Radioactive waste management in France

Surface disposal for LIL & VLL radioactive waste

Safety, flexibility, modularity, efficiency & optimisation,

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INAC / ENIN Recife BRAZIL
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Waste classification and management solutions

Overview of radioactive waste classification

	Short-lived waste (SL) Period ≤ 31 years	Long-lived waste (LL) Period > 31 years
Very low level	Waste from dismantling operations **Surface disposal** – CSTFA **since 2003**	
Low level	Waste mainly from day-to-day NPPs'operation **Surface disposal** CSM **1969-94** CSFMA **since 1992**	Graphite, radium-bearing waste **Subsurface disposal** Studies stage in France
Intermediate level		
High level	Waste from SF reprocessing plants **Cigeo Geological disposal facility** **to be commissioned in 2025**	

- Below 100-day period, management through in-situ radioactive decay.
- Only solid waste are to be disposed of.

CSA LIL surface disposal facility

ADS Surface based on the CSFMA (Aube district) for LIL-SL waste

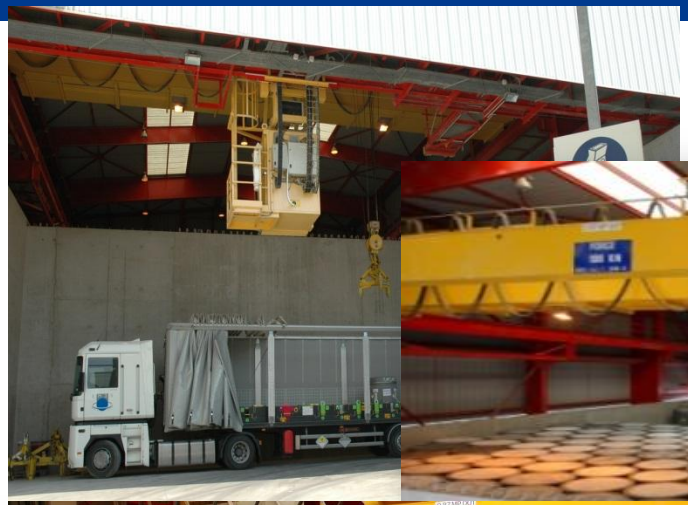
Based on the lessons learnt from CSM:

- multi-barrier concept ➔ safety
- modular design ➔ flexibility, adaptability to waste forms and production, etc
- continuous optimization ➔ safety, operation, cost
- technological transfer ➔ eg El Cabril, Lithuania, Korea, etc

