ANDRA'S DISPOSAL FACILITIES
FEEDBACK OF 40-YEAR OPERATIONS IN FRANCE

АНДРА: ОПЫТ ЭКСПЛУАТАЦИИ ЗАХОРОНЕНИЙ ВО ФРАНЦИИ

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Introduction Вступление

- CENTRE DE LA MANCHE (LILW) ПОЗ Ла Манш для СНАО
  - Development of an original surface disposal concept
  - Разработка оригинальной концепции захоронения
- CENTRE DE L'AUBE (IL-SLW) ПОЗ Об для СНАО КЖ
  - Implementation and improvement of the initial concept
  - Maximizing the advantage from its flexibility
  - Усовершенствование изначальной концепции
- CIRES (VLLW) ПОЗ для ОНАО
  - Safe and cost effective disposal route
  - Безопасность и эффективность захоронения
- CIGEO (HLW, IL-LLW) ПОЗ для ВАО и СНАО ДЖ
  - Reversible geological repository based on 25 years of research
  - Обратимое захоронение в геологических формациях

CONCLUSION Заключение

Andra at a glance / Кратко об агенстве Андра

- **Andra is created in 1991 on the basis of a French decree fixing the rules for the radwaste management**
  Агентство основано в 1991 г. согласно декрету об обращении с РАО

- **Andra is a public Agency acting under the supervision of the French ministers of Energy, Environment and Research**
  Агентство находится под прямым контролем трех министров – энергетики, окружающей среды и научных исследований

- **620 employees with more than 400 engineers and scientists**
  620 сотрудников, в т.ч. более 400 инженеров и ученых

- **3(+1) sites in France for operating radwaste disposal facilities**
  3 (+1) пункта окончательного захоронения РАО (ПОЗ) во Франции

- **> 170 MEUR annual turnover (2012)**
  годовой оборот 170 млн евро (2012 г.)

The French Waste classification
Классификация РАО во Франции

	Короткоживущие отходы ≤ 31 год **Short-lived waste** Period ≤ 31 years	Долгоживущие отходы > 31 год **Long-lived waste** Period > 31 years
OHAO **Very low level**	Waste from dismantling operations (CSTFA in France since 2003) **Отходы вывода АЭС из эксплуатации – с 2003 г. в ПОЗ ОНАО**	
Low level **HAO**	Waste mainly from day-to-day operation of NPPs (CSFMA in France since 1992) **Отходы эксплуатации АЭС – с 1992г. в ПОЗ НАО**	Graphite, radium-bearing waste (Studies stage in France) **Графитовые и радиосодержащие отходы – этап исследований**
CAO **Intermediate level**		**Отходы от переработки уранового топлива – геологический ПОЗ, эксплуатация с 2025 г. Высокоактивные остеклованные отходы после кондиционирования и охлаждения**
High level **BAO**	Waste from UF reprocessing plants (Geological disposal facility in France to be commissioned in 2025) HL vitrified waste : after reprocessing & cooling,	

Radioactive Waste Inventory - реестр РАО

Последнее издание выпущено в 2012 г.

Radioactive Waste National Inventory

Last Edition published in July 2012

Waste volume (m^3) Объем	Waste at end-2010	Forecast end-2020	Forecast end-2030
HLW - ВАО	2,700	4,000	5,400
ILW-LL САО -ДЖ	41,000	45,000	49,000
LLW-LL НАО –ДЖ	87,000	89,000	133,000
LILW-SL НСАО –КЖ	830,000	1,000,000	1,200,000
VLLW -ОНАО	360,000	750,000	1,300,000
Total - Всего	**~1,320,000**	**~1,900,000**	**~2,700,000**

CENTRE DE LA MANCHE (CSM)

