PERSPECTIVES FOR DEEP GEOLOGICAL FORMATION DISPOSAL RESEARCH IN FRANCE BEYOND 2006

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Evaluations of the « Dossier 2005 Argile » (1)

National Review Board (CNE)
IRT Peer Review, OECD/NEA
ASN
Andra's Scientific Board

- **Transposition zone**
  - Detailed survey of the transposition zone in order to select the implementation site of repository structures
- **URL activities**
  - Implementation of a demonstrator programme in order to verify the performance of repository equipment and to test the reversibility of concepts
  - Continuation URL investigations and studies
  - Long-term experiments (diffusion)
  - Effectiveness of plug
- **Reversibility**
  - Demonstrate technically the repository's management and reversibility
  - Limit reversibility in time through stepwise management

Priority research themes

- Hydrogeological modelling
- Behaviour of corrosion gases and gas management
- Radionuclide migration at different scales
- Mechanical behaviour of repository and plugs
- Safety studies and especially operational safety
- Integration of social and economic issues in order to insert a repository project within its host territory
- Special emphasis on the 0-X000 years when major coupling phenomena are involved (focus on the operation and reversibility phases)

Consequences

- **Improvement of “geological” knowledge (geostatistical analysis)**
- **Further developments of in situ and long term experiments**
- **In situ tests of technological demonstrators**
- **Focus on the step-wise reversible disposal management**

- **Focus on the Bure URL**
- **Site specific investigations requested**

2006-2015: Development, optimisation and detailed studies

Responding to the questions raised by evaluators

- Pursuing three priority subjects in the underground laboratory:
  - Radionuclide migration within the rock: long-term diffusion experiments and representation at different scales
  - Management of corrosion gases within the repository
  - Long-term evolution of the EDZ
- Building equipment and plug demonstrators in order to verify their feasibility and the implications on reversibility
- Verifying the existence of faultless sites in the transposition zone
- Integrating social and economic issues in order to insert a repository project in its host territory

Scientific and technical programme focusing on four major objectives

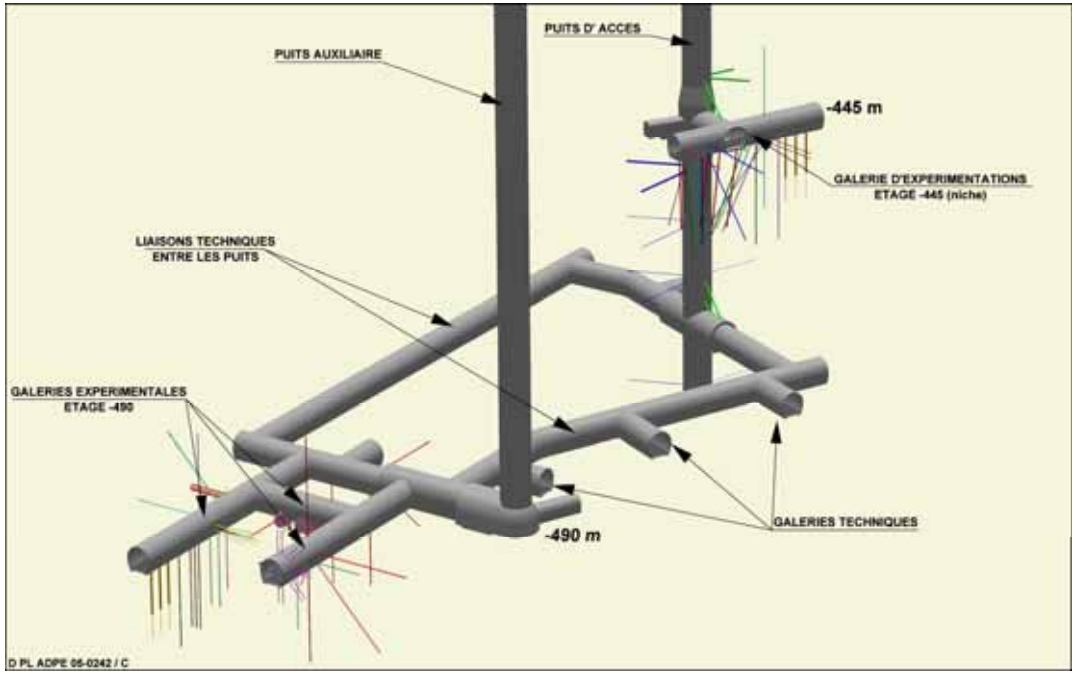
- To consolidate acquired data in the underground laboratory and conduct long-term experiments
- To perform integrated technological tests (engineering studies, prototypes from the surface)
- To survey the transposition zone around the underground laboratory in order to propose a step-by-step process aiming at precising the location of the implementation site
- To quantify more precisely safety margins

