



# PEBS Newsletter No. 7

This newsletter provides information about the final phases of specific laboratory work and outlines the final event of the project.

## Laboratory experiments at CIEMAT

The PEBS project aims to gain an understanding of the behaviour of the EBS and to assess its long-term safety functions in a multi-disciplinary and integrated approach, with experimentalists and modelers from various disciplines working in an interactive and coordinated manner. The experimental work is carried out at different spatial and time scales, from long-term (several years), large-scale in situ tests to shorter-term, small-scale laboratory tests.

### Mock-up tests.

The FEBEX mock-up test is an experiment at almost full scale, which has been running at the CIEMAT facilities (Madrid) under controlled boundary conditions since February 1997. Its main components are (Figure 1): a stainless steel confining structure that simulates the gallery, through which hydration takes place; the heater system, composed of two electric heaters that simulate the heat generation of the waste canisters; a hydration system that supplies granitic water to hydrate the bentonite mass at a constant controlled pressure of 0.5 MPa; a 63-cm thick engineered barrier composed of compacted FEBEX bentonite blocks surrounding the heaters; more than 500 sensors installed within and outside the buffer material to monitor the boundary conditions and the system behaviour (temperature, total pressure, pore pressure, water injection

pressure, relative humidity and strains); and a monitoring and control system that records the data.

At the same time, the Geochemical Advanced Mock-up Experiments (GAMES, Figure 2) are being conducted, with the aim of investigating the changes that may occur in the buffer material as a result of thermo-hydraulic and geochemical processes in granite and clay host rock concepts. Concrete blocks are used in the mock-up as hydration surfaces, simulating the clay host rock concept, and corrosion is enhanced at the heater surface in both mock-ups. The chemistry of the hydration water matches that expected in each host rock. To simulate the prevailing long-term conditions, the degree of saturation of the bentonite is high (saturation was forced from the beginning of operation), and the temperatures low (below 40 °C).

### Laboratory tests.

The performance of large-scale tests is complicated and time-consuming and boundary conditions in such tests are not always well controlled and known. Laboratory tests in thermo-hydraulic cells that simulate the conditions of the sealing material during operation are therefore a valuable alternative for identifying and quantifying processes. In these cells, the sealing material can be subjected simultaneously to heating and hydration. The cells are cylindrical and designed to be hermetic and non-deformable. The heat generated by the radioactive decay of the wastes in the containers is simulated by an electric heater and simulated groundwater is injected.