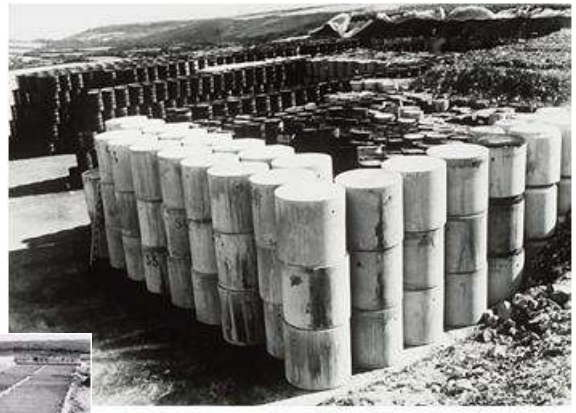
- ✓ **Sealed disposal facility for low and intermediate level waste**
- ✓ **Development of a surface disposal concept**
- ✓ **Закрытый приповерхностный ПОЗ для СНАО**

CENTRE DE LA MANCHE
General view (1979)

CENTRE DE LA MANCHE
Improvement of disposal design

Initial principle (1969)
Intermediate level waste to be disposed in concrete cells or waste to be conditioned in concrete blocks or cemented drums and disposed of on the ground


Disposal trench (1969)


Disposal platform (1971)


Cells to be grouted (1969)

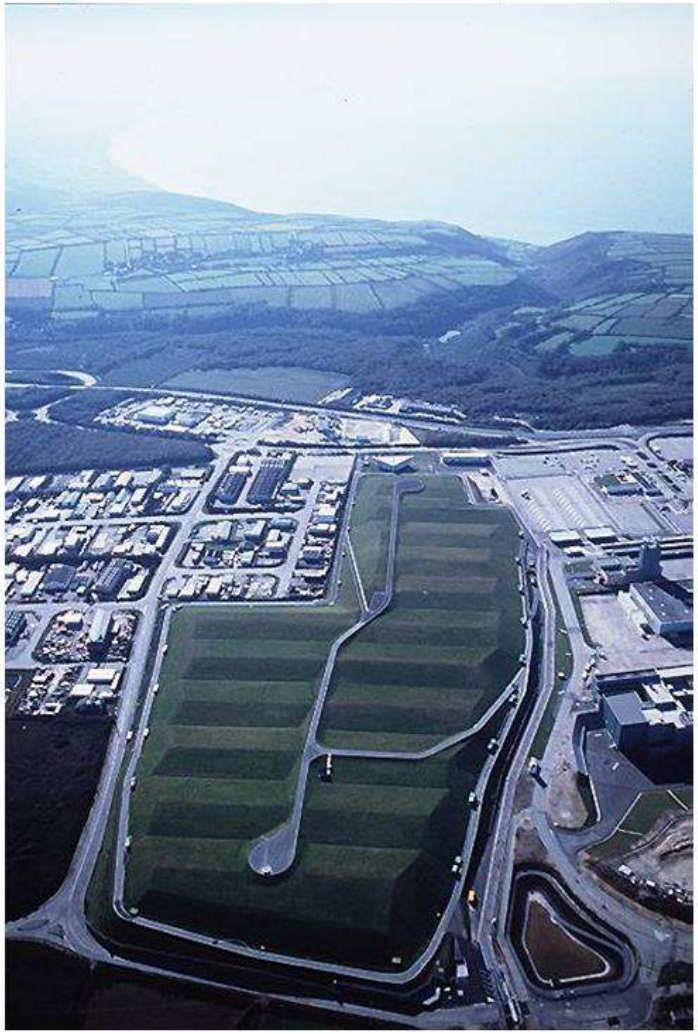

Disposal platform and cells to be grouted (1985)


The site (1991) with disposal platforms

Изначальная концепция 1969 г.
Захоронение кондиционированных РАО в траншеях или некондиционированных РАО в бетонных отсеках

CENTRE DE LA MANCHE
Entering the institutional control period (January 2003)

Disposed volume (1969-1994) : 527,000 m³



Radiological and chemical monitoring
Discharges
Underground water
Surface water

Capping system monitoring
Water-tightness performances
Rainfall water distribution
Membrane sampling
Topographic measurements