Evolution of shaft and drifts

Hydraulic and mechanical follow-up

Continuation of ongoing experiments

- Mechanical strength of structures
- Thermal behaviour of formation and materials
- Water and radionuclide transfers
- Water chemistry



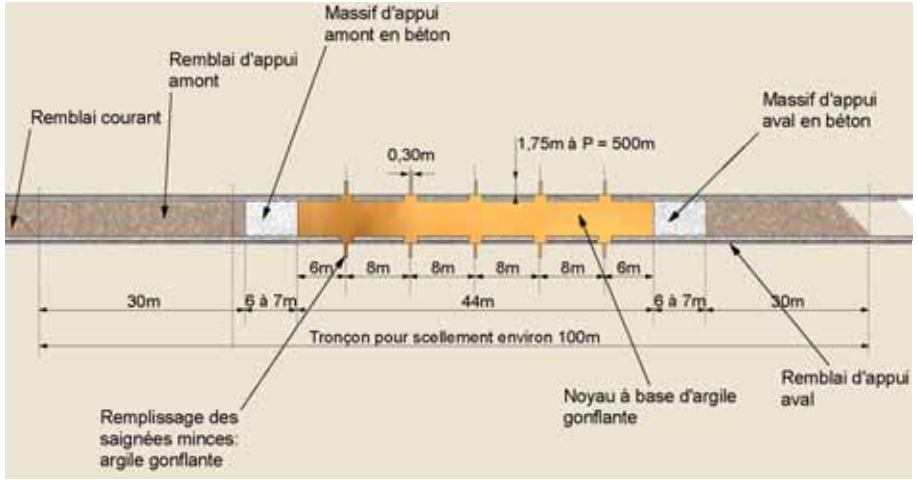
MAT (2007-2008)

Behaviour of materials in the formation (concrete, steel)

DIR (2007)

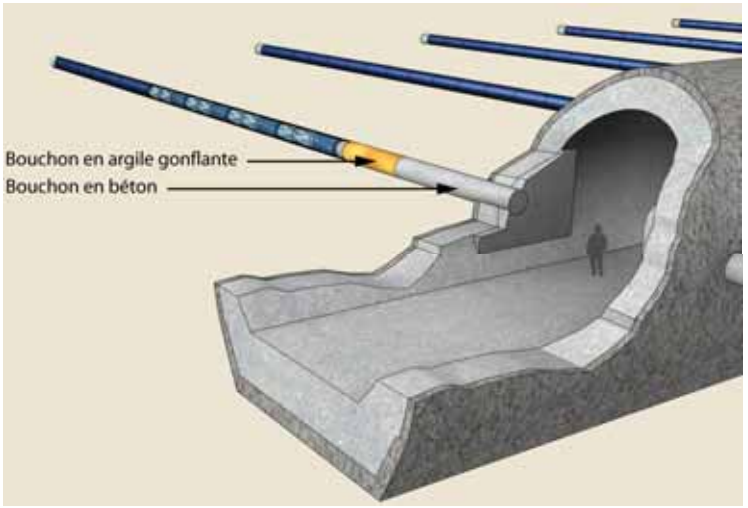
Long-term radionuclide diffusion and retention in the Callovo-Oxfordian formation

- **Excavation and lining**
  Excavation, support and durable lining (new drifts)



- **Technological tests and plugging/backfill demonstrators**
  Preparation, construction, instrumentation, loading and long-term follow-up