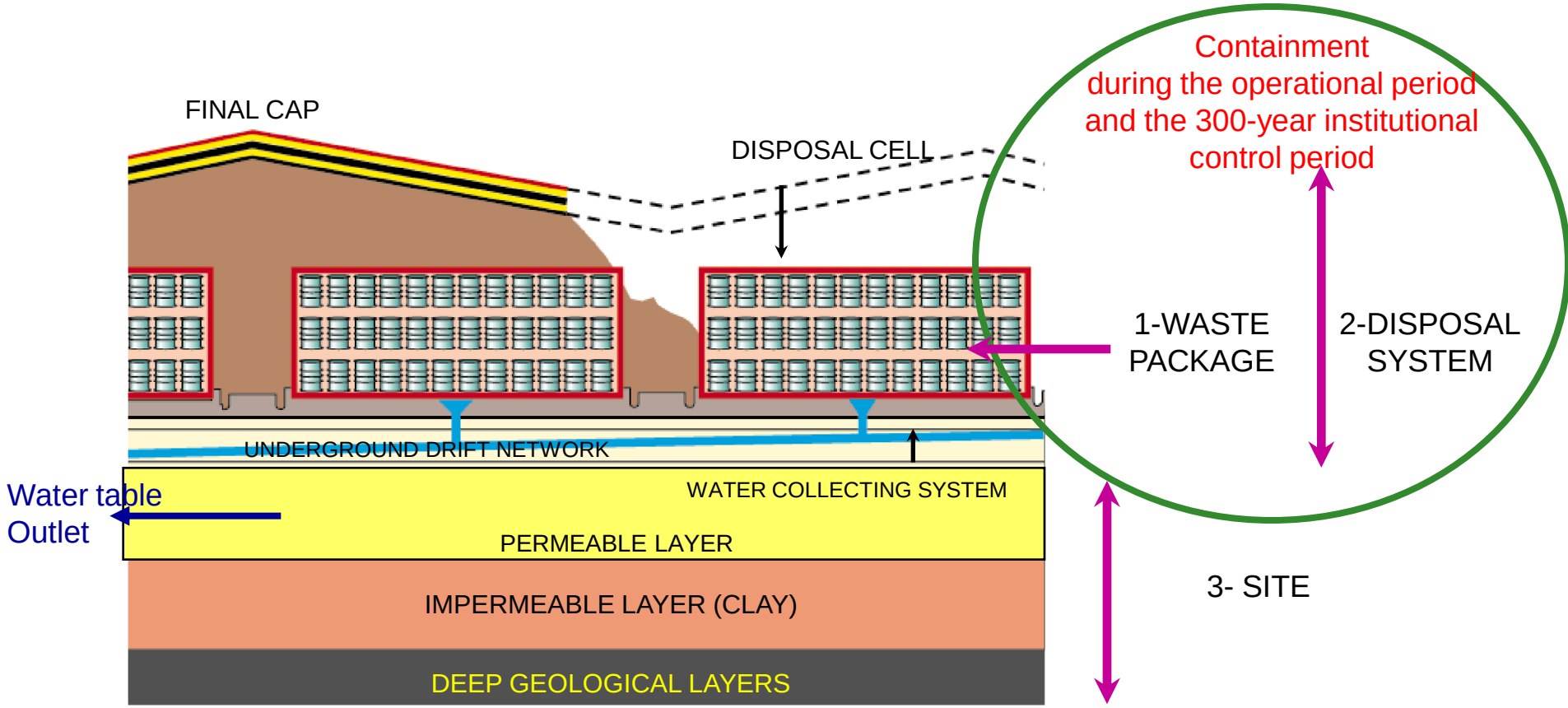
Licenced in 1989 & commissioned in 1992
1,000,000 m3 waste packages

4,000	TBq	H3
400,000	TBq	Co60
40,000	TBq	Sr90
200,000	TBq	Cs137
40,000	TBq	Ni63
750	TBq	alpha emitters (after 300 years)