Information/Communication
A public report issued every year
Local Information Commission

Water collected under the disposal vaults
21,000 m³ in 1991
309 m³ in 2008

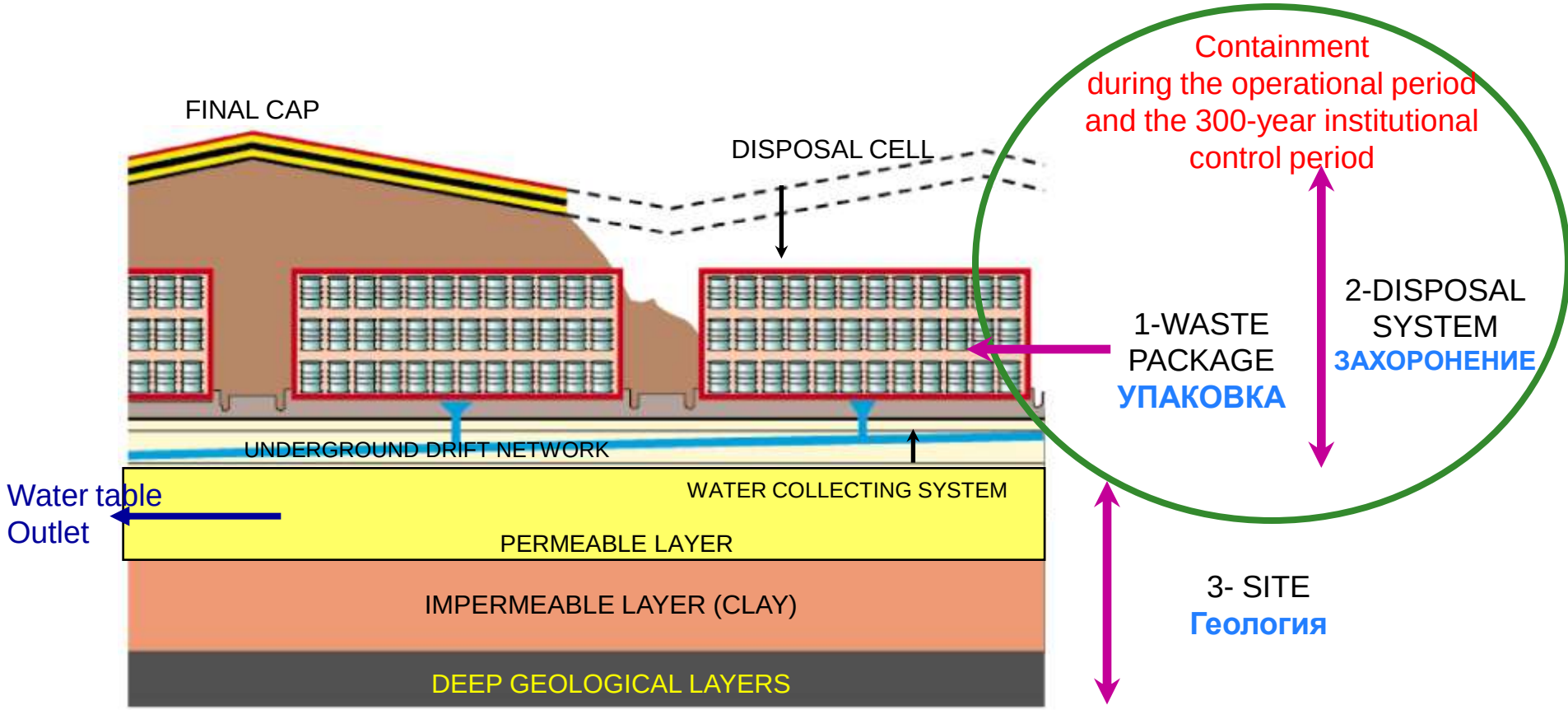
Consolidation of slope

Impact of the facility
Воздействие на ОС 0,65 µSv/y

CENTRE DE L'AUBE (CSA)