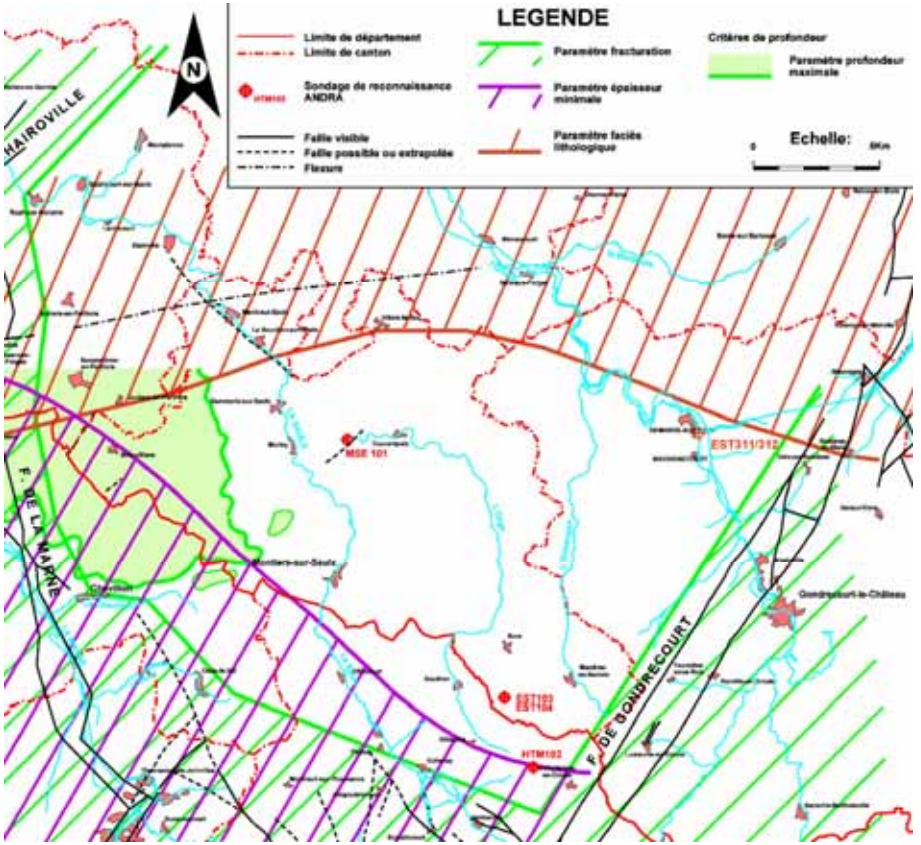
- **Disposal cells**
  - Prototype of a disposal cell for ILLL waste (excavation, casing, deformation follow-up)
  - Demonstrators of disposal cells for HLLL waste (thermics, hydromechanics, stress; plugging operations, waste emplacement and retrieval)



Survey around the underground laboratory

- Surface survey
  - –Boreholes: geometry of the formation; mechanical properties, water quality and datation
  - –2-D seismic studies
  - –3-D seismic studies over 30-40 km^2 (geometry of the formation, geological properties)

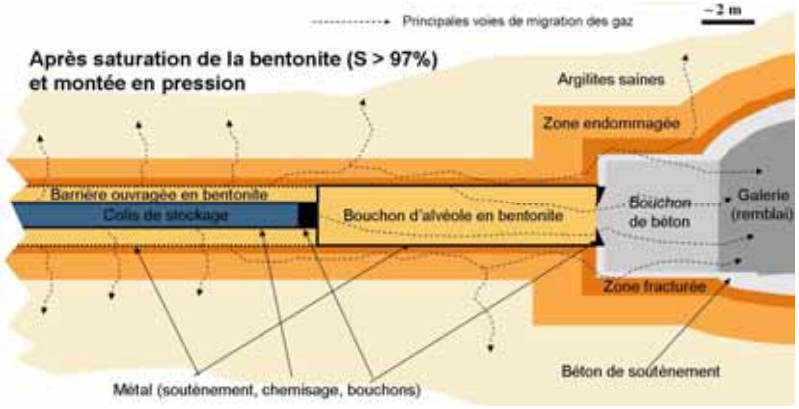
• Step-by-step process for the sitting of a geological disposal
• Hydrogeological modelling
• Evaluation of the role of regional faults
• Detection and characterization of possible minor faults



Delineation of a favourable implementation zone for a potential repository

Major research themes

- Improved understanding of basic phenomena
  - Behaviour of packages in the repository
  - Chemical evolution of radionuclides and transport
  - Gas production and transfers
  - Long-term mechanical evolutions of structures



- Couplings between phenomena and at interfaces between repository components
  - EDZ
  - Impact of thermics on mechanical and chemical properties
  - Hydraulic transient phase
  - THMC behaviour of disposal components

- Validity of data at different scales
  - Transposition of the data obtained in the URL to a larger area (mechanical and chemical properties)
  - Extrapolation of behaviour laws over the short and medium terms (geomechanical, chemical kinetics)

- **Detailed studies on the processes and the components:**

HL and ML packages and cells

- **Detailed studies of overall architectures:**

• Precise definition of underground structures, in terms of their dimensioning, construction methods and equipment

• Surface nuclear facilities (reception and surface storage of packages, disposal package conditioning facilities, etc.)

