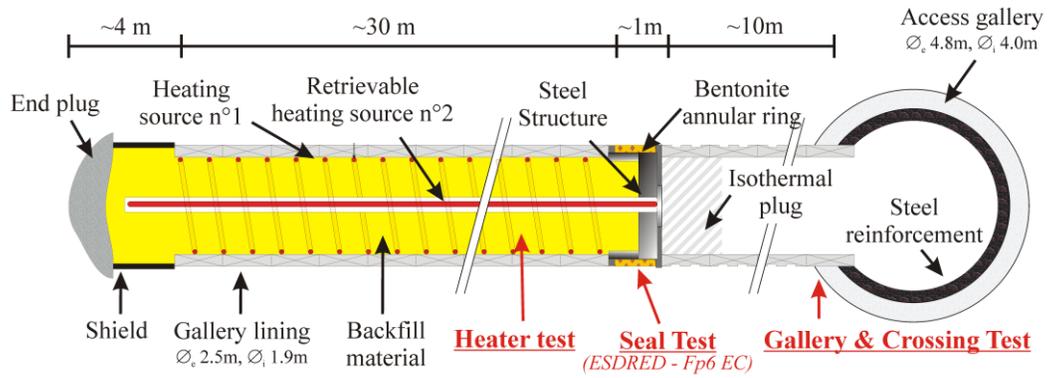


Figure 1 – Praclay experiments

KEYWORDS

HLW, geological disposal, Boom Clay, large scale heater and seal tests, bentonite, EBS, numerical simulations, gas injection tests, permeability tests