



# (Contract Number:FI6W-CT-2004-508851)

# **PROJECT PRESENTATION**

# ENGINERING STUDIES and DEMONSTRATION of REPOSITORY DESIGNS

Authors:

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Start date of project : 01/02/04

Duration : 60 Months

Project co-funded by the European Commission under the Euratom Research and Training Programme on Nuclear Energy within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	Х
RE	Restricted to a group specified by the partners of the ESDRED project	
CO	Confidential, only for partners of the ESDRED project	







## Introduction

Geological disposal of high-level and long-lived radioactive waste as well as spent nuclear fuels has been studied by various organisations, notably radioactive waste management agencies and major research organisations, for the last 30 years.

The feasibility work related to geological disposal, from a scientific/technical viewpoint, has reached a very mature level and therefore this work has provided, to date, valuable input to all subsequent safety analyses. This feasibility work must now be complemented with engineering and technological developments, basically with regard to:

- the repository construction including underground activities such as shaft sinking, tunnel and drift excavation and lining, disposal cell/drift outfitting, etc ...,
- the waste canister transportation from surface to underground and their emplacement in the disposal cell/drifts,
- the disposal cell/drift closure including sealing and backfilling operations,
- the general layout surface and underground with the management of various throughputs including personnel, excavation and construction materials, waste canisters, ventilation, etc in a mining and/or nuclear environment.

#### Nature and Scope of the Project

The Integrated Project known as ESDRED is a joint research effort by major national radioactive waste management agencies (or subsidiaries of agencies) and by research organisations, representing nine European countries. ESDRED, part of the European Union (EU) 6<sup>th</sup> Euratom Framework Programme for Nuclear Research and Training (2002-2006), is a major step towards establishing a sound technical basis for demonstrating the safety of disposing spent fuel and other high-level and long-lived radioactive waste in deep geological formations (up to hundreds of metres below surface) and to underpin the development of a common European view on the main issues related to the management and disposal of radioactive waste.

To identify the key technological issues, a review of the various activities involved in the construction and closure of a repository has been performed with regard to the existing or easily adaptable technologies available within Mining, Civil and Nuclear Engineering.

The results of this examination are the following:

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- the construction, operation and closure of an underground repository requires not only the well-mastered know-how developed so far in conventional Mining and Civil Engineering, but also the specific technological solutions linked to radiation-protection and to the operational safety requirements of a nuclear facility.
- a thorough investigation and subsequent demonstration of nuclear activities being carried out underground are required.





# **Activities**

The ESDRED Project has a total budget of EURO 18.7 million, of which 7.3 million is from the EU's Framework Programme. The overall objective of the 5 year Project is to demonstrate, (in compliance with requirements regarding operational and long term safety, retrievability and monitoring), the technical feasibility at an industrial scale of activities (see sketch here-below) such as:

- buffer construction technologies for horizontal disposal concepts (Module # 1),
- waste canister transfer and emplacement technology for horizontal and vertical disposal concepts (Module # 2),
- heavy load emplacement technology for horizontal disposal concepts (Module # 3),
- use of specific low pH cement and shotcrete techniques to build disposal cell/drift sealing plugs and/or to reinforce underground structures and linings (Module # 4)



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PP -Dissemination level : PU Date of issue of this report : 26/07/04





#### Details of a generic emplacement concept (horizontal disposal) with its various elements



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Sketch of the heavy load emplacement through fluid cushion technology for horizontal disposal concepts



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PP -Dissemination level : PU Date of issue of this report : 26/07/04





Complementary activities include the training of engineers and professional staff, contribution to the education of students and young scientists, dissemination and communication of the project results to the stakeholders including the public, and co-ordination of work between the different project engineering and development activities.

A significant part of this training and education will be dedicated to New Member States of the European Union. This will be organised mainly in the form of secondment and/or seminars.

## **Expected Results**

The ultimate objective of the ESDRED demonstration activities is the fabrication and working demonstration of full scale first generation prototypes, whenever possible. The demonstration activities to be performed in Underground Research Laboratories (URLs) will serve as a basis for the future development of operational industrial solutions (prototypes, pilots) at sites selected to become final repositories.

#### Societal Impact

It is recognised that nuclear power produces electricity without emitting carbon dioxide  $(CO_2)$ , a gas responsible for global warming. However, management of radioactive waste from the nuclear fuel cycle [past, present and future] remains a key issue for the continued and future use of nuclear energy.

To make this challenge a success, a safe, permanent and publicly acceptable solution needs to be implemented for the management of all radioactive waste. Disposal of high-level and long-lived radioactive waste and spent fuel in deep underground repositories is generally found, by international technical experts, to be the most suitable management option.

ESDRED is to demonstrate that feasible techniques are available for the implementation of deep geological disposal thereby contributing to raising the confidence of all stakeholders, and the public at large, in the soundness of this management option.

Although disposal concepts vary from country to country depending, for instance, on the type of waste to be disposed and/or the nature of the host rock, the ESDRED review exercise has highlighted a number of common elements that are of importance to the various European waste management agencies. These include, among others, heavy load waste package transportation and waste canister emplacement technologies, retrievability, buffer construction, monitoring activities and lining and sealing of disposal cells/drifts with specific types of cements.



#### Information for Stakeholders and the Public

Radioactive waste management is also a societal issue and as such it concerns a wide range of stakeholders apart from the usual research community and the implementers. These, especially with regard to the siting process, would include national and local political representatives, stakeholders' oversight committees, societies for the protection of the environment such as NGO's and the public at large.

The ESDRED Project team is available to present and explain the objectives and issues of the project, on Request, at stakeholder forums.

The ESDRED website provides information at several levels of detail, therefore adapted to the various audiences, notably from short abstracts to the full description of the technical activities as described in the Contract between the European Commission and the Contractors.

#### **ESDRED Project Website Address & Contacts**

Website : www.esdred.info

Contact by E-mail : contact@esdred.info

#### List of partners

#### Radioactive waste management agencies:

ANDRA, France ENRESA, Spain NAGRA, Switzerland NIREX, United Kingdom ONDRAF/NIRAS, Belgium POSIVA, Finland SKB, Sweden

# Technical module leaders :

- ONDRAF/NIRAS (Belgium) for module # 1,
- DBE TECHNOLOGY (Germany) for module # 2
- SKB (Sweden) for module # 3
- ENRESA (Spain) for module #4

**Technological R&D organisations:** AITEMIN, Spain CSIC, Spain DBE TECHNOLOGY, Germany ESV EURIDICE EIG , Belgium GRS, Germany NRG, The Netherlands

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PP -Dissemination level : PU Date of issue of this report : 26/07/04





## **Contract information**

Period : February 2004 to January 2009

Budget :Total project cost :  $\in$  18.7 millionEC contribution : $\in$  7.3 million

## **EC Project Officers**

Messrs Michel RAYNAL & Christophe DAVIES European Commission Research Directorate-General MO75 5/45 B-1049 Brussels Belgium

#### **Coordination**

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PP -Dissemination level : PU Date of issue of this report : 26/07/04 8/8

