

Background

NF-PRO is a four-year (2004-2007) Integrated Project (IP) supported by funding under the Sixth Research (EURATOM) Programme of the European Commission. NF-PRO is coordinated by SCK·CEN and investigates key processes in the near-field of geological repositories for the disposal of high-level vitrified waste and spent nuclear fuel.

The near-field of a geological repository consists of the area surrounding the waste packages and is composed of several engineered barriers that enclose and confine the disposed waste (see figure below). These barriers include the waste form, the waste canisters, backfills, seals, plugs and the part of the host rock that has been modified by the excavation of the repository. In all repository designs under investigation within EU Member States, the near-field plays an important role in ensuring the overall safety of disposal: its principal function is to retain radionuclides over extended periods of time and to minimise their release from the waste to the host rock.

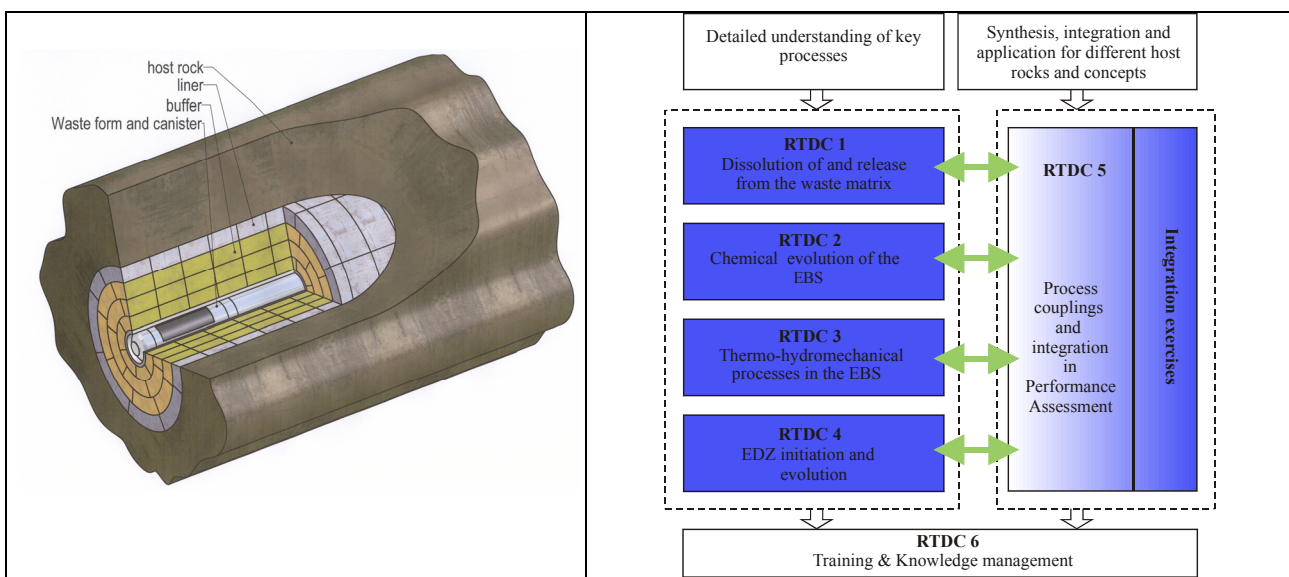
Objectives

The main objective of NF-PRO is to integrate European research on the near-field with the aim of enhancing common understanding of the long-term changes taking place in a deep repository. NF-PRO assesses how these changes affect the containment of the disposed radioactive waste. Knowledge generated by the project can be applied in waste management programmes to optimise repository designs and to make barriers functional and resource-efficient. The integration of results from detailed process studies in assessments on the overall near-field system performance is a key objective of NF-PRO. The level of integration envisaged by NF-PRO has not yet been achieved in earlier research projects supported by the European Commission. Accordingly, NF-PRO represents a major step forward in the establishing of the scientific and technical basis for geological disposal and the safe management of radioactive wastes.