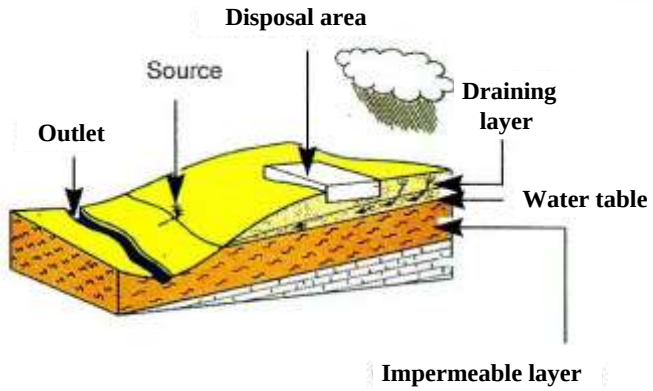
- ✓ **Operational disposal facility for low and intermediate level short lived waste**
- ✓ **Implementation of the concept**
- ✓ **Maximizing the advantage of its flexibility**
- ✓ **Эксплуатируемый ПОЗ для СНАО КЖ**
- ✓ **Гибкость усовершенствованной концепции**

The 3-barrier containment system

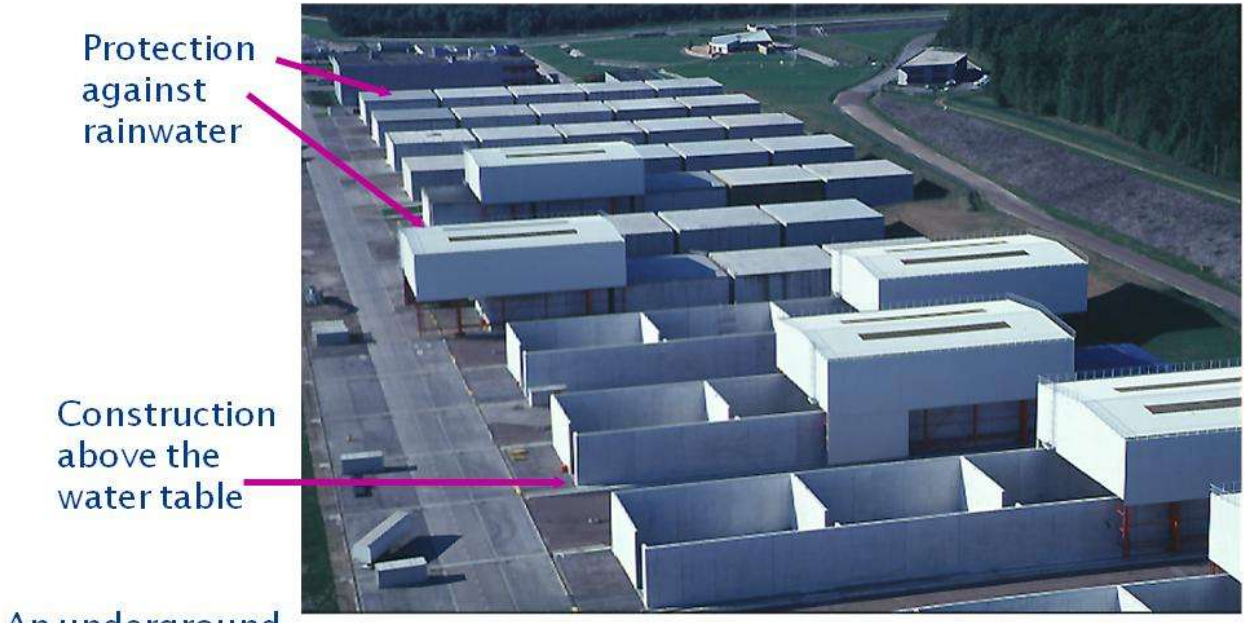


CENTRE DE L'AUBE
The implementation of the concept

Impact of the facility
Воздействие на ОС
0,003 µSv/y



Site selection
Выбор площадки



Disposal design
Дизайн захоронения

CENTRE DE L'AUBE
An operational period that is forecast till 2040-2050

Based on the lessons learnt from CSM: Уроки извлеченные из первого ПОЗ

- multi-barrier concept ➔ safety **Многобарьерная система**
- modular design ➔ flexibility, adaptability to waste forms (large size waste) and production
- continuous optimization ➔ safety, operation, cost **Постоянное усовершенствование**

technology and know-how transfer ➔ eg El Cabril, Lithuania, Korea, etc
Трансфер технологий для аналогичных сооружений