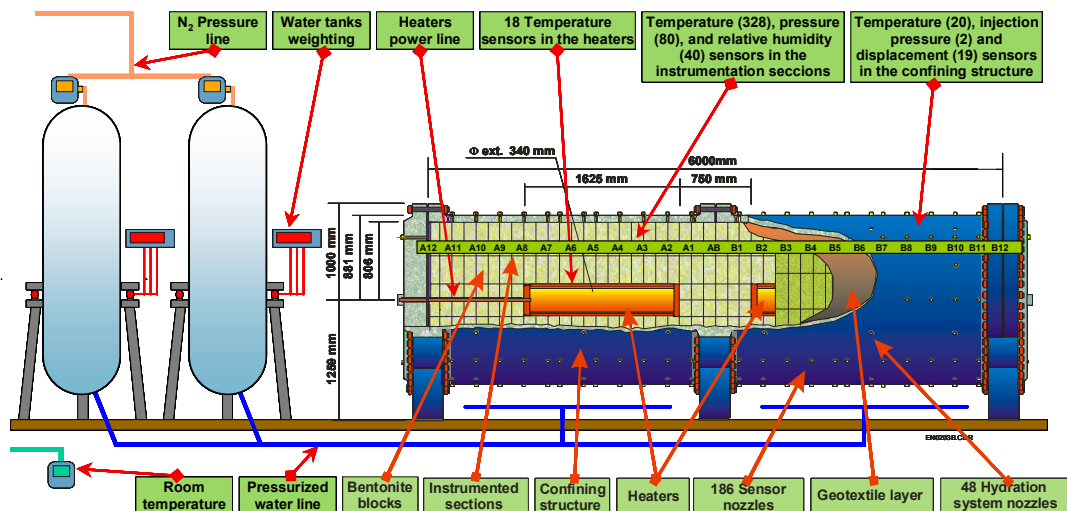


Figure 1: General layout of the mock-up test, including instrumented sections

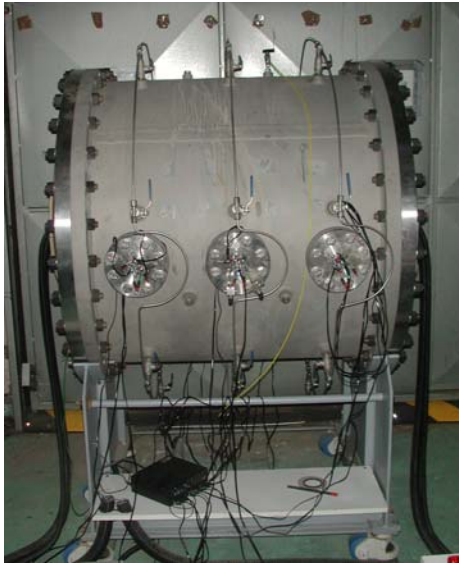


Figure 2: GAME mock-up (barrier length 1 m, thickness 22-30 cm).

To simulate the whole thickness of the barrier in different reference concepts, Teflon cells with an internal diameter of 7 cm are used, whose modular configuration can be changed so as to have columns of 10 to 60 cm length. To avoid the deformation of the cells through bentonite swelling, their outside is covered with semi-cylindrical steel sections. The water intake can be measured online, as can the relative humidity and the temperature inside the sealing material. The most recent version of these cells includes: the insertion of a load cell at the top, to measure the pressure exerted by the material on saturation; the measurement of the heater power; and an extra external insulation around the cell body (necessary when working with materials of very low thermal conductivity, such as materials with low initial degrees of saturation). These new cells are being used to simulate the conditions of the HE-E in-situ experiment (Figure 3, left). The duration of the tests in this kind of cells ranges from 0.5 to more than 9 years.

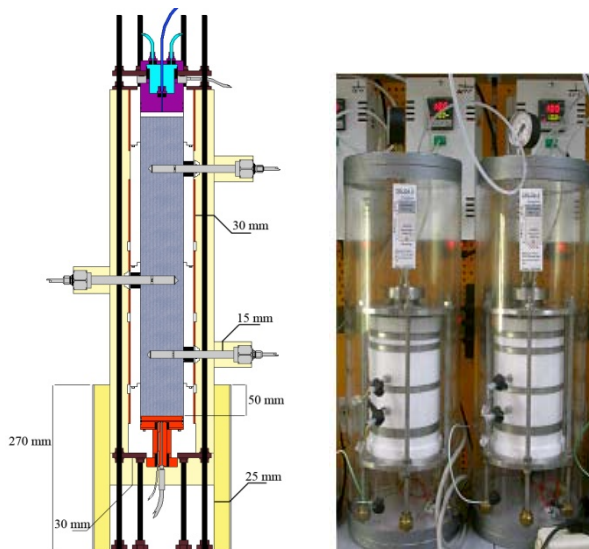


Figure 3: Thermo-hydraulic cells

Smaller cells (Figure 3, right) were designed for the study of the corrosion processes at the canister/bentonite interface and the processes at the concrete/bentonite interface (see Newsletter No. 6).

## The final event of the PEBS project "International Conference on the Performance of Engineered Barriers"

The PEBS project will end with an international conference, as a platform for technical and scientific discussions related to engineered barrier systems.

### Conference objectives

The objectives of the conference are to discuss, document and disseminate the current state of research on the performance of engineered barriers in geological repositories for high-level nuclear waste. Sessions are rounded up with discussions, aiming at bringing together views from experimentalists, modelers, and safety assessors. The outcome of the PEBS project plays a central role, but it is put in context through presentation of the outcome and status also from other projects and activities.

### Main Topics

The conference focuses on the evaluation of engineered barrier performance as the basis for long-term safety of geological repositories for the disposal of radioactive waste. Abstracts are invited on the following subjects:

- New insights through laboratory and in-situ experiments of engineered barriers
- Recent developments in numerical modelling of THM(-C) processes in engineered barriers
- Improvements in long-term performance prediction and potential impacts on safety assessment

### Important deadlines

#### Authors

October 6, 2013	Abstract submission
October 31, 2013	Authors' notification
November 29, 2013	Extended abstracts

#### Attendees

September 2, 2013	Registration opens
November 8, 2013	Early bird registration (120 €)
December 31, 2013	Late registration (150 €)

### Contents of the next Newsletter

The following Newsletter will report on some major results of the project.

For more detailed information, see the PEBS web site:

<http://www.pebs-eu.de>