Principal results

Research within NF-PRO is structured in five so-called Research and Technology Development (RTD) Components (see figure below). Each RTD Component addresses a series of dominant processes or specific section of the near-field system.

RTD Component 1 investigates processes having an effect on the performance of spent fuel and the vitrified high-level waste matrix. RTD Component 2 studies the chemical evolution of the near-field. Specific emphasis is on chemical interactions between various components of the engineered barrier system. NF-PRO's RTD Component 3 investigates thermal, mechanical and hydraulic changes in the area surrounding heat-producing waste. RTD Component 4 considers process related to the development and the evolution of part of the host rock that has been modified by the excavation of the repository. Process couplings and integration in performance assessment are dealt with in Component 5.



(left) main components of the near-field system, (right) project structure of the IP NF-PRO

NF-PRO aims to develop a comprehensive understanding of the overall near-field system performance and evolution. To this end, results from detailed process investigations obtained in RTD Components 1 to 4 are applied and integrated into assessments of the overall near-field system performance (RTD Component 5). This is implemented in the NF-PRO project through the project structure and organisation:

- Input from performance assessment groups (RTDC 5) to the process/component level experiment and modelling groups (RTDC1 to 4) and *vice versa* has been planned from the start of the project onwards;
- Five reference cases have been defined. Each reference case represents a combination of a waste form (vitrified waste or spent fuel) with a number of materials constituting the engineered barrier system. These reference cases are used as a (generic) basis for integrating results from detailed process investigations into assessments of the overall system performance in a structured way. The reference cases are also used for testing the importance/relevance of various processes through modelling exercises. For each of these reference cases, a phenomenological description has been made and a first set of mass and energy balance calculations has been defined.

Experience from the first two years of the project has shown that this approach is successful: an increased understanding of each others work and terminology is observed, interest in and awareness of added value of process and PA level modelling is growing, and consensus on key processes is increasing. Also, an increased willingness to adapt the work programme to the needs of various types of expertise and needs represented in NF-PRO is observed.

Scope	An FP6 project investigating key processes in the near-field of geological repositories for HL waste and spent fuel disposal
Host rocks studied	Crystalline rock, clay, salt
Project duration	4 years
Starting date	January 1 st , 2004
Consortium	40 organisations (see Website)
Coordinating organisation	SCK•CEN (Mol, Belgium)
Granted EC contribution	8,000,000 €
Total budget	18,000,000 to 19,000,000 €

Key facts concerning the Integrated Project NF-PRO

Future work

Research within NF-PRO is ongoing and major outcomes from experimental work will become available in 2006 and 2007. These results consist of data from laboratory testing on vitrified high-level waste and spent fuel and from large-scale *in situ* experiments performed in Underground Research Facilities. *In situ* experiments within NF-PRO include among others investigations on gas migration in a saturated bentonite buffer (the LASGIT experiment performed at the Aspö Hard Rock Laboratory (Sweden)), research on the excavation disturbed zone (as part of the PRACLAY project at the HADES facility (Belgium)) and investigations on thermo-hydro-mechanical processes in the bentonite buffer (as part of the FEBEX experiment at the Grimsel Test Site (Switzerland)). Also, several topical reports on cross-cutting issues will be drafted. At present, three reports are under preparation, in particular a topical report on gas generation and transport in the near-field, a report on chemical interactions and gradients of pH, and a topical report on coupled chemical and thermo-hydrromechanical processes.

Main contact person

Alain Sneyers, alain.sneyers@sckcen.be
nfpro@sckcen.be
<http://www.nf-pro.org/>

Main reference

EURATOM Research Projects and Training Activities (2005). Publication by the European Commission – Directorate-General for Research EURATOM. Volume I. EUR 21228

Alain Sneyers, Geert Volckaert (2005). “*NF-PRO: An Integrated Project on key-processes and their couplings in the near-field of a repository for the geological disposal of vitrified high-level radioactive waste and spent fuel*”, Proceedings of the OECD/NEA EBS Workshop (La Coruña, 24-26 August 2005).