CENTRE DE MORVILLIERS (CIRES)

- ✓ **Operational disposal facility for very low level waste mainly from decommissioning**
- ✓ **Continuous improvement and adaptation**
- ✓ **Cost efficient disposal in conformance to French regulation**
- ✓ **Эксплуатируемый ПОЗ для ОНАО**

CENTRE DE MORVILLIERS
A design that complies with hazardous waste regulation

Disposal cells emplaced in clay
Protection by a membrane
Clay capping system

+ protection against rainwater by a mobile shelter

Steam generators disposal: 2 already disposed, 2 on the way

Крупногабаритные отходы: парогенераторы

CENTRE DE MORVILLIERS – LIFE STAGES

Disposal Facility for HLW and IL-LLW (CIGEO)

- ✓ **Planned reversible geological repository based on 25 years of research**
- ✓ **Проект обратимого ПОЗ для ВА и САО ДЖ**

General legal framework

2006 Planning Act Организационно-плановый Акт 2006 г.

- Decision in principle: geological disposal in a formation already investigated from an underground laboratory
- License application for the construction of the geological disposal to be reviewed in 2015
- Commissioning of the geological repository in 2025, subject to the license

- Andra shall be responsible … to make available to the public relevant information concerning the management of radioactive waste and to participate in the dissemination of scientific and technological culture in that field

Applicable rules (art.12)

- The application shall be preceded by a Public debate
- Reversibility must be guaranteed during not less than 100 years

A variety of radioactive waste forms – разнообразие форм РАО

ВАО

HLW: 10,000 m³

59 реакторов во Франции

59 French Nuclear Units

Переработка ЯТ

Processing of UF

РАО от НИОКР и промышленности , исторические РАО

СА-ДЖО

IL-LLW: 70,000 m³

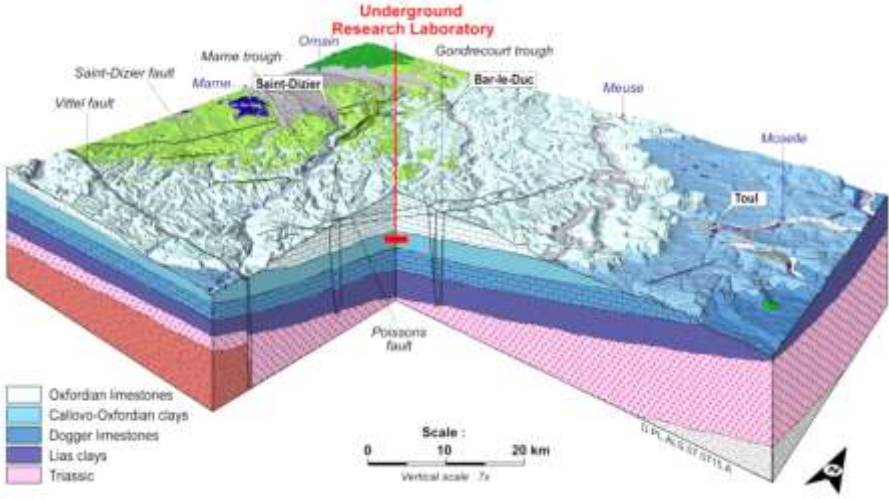
Technology waste, research activities and legacy waste

