MODERN PROJECT: MONITORING DEVELOPMENTS FOR SAFE REPOSITORY OPERATION AND STAGED CLOSURE

S. Mayer[1]*, S. Ouchhi[1], J. Verstricht[2], H. Maurer[3], B. Breen[4]

1. Andra, 1-7 rue Jean-Monnet, 92298 Châtenay-Malabry cedex, France (stefan.mayer@andra.fr)
2. Euridice, Boeretang 200, 2400 Mol, Belgium
3. Institute of Geophysics, ETH Zürich, Sonneggstrasse 5, 8092 Zürich, Switzerland, Switzerland
4. NDA, Moor Row, Cumbria, CA24 3HU, United Kingdom

In a first part, the overall objectives of the MoDeRn project (Monitoring Developments for safe Repository operation and stage closure project) are presented. MoDeRn is a four year (2009-2013) collaborative project co-funded under the 7th Framework Program for Nuclear Research and Training (EURATOM). It involves 17 organizations responsible for research into radioactive waste management in the European Union, United States, Japan and Switzerland, with partners with extensive experience in monitoring activities in underground research laboratories (URL); as well as research institutes and universities with substantial experience in research on socio-technical interactions and public and stakeholder engagement. An overview of the project work packages and of their interdependencies is given in Figure 1.

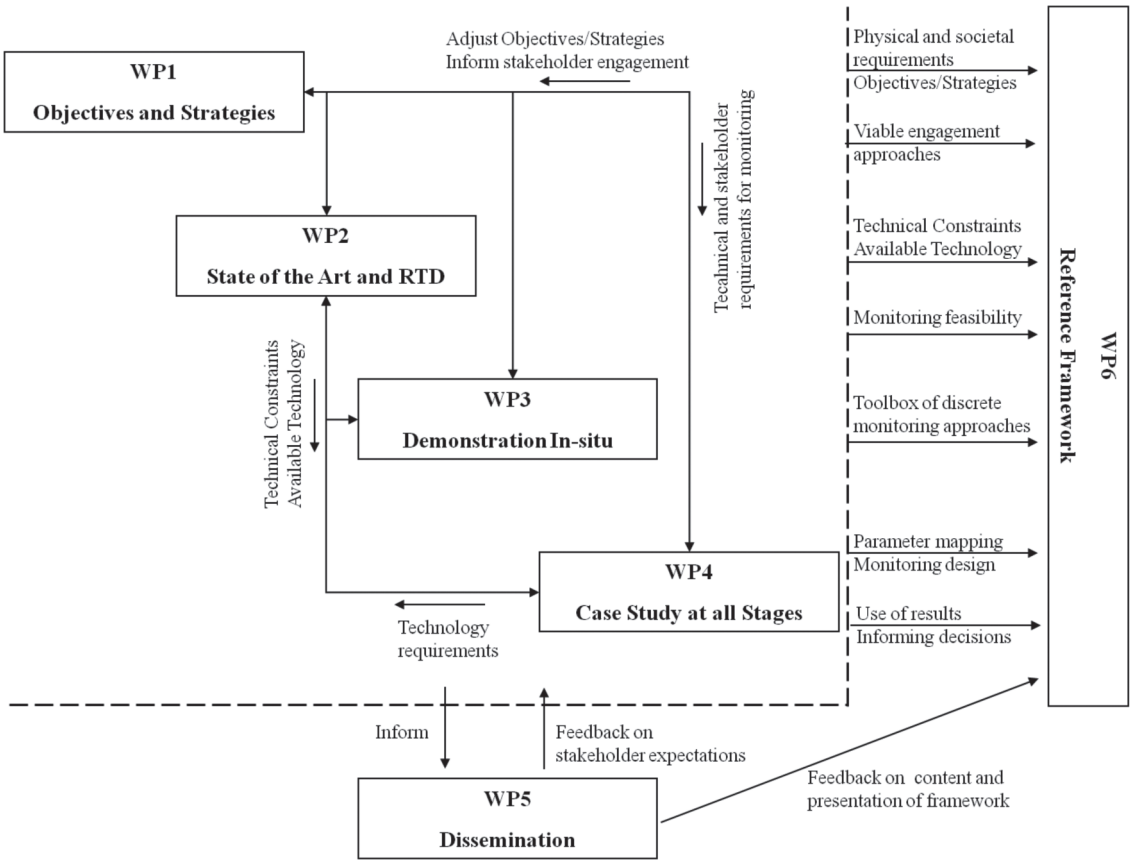

Figure 1: Overview of project components.

The successful implementation of a repository program for radioactive waste relies on both the technical aspects of a sound safety strategy and scientific and engineering excellence as well as on social aspects such as stakeholder acceptance and confidence. Monitoring is considered key in serving both technical and social objectives. It is not only essential to underpin the technical safety strategy and quality of the

engineering, but it can also be an important tool for public communication, contributing to public understanding of and confidence in the repository behaviour.

By inclusion of specific national contexts of waste management programs in different countries, the MoDeRn project aims at providing a reference framework for development and implementation of monitoring activities. This will be achieved by stakeholder engagement during all identifiable phases of the radioactive waste disposal process. Thus, site characterisation, construction, operation and staged closure, as well as post-closure institutional control phases have to be addressed. MoDeRn considers different host rock types, such as salt, tuff, crystalline rock and clay rock in which several monitoring strategies are evaluated.

In a second part, the presentation focuses on the aims for monitoring specific properties of a clay host rock or clay engineered barrier. As part of this project, several in-situ monitoring demonstration activities will be conducted in the URLs near Grimsel pass (Switzerland), Mol (Belgium) and Bure (France). The monitoring demonstrator at the Grimsel URL combines classic (wired) instrumentation and novel wireless data transmission technology for monitoring a swelling clay plug experiment. The latter technique would be required in the event long term safety considerations, which prohibits the use of wired or signal transfer. Furthermore, the Grimsel URL setup includes a seismic monitoring experiment for non-intrusive monitoring of the swelling clay plug. High-resolution waveform inversion techniques will be considered for analyzing the seismic data.

The monitoring developments tested at the Mol URL also emphasize improvements of non-intrusive micro-seismic monitoring techniques used in a clay environment, which is the most challenging environment for such geophysical techniques. The goal is to obtain a reliable geophysical monitoring tool for assessing the host rock quality – as related to natural discontinuities as well as to the excavation and/or thermally induced disturbed zone. This could be achieved by a more sophisticated signal analysis combined with signal sources and receivers that are optimised for use in a clay environment. In addition, the applicability of novel monitoring techniques such as fiber optics based sensors will be assessed. Most of these developments will occur in the frame of the large-scale heater test PRACLAY.

Finally, the monitoring developments tested at the Bure URL aim at testing a monitoring setup of a mock-up, steel lined vitrified waste disposal cell. The feasibility of such instrumentation will be tested, and it is expected to obtain a more detailed knowledge of steel liner loading due to host rock deformation. The steel liner will be instrumented with fibre optic sensors to detect any more significant (possibly abrupt) loading and deformation events. In addition, liner segments will be instrumented with gauges installed at various depths of the liner thickness, to provide for a more detailed monitoring of radial and axial deformations to which the liner might be subjected.