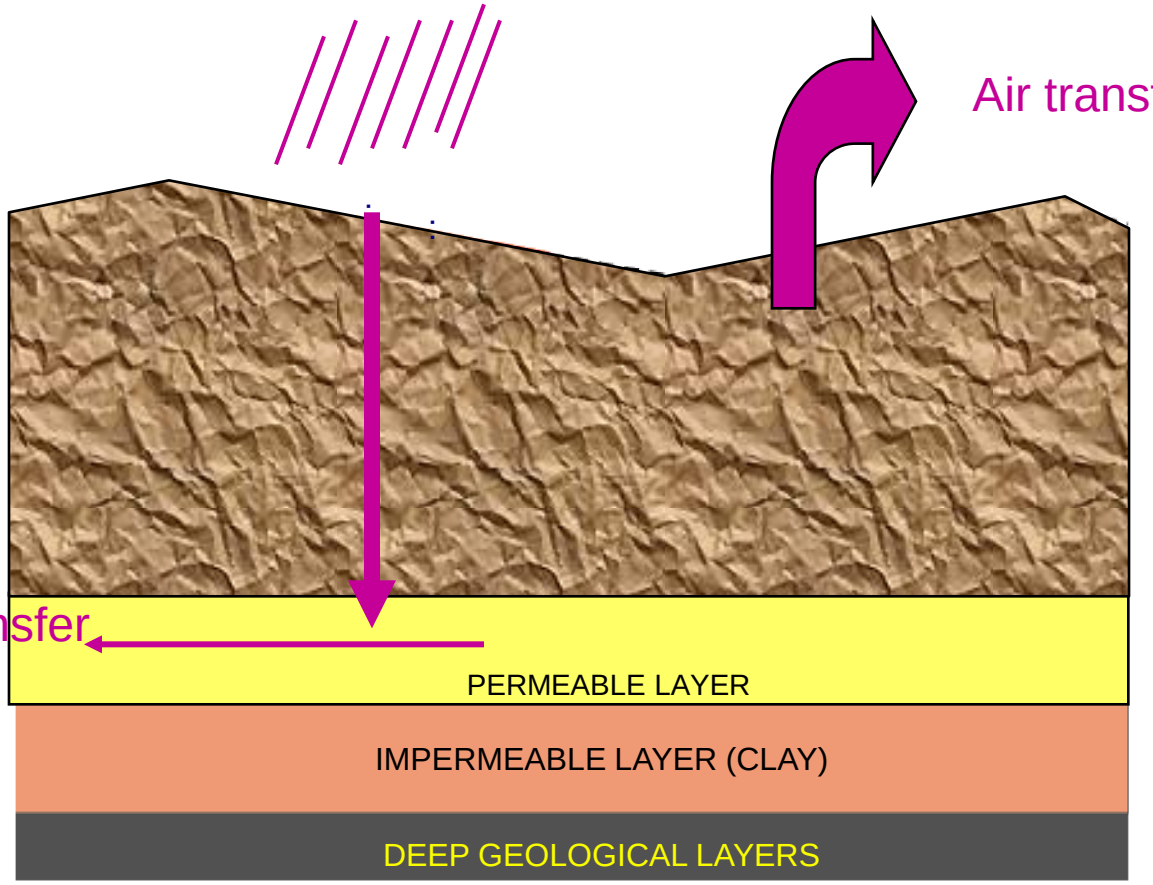
CSA operation



The 3-barrier containment system



Long-term safety is achieved by the site geology

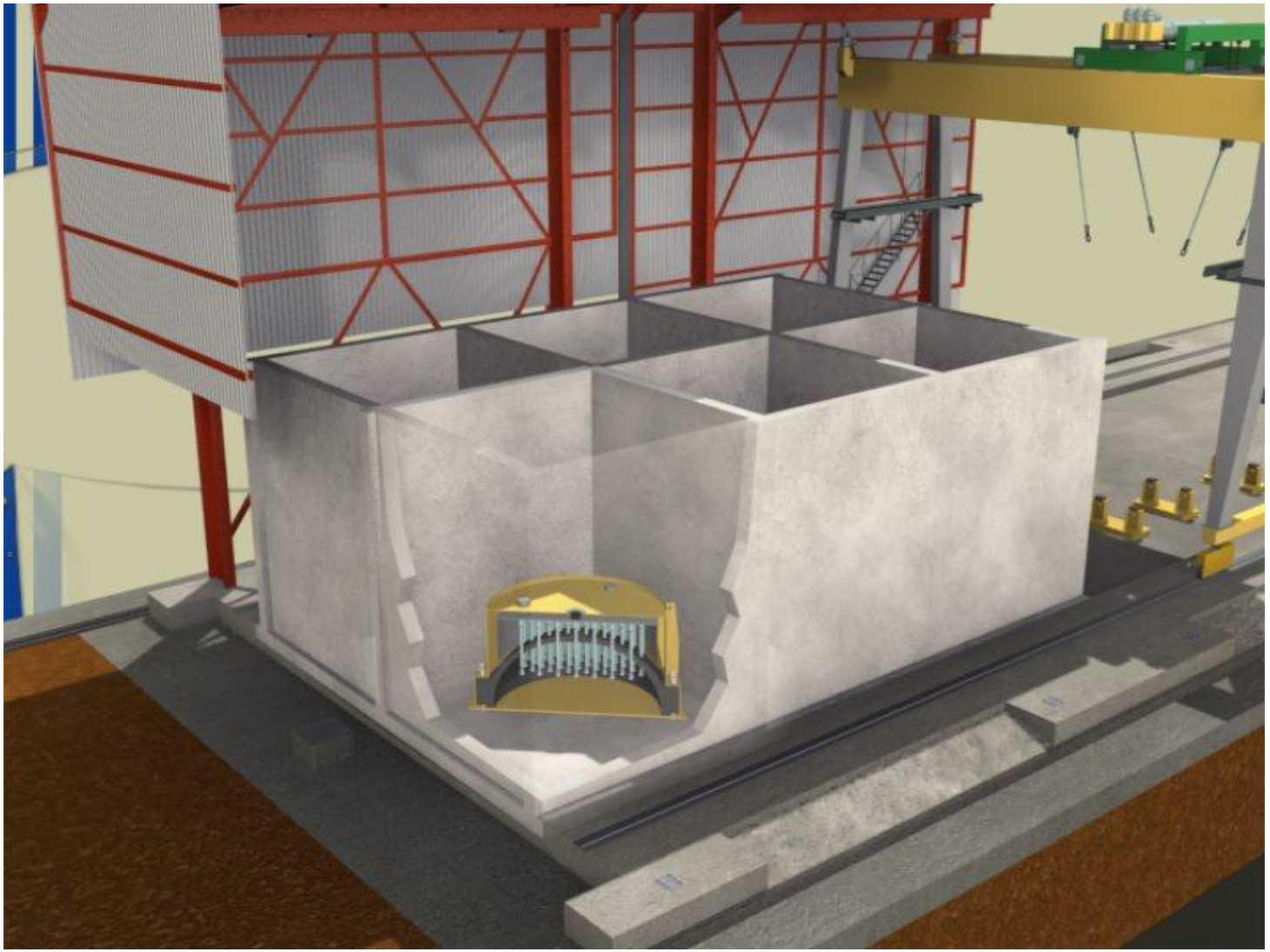


Engineered barriers are considered as damaged at the end of the 300-year post-closure institutional phase (monitoring)

→ The necessity to monitor long-lived radio-nuclides at waste acceptance

Reactor vessel head disposal at the CSA

Reactor vessel head disposal cell design



Arrival & docking at the disposal cell

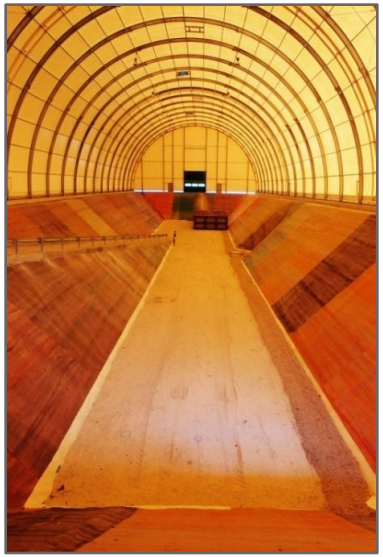
Emplacing & cementing in the disposal cell