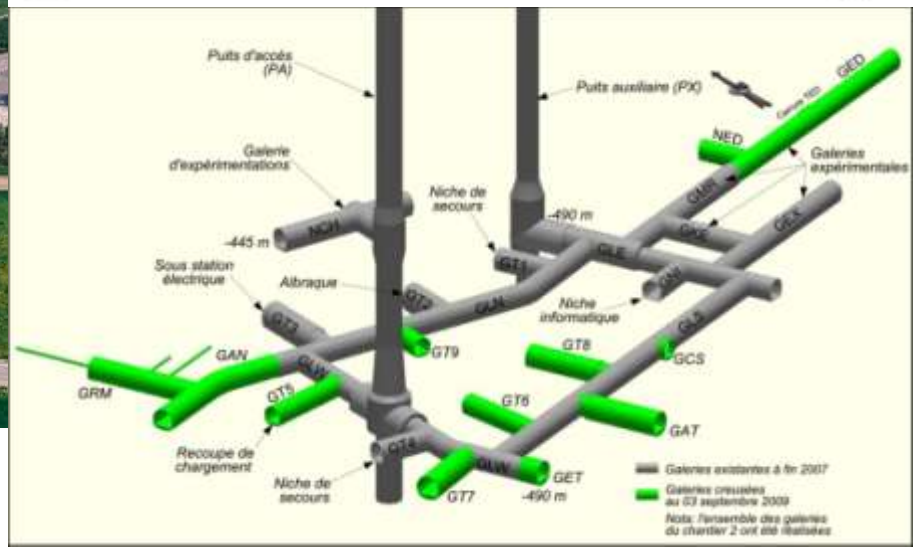
A variety of waste types

Разнообразие физических форм РАО

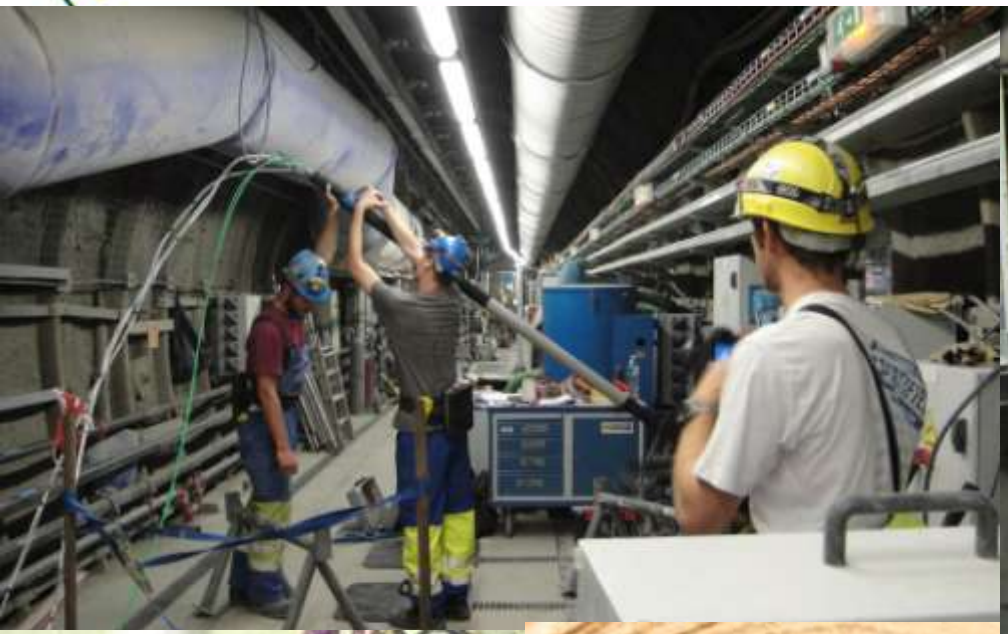
URL: Research, Construction and Operation of the Underground Laboratory in Meuse/Haute-Marne (Bure)