• Transfer, emplacement and possible retrieval of disposal packages

- **Instrumentation technologies and measuring devices**

- **Operating safety studies**

General planning

DIALOGUE

- CLIS : information on programs, dialogue
- Definition of a 30 km² area
- Possible sitting of the geological disposal

SURFACE EXPLORATION SURVEY

- 1st campaign : 2D sismic, boreholes
- 2nd campaign : 3D sismic, boreholes,

URL PROGRAM

- New drifts, experimentations
- Technological tests and demonstrators

SCIENTIFIC AND ENGINEERING STUDIES

SAFETY ANALYSIS

DOSSIER 2012

- Rédaction

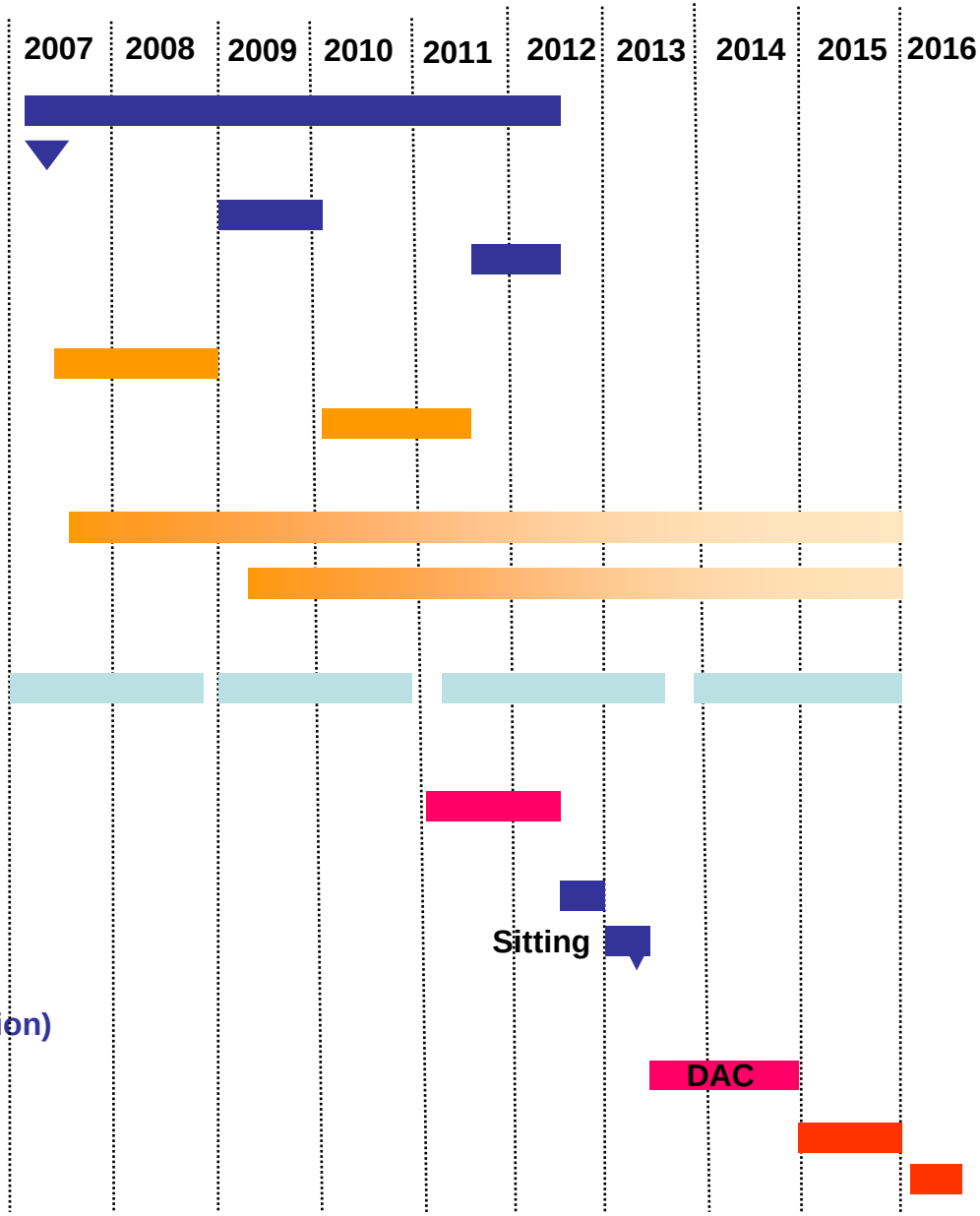
PUBLIC DISCUSSION

- Preparation phase
- Discussion

DOSSIER DAC (request for authorization of construction)

- Rédaction
- Instruction DAC (Art.8)

2016 LAW



Evolution of the missions of Andra related to the French Law on the management of radioactive waste voted on june, 28 2006

➢ Surface Storage: to accompany the creation or the modification of existing installations, according to needs during the next decade

➢ Geological Disposal: to prepare a file of request for authorization in 2015, for starting the exploitation in 2025

Major évolutions of the missions of Andra:

- Responsability for the R&D on surface disposal
- Behaviour of waste packages in disposal conditions
- Opinion on the specifications of waste conditioning
- Contribution to the costing of long-term management of radioactive wastes
- Management of “orphan” radioactive waste
- Realization of the national inventory of the radioactive matters and radioactive wastes
- Possibility for the Agency of creating and of managing surface or sub-surface storages