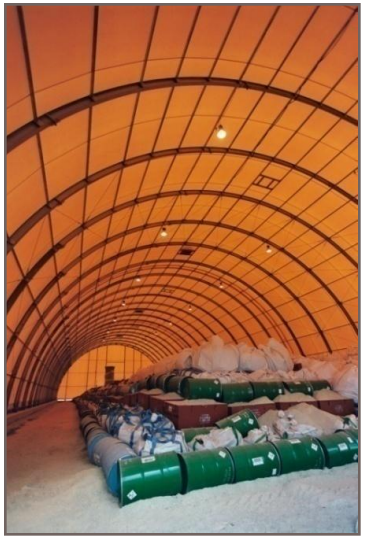
CIRES VLL surface disposal facility

ADS Surface based on the CIRES (Aube district) for VLL waste

Commissioned in 2003
630,000 m3 capacity
Planned for 30 years operation

CIRES operation





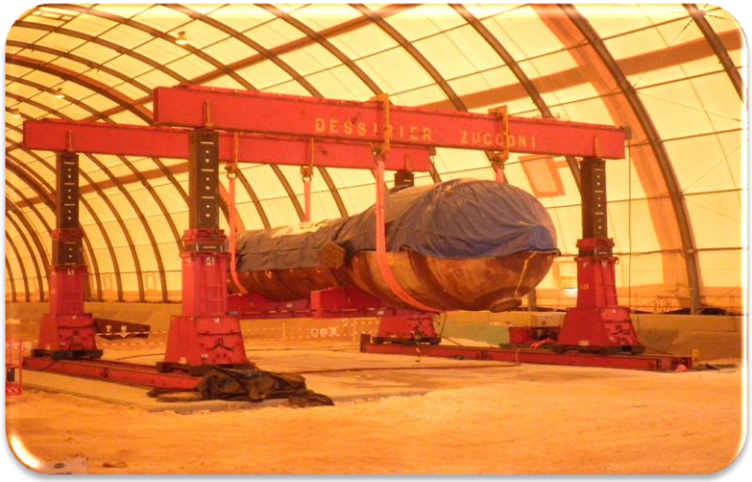
Steam generator disposal at the CIRES

Arrival & storage at the CIRES facility

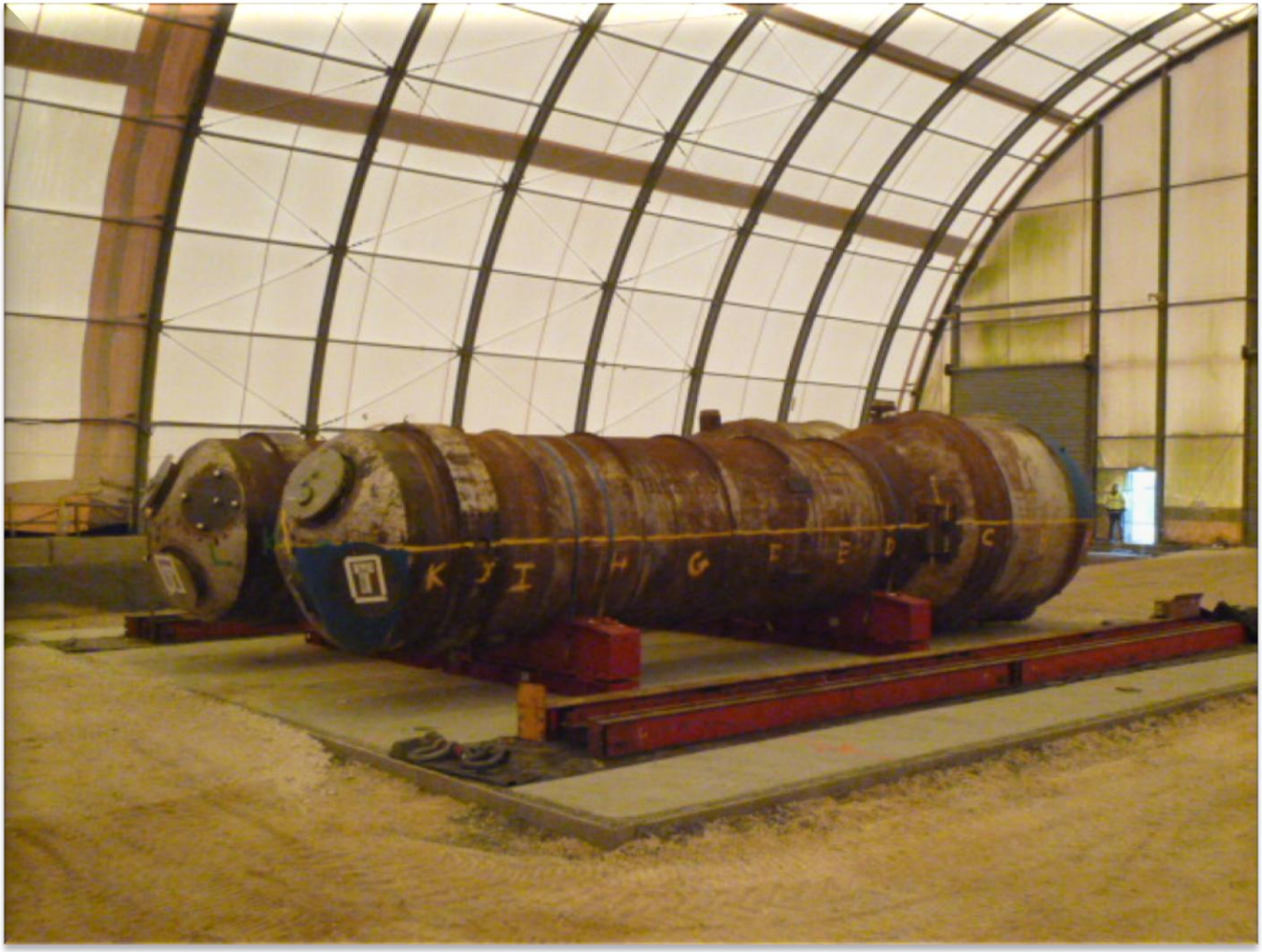
Disposal cell preparation: concrete slab