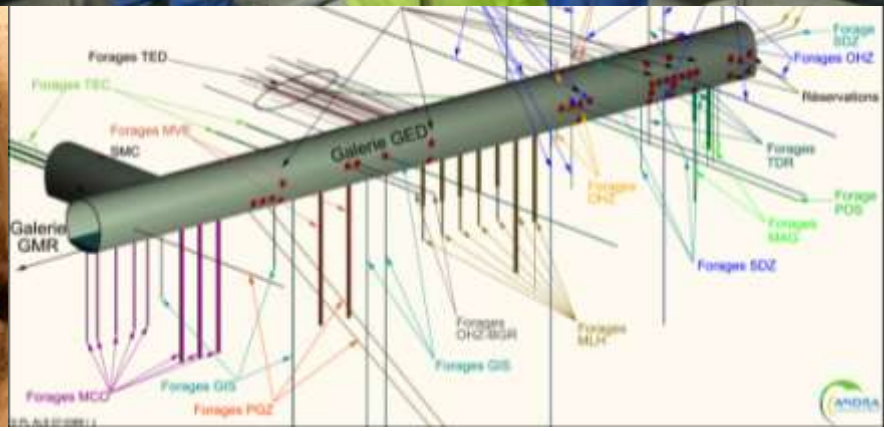
ПОДЗЕМНАЯ ИССЛЕДОВАТЕЛЬСКАЯ ЛАБОРАТОРИЯ



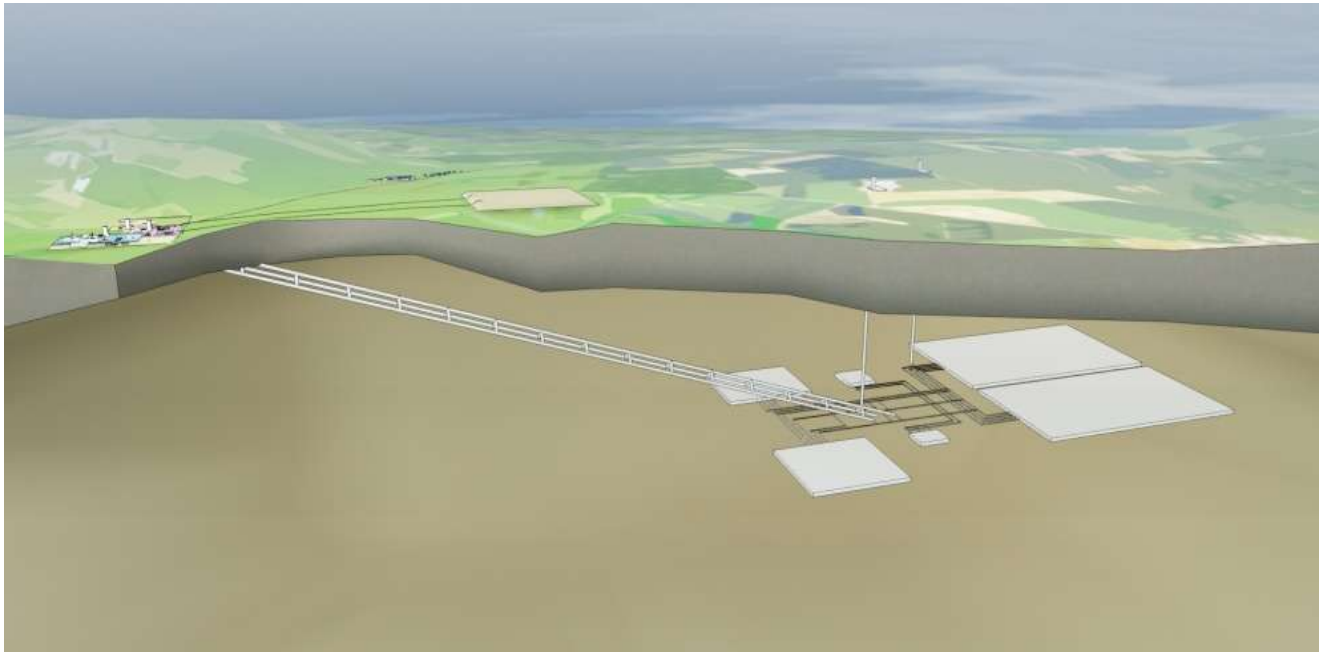


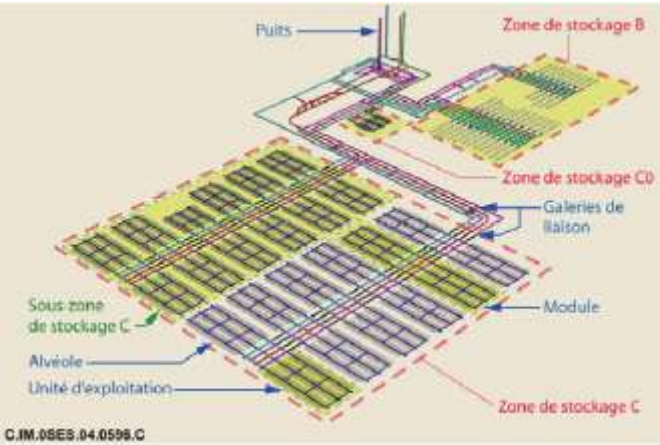
URL: Experiments in the Underground Laboratory

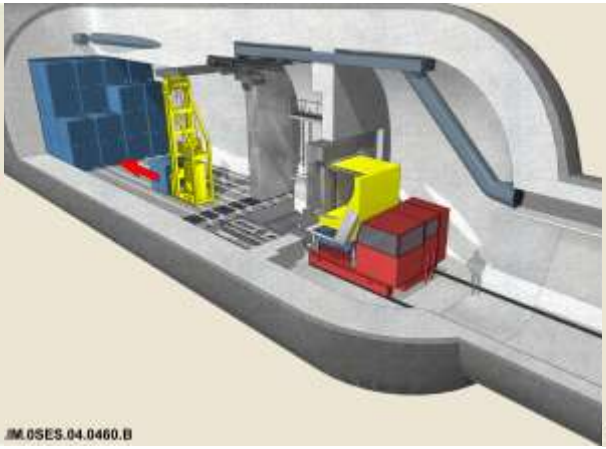


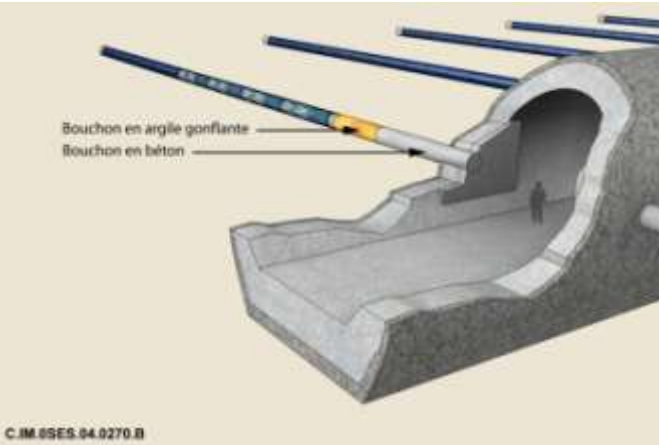


CIGEO: Deep Geological Repository Project ПРОЕКТ ПО3









Geological Disposal: A Project with a High Added Technological Value

CONCLUSION

CONCLUSION: CONSTANT DEVELOPMENT AND IMPROVEMENT FOR DISPOSAL FACILITIES

40 years of operation 40-летний опыт в эксплуатации ПОЗ

- From prototype to industrial process
- Adjusting operational tools to waste generators needs
- Long-term issues as a daily concern
- Building the experience of the closure of a facility
- Obtaining and maintaining confidence of the public
- Feedback for existing and planned facilities

Increasing local involvement in the decisions taken on waste management Вовлечение регионального уровня в процесс

- Dialogue with waste generators to identify relevant management routes
- Public Acceptance and Awareness

The need of international cooperation Важность международного сотрудничества