Transfer of the SG into the disposal cell

Emplacement of the SG in the disposal cell

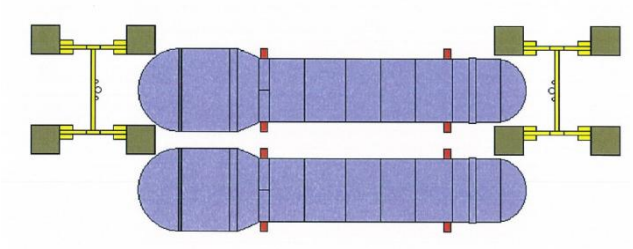


SG in the disposal cell



Concrete injection into the SG

- Injection pipe NPS 160
- Vent pipe NPS 60
- Checking pipe NPS 60



SG secondary side connection → 30 m^3 concrete injected into → SG primary side connection → 8 m^3 concrete injected into

Disposal cell filling can be completed

Thank you

Annex

Andra head-office and facilities

Radioactivity level classification

VLL* Very-Low-Level 1 to 100 Bq/g

LL Low-Level 100 to 100 000 Bq/g

IL Intermediate-Level

100 000 to 100 millions Bq/g

HL High-Level (vitrified waste)

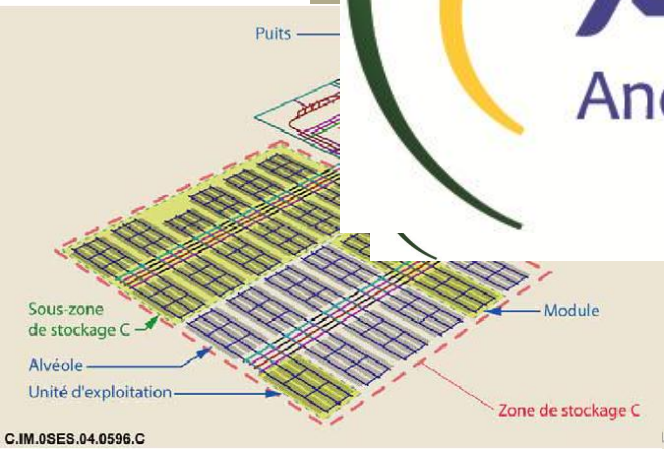
10 billions Bq/g

* There is no clearance level for solid waste according to French regulations

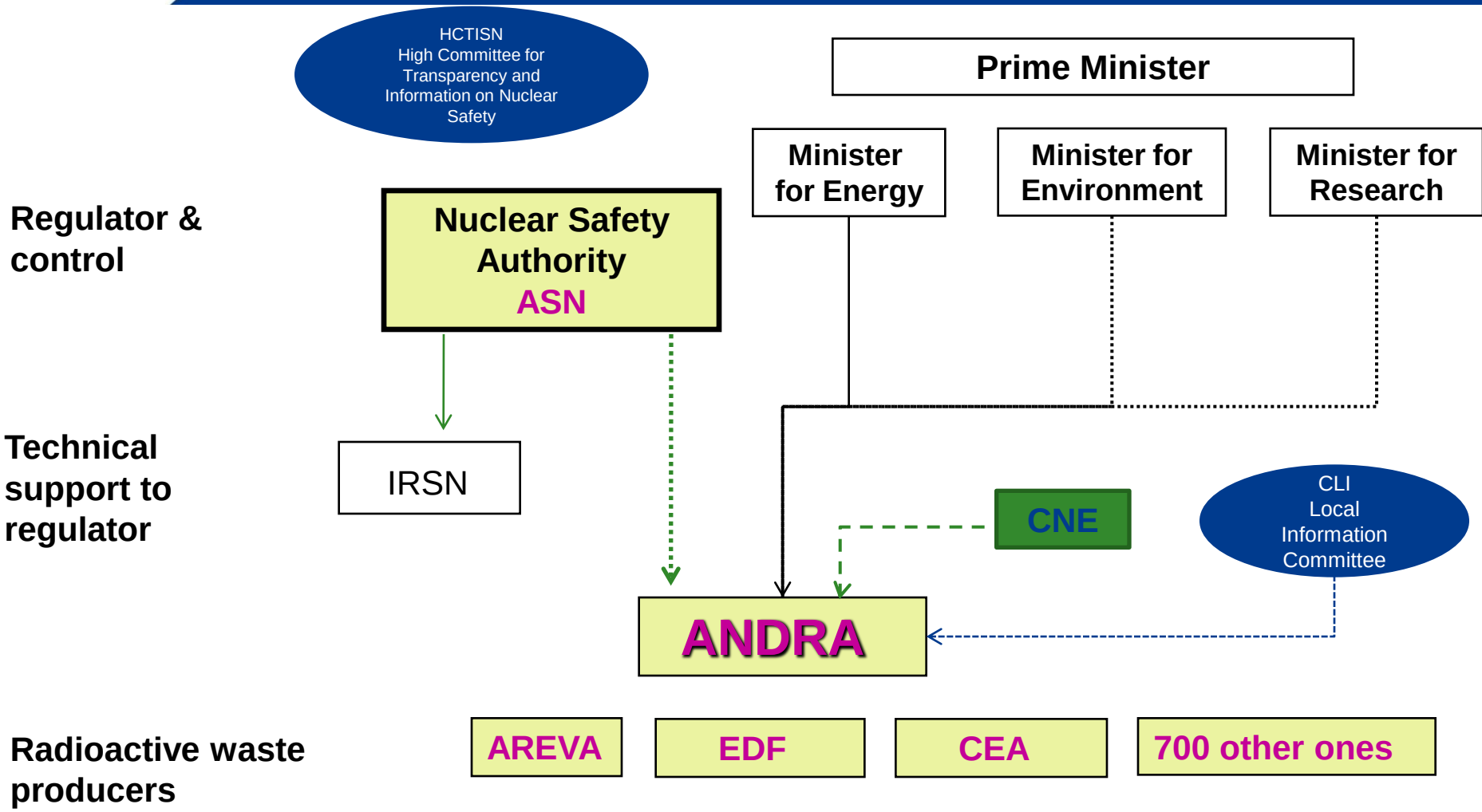
ADS Geological based on *Cigeo*, the deep geological repository project for IL-LL & HL waste

(Meuse/Haute-Marne districts)

ADS · Geological
Andra Disposal Solutions



The "Today" general framework



The CSM (Manche district)

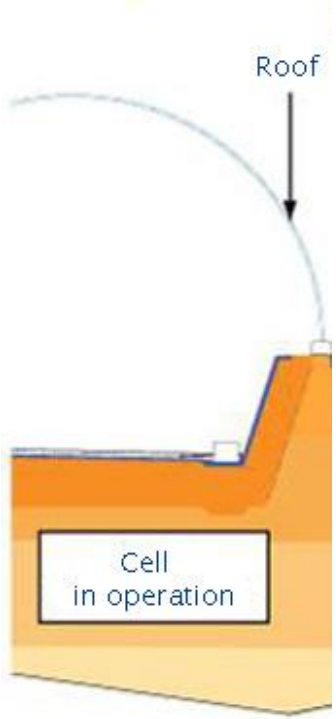
A facility (LIL waste) under post-closure monitoring phase

Commissioned in 1969 and closed down in 1994 after reaching its maximum capacity, the CSM accommodated about 527,000 m^3 of low-level and intermediate-level waste over a period of 25 years.

During several centuries, the facility and its environment will be monitored on a permanent basis.

Storage preparation: gantry setting up

CIRES design



Transfer of the SG into the